

Sabola, Gift Andrew

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The link between Chinese belt and road initiative and foreign direct investment inflows in Southern Africa

Gift Andrew Sabola^a

^a School of Economics, Zhejiang University of Technology, NO. 288, Liuhe Road, Pingfeng Campus, Xihu District, Hangzhou, Zhejiang, 310013, China

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ABSTRACT

This study investigates the association between infrastructure development in China's Belt and Road Initiative (BRI) and foreign direct investment (FDI) inflows to southern Africa, using a propensity score matching–difference-in-difference (PSM-DID) regression. The empirical examination is based on a sample of eight southern African countries selected based on data availability. We find that China's BRI has significantly positive effects on FDI inflows to southern Africa. Therefore, governments and development policy makers in southern African countries are recommended to devise supporting policies in order to ensure that the BRI leads to sustainable FDI inflows and sustainable economic growth. The study makes significant contributions to theory, policy, and practice. In policy and practice, our study is valuable for policy-making on driving FDI inflows. However, the context of the study is specifically southern Africa, hence, the results might not be generalizable to other African regions or Africa as a whole, so further research is needed to consider those areas.

1. Introduction

In most developing countries, foreign direct investment (FDI) is generally considered the main stimulus to economic growth (Khadaroo & Seetanah, 2010). According to Ngueta (2020), the level of economic development in developing countries requires sustained foreign investment to stimulate the economy and improve welfare. The United Nations Conference on Trade and Development (UNCTAD) (2021) reports that FDI is key for tackling prevalent macroeconomic problems in developing countries, such as poverty and unemployment. Hence, developing countries, particularly those in Africa, have tried to stimulate FDI (Michiels, 2018; Zhang, 2021). In this regard, China's Belt and Road Initiative (BRI) is considered a major determinant in the stimulation of FDI in African developing economies (Aladejare, 2022; Onye et al., 2022; Wethal, 2019). More important, several previous studies, such as Fosu (2021) and Nketiah-Amponsah and Sarpong (2019), acknowledge the important role of infrastructure development in stimulating FDI in emerging economies.

As a result, in most emerging economies, the government emphasizes efforts to stimulate FDI, such as greater infrastructure development (Wang, 2020). As hypothesized in Dunning's eclectic theory, locational

advantages, such as good infrastructure, attract FDI (Dunning, 2015). Because of the importance of infrastructure development in bilateral trade relations, the Chinese government signed a memorandum of understanding (MOU) with the governments of over 140 countries in order to develop infrastructure as part of the BRI (Jenkins, 2022; Nugent & Lu, 2021). Xi Jinping, the president of China, first proposed this BRI infrastructure development strategy in 2013, articulating the need to construct, first, the Silk Road Economic Belt¹ and, second, the Twenty-first-Century Maritime Silk Road² (Khan et al., 2021; Ma et al., 2019). The BRI is an ambitious project for improving connectivity and cooperation among various countries in Asia, Europe, and Africa (Chen & Lin, 2018; Jenkins, 2022; Khan et al., 2021). It focuses on five key areas of cooperation: development policy coordination, infrastructure and facility network building, strengthening trade relations and investment, strengthening financial cooperation, and deepening socio-cultural exchange (Chen, 2018; Khan et al., 2021; Wu & Chen, 2021).

The major objective of the BRI is to reduce the time and cost for transporting people and goods between China and BRI economies because most developing countries face serious gaps in infrastructure development, especially transportation infrastructure (Chen, 2018; Choudhury, 2021). The BRI is based on the premise that availability of

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E-mail address: sabola95@gmail.com.

¹ A trans-continental passage that links the Republic of China with south Asia, south east Asia, Central Asia, Europe and Russia by land (Khan et al., 2021).

² A sea route connecting China's coastal regions with south and south east Asia, the Middle East, the South Pacific, Europe and Eastern Africa (Khan et al., 2021).

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crucial infrastructure (roads, ports, communication, and electricity) will enhance trade engagement and attract higher FDI to the BRI countries (Choudhury, 2021; Nugent & Lu, 2021). Hence, over the past two decades, FDI in BRI economies has increased significantly, to the point that China accounts for more than 20 percent of the total FDI inflows to BRI economies (Chen, 2018; Nedopil, 2022). According to Nugent and Lu (2021), this increase in total FDI inflows to the BRI economies is predicted to increase annually by approximately 5 percent until 2025, and this increase will have a positive effect on the gross domestic product (GDP), employment, and trade of lower-income countries. However, Chen and Lin (2018) contend that the magnitude of the effects varies significantly by destination and source country.

All the countries in southern Africa joined the BRI between 2013 and 2018 by signing MOUs with the Chinese government, and transport infrastructure development has improved significantly in the region since then (Dzekashu & Anyu, 2021; Nedopil, 2022). Prior research shows that, since 2013, China's outward FDI in southern African BRI countries increased rapidly, from US\$10.8 billion in 2014 to US\$21.4 billion in 2018 (UNCTAD, 2021). In addition, most southern African countries, such as South Africa, Zambia, and Angola, are among the top recipient markets of Chinese BRI investment (Dzekashu & Anyu, 2021; UNCTAD, 2021). Nonetheless, the southern African region lags behind other African regions in terms of FDI and economic growth (Nketiah-Amponsah & Sarpong, 2019). Hence, the link between BRI and FDI in the context of southern Africa needs to be empirically examined.

Moreover, most studies have overwhelmingly concentrated on other BRI regions, such as sub-Saharan African (SSA) and East Africa, and little research has been based exclusively on the southern African region, which is one of the top destinations for China's outward FDI. No research has been conducted on the contribution of the BRI to FDI inflows to southern Africa. Previous studies on infrastructure development and FDI have also had mixed and inconclusive results. Moreover, some previous studies fail to consider the possibility of endogeneity problems in FDI econometric estimations, which may have resulted in biased estimations. Hence, further comprehensive research is needed. Therefore, this study examines the empirical link between the BRI policy and FDI in southern Africa for the period 2003 to 2021 using a difference-in-difference (DID) methodology.

This study makes a significant contribution to both theory and policy by examining the contribution of China's BRI to FDI inflows in southern Africa. We enrich the existing literature in numerous ways with respect to theory. First, to the best of our knowledge, several studies have examined the relationship between the Chinese BRI and FDI inflows, however, none of them cover southern African countries. So, this paper is a pioneering study on the impact of China's BRI on FDI inflows in southern Africa. Second, the research is of great use to future researchers, as it could be used as a source of empirical analysis. In policy and practice, our study is valuable for policy-making that drives FDI inflows. In particular, the findings, conclusions, and recommendations in this study can be used by policy makers, such as national governments, to help in formulating policies that drive FDI while taking full advantage of the BRI. The research may also be useful for development, investment, and trade policy makers and practitioners trying to strengthen and support Sino-African relations.

The rest of the paper is structured as follows. Section 2 presents a theoretical and empirical literature review. Section 3 presents the materials and methods employed to achieve the goals of the research. Thereafter, Section 4 discusses the empirical results, followed by Section 5, which gives our conclusions and policy recommendations.

2. Literature review

The literature review is divided between the theoretical literature, outlining the main theories underpinning the study, and the empirical literature, describing some of the previous scholarly work on BRI infrastructure development and FDI.

2.1. Theoretical literature

The existing literature describes numerous theoretical frameworks for modeling the impacts of infrastructure development on FDI (Nketiah-Amponsah & Sarpong, 2019). However, this study theoretically relies on Dunning's (1988) eclectic theory, also known as the ownership, location, and internalization (OLI) paradigm. This theory argues that FDI is determined by advantages due to OLI (Batschauer da Cruz, Eliete Floriani, & Amal, 2022). In particular, the study pays particular attention on location-specific advantages, which relate to the importance of the firms or countries that invest in host countries. According to Dunning (2015), location-specific advantages are related to advantages that make foreign countries more attractive destinations for FDI than other advantages, such as political and economic stability.

Location advantages also embody other characteristics, such as good infrastructure (communication, transportation, and other forms of infrastructure) (Bajrami, 2019; Dunning, 2015). In addition, the theory confirms that factors such as market size also determine the location of FDI in host countries (Bajrami, 2019; Jones et al., 2020). Given that this study examines the link between the impact of infrastructure development through the BRI and on promoting FDI inflows to southern Africa, the eclectic theory is suitable for our research.

2.2. Empirical literature

The link between BRI and FDI has attracted a lot of academic attention. This section presents some of the empirical studies on BRI policy and FDI, outlining methodologies and empirical results.

In an empirical study, Liu et al. (2017) identify the main determinants of China's outward FDI among BRI countries between 2003 and 2015, showing that the BRI has a positive and statistically significant effect on Chinese outbound FDI. They use panel data on 93 countries, including 49 BRI countries and 44 non-BRI countries. The majority of these countries are not in Africa, but some southern African countries are included, such as Zimbabwe, South Africa, Botswana, and Zambia. The study uses the gravity model and analyzes the data by conducting a fixed-effects regression with the generalized method of moments (GMM). The dependent variable is the natural logarithm of inward FDI flows from China, and the independent variables include a dummy variable for BRI policy, the exchange rate, trade openness, political stability, natural resource endowment, and technology. The results reveal that the BRI significantly facilitates outward FDI to BRI countries.

The findings by Liu et al. (2017) are similar to those obtained by Ma et al. (2019), which examines the effect of Chinese BRI on China's outward FDI in Europe, using the trade gravity model. Their sample consists of empirical data pertaining to China's outward FDI, foreign trade, and BRI for the period 2003 to 2016 on 21 European countries (Germany, Belgium, United Kingdom, Russia, Netherlands, France, Switzerland, Italy, Poland, Czechia, Sweden, Denmark, Ireland, Hungary, Austria, Romania, Finland, Belarus, Malta, and Luxembourg). The key independent variables are market size proxied by GDP, Chinese outward FDI, geographic distance between European countries and China, macroeconomic stability proxied by the exchange and inflation rates, trade freedom, population, and a dummy variable for BRI. They conduct a panel regression analysis using the logarithmic function and find that the BRI had a positive impact on FDI in European countries, that inflation and exchange rates have insignificant effects on China's outward FDI, and that Chinese FDI in Europe significantly promoted higher trade between European countries and China.

Obtaining findings similar to those by Ma et al. (2019), Rehman et al. (2022) examine whether BRI-based infrastructural development attracts FDI around the world. They analyze panel data for the period 2000 to 2019 using the GMM, with a sample of 66 BRI countries in Asia, Europe, Middle East, and Africa. The control variables include the gross domestic product (GDP) per capita, trade, population, human capital, and institutional quality in the BRI countries. They compare FDI inflows for two

periods: pre-BRI (2000–2012) and post-BRI (2013–2019). The study reveals that BRI helped to attract FDI to BRI countries.

Lee et al. (2022) examined the pull and push factors in China's outward FDI to BRI countries from the European, Asian, and Middle East and North Africa (MENA) regions, relying on Dunning's theory. They use dynamic and static panels and quantile regression techniques to model the determinants of China's outward FDI with a sample of 50 BRI countries, using data for the period 2005 to 2016. The results reveal that natural resource availability, low labor costs, and institutional factors were key determinants of China's outward FDI. However, host countries' GDP, inflation, and trade openness have no significant influence on China's outward FDI in BRI countries, findings that are similar to those by Ma et al. (2019).

Then, using a different methodology from the one employed by Ma et al. (2019), Jin et al. (2021) use a DID methodology to determine whether the BRI was problematic for Chinese foreign investment in European countries with firm-level panel data from the China Global Investment dataset for the period 2005 to 2017. The DID estimates reveal that the BRI had a dampening impact on Chinese foreign investment than might have occurred in its absence. Yu et al. (2022) examines the effect of the BRI on Chinese outward FDI in Africa, using the DID approach with data on Chinese listed multinational enterprises for the period 2011 to 2020. The results show that BRI significantly facilitated Chinese firms' outward FDI in the host countries.

In addition, Bakker (2022) empirically investigates the relationship between Chinese outward FDI, the BRI, and economic growth in African countries. Bakker uses a dynamic panel data regression model to analyze data on 54 African countries for the period 2006 to 2020, with control variables such as natural resource rents, population, and inflation. The results reveal that participation in the BRI by African countries significantly increases Chinese outward FDI there, as also observed by Rehman et al. (2022) and Ma et al. (2019).

Similarly, Wang et al. (2020) analyzes the impacts of BRI on Chinese outward FDI in SSA countries, using a trade gravity model. They conduct a multivariate regression analysis, with panel data on 35 SSA countries for the period 2003 to 2018. The results show that the BRI is positively related to Chinese outward FDI, the host country's GDP, and bilateral trade. However, the study does not account for the long-run effects of BRI investment on outward FDI. Wang et al. also find that geographic distance negatively impacts outward FDI investment and bilateral trade between China and SSA countries.

Di Vito (2019) examines the effect of the BRI on Chinese outward FDI in Africa and finds that market size attracts Chinese investors to the host BRI African countries. Shahriar et al. (2020) identify the determinants of China's outward FDI in 64 BRI countries for the period 2004 to 2015. Using a gravity model, they reveal that market size is among the major determinants of China's outward FDI in BRI countries.

By contrast, Kang et al. (2018) find no significant effect of participation in the BRI on Chinese outward FDI. They investigate the effects of the BRI on China's outward FDI, using data on 216 countries, including 74 BRI countries and 142 non-BRI countries for the period 2010 to 2015 with a matching DID methodology. The dependent variable is the natural logarithm of China's outward FDI flows in millions of US dollars. Inflation measured by the GDP deflator, political stability, natural resource intensity, and corruption are among the independent control variables. However, they find no significant effects of BRI on FDI in host countries, and their results show that Chinese outward FDI is about 40 percent higher in BRI countries than in the non-BRI countries.

This review of empirical studies reveals several gaps that this study fills. First, none of them specifically study the link between BRI and FDI in southern Africa; rather, most of the studies focus on Europe and the entire African continent and subregions such as SSA. The findings of the studies on developed European countries lack generalizability to the context of developing economies in the southern African region. This is a significant gap in empirical literature because, as noted, Chinese outward FDI in Africa varies greatly by region. Second, other than several

empirical studies on BRI and FDI, the prior results are inconsistent and inconclusive, with both significant and insignificant effects of BRI on FDI. This is because some empirical studies suggest that BRI has a significantly positive effect on FDI, but others show insignificant effects or significantly negative effects—hence, no consensus has been reached. Our study addresses the variation in findings. Lastly, the majority of previous studies use a panel regression methodology, though a few employ the DID methodology, so the net policy effects of BRI on FDI were not obtained, thereby impacting robustness of the estimates. Therefore, this study enhances the robustness of results by employing the DID methodology to estimate the net policy effects of BRI on FDI in Africa. This study makes a significant contribution to the literature by addressing these research gaps. In particular, our empirical study examines the impact of the BRI policy on FDI inflows in the southern African region.

3. Data and methodology

This section outlines and discusses the methodology employed in this paper, including model specification, estimation techniques, data sources, and variables employed.

3.1. Model specification and estimation technique

This research adopts the quantitative research approach to collect data for analysis. The ex-post facto research design attempts to determine cause-and-effect relationships between the independent variables and the dependent variable (Umstead & Mayton, 2018). Umstead and Mayton (2018) state that this research design is suitable when researchers seek to establish cause-and-effect relationships between variables from a historical perspective without manipulation of the data. Hence, this research design is deemed the most suitable for our research, which establishes the link between China's BRI and FDI inflows in southern Africa using historical data.

To do so, we collect secondary quantitative data and analyze it using DID methodology in order to achieve our research objectives. The DID methodology has been employed in similar previous studies, such as Jin et al. (2021), Kang et al. (2018), and Yu et al. (2022). Our treatment group consists of southern African countries that have successfully and formally signed MOUs with China to participate in the BRI (southern African BRI countries), and the control group is made up of southern African countries that are not participating in the BRI (southern African non-BRI countries). As outlined by Nedopil (2022), all 15 southern African countries except for the Democratic Republic of Congo, Eswatini, Mauritius, and Comoros have officially signed MOUs with China about the BRI. Hence, these four southern African countries form the control group, and South Africa, Botswana, Zambia, and Angola comprise the treatment group. The sample period begins in 2013 because that is the year that the BRI infrastructure development strategy was launched, though the MOUs were signed in different years (Bakker, 2022).

The study employs a logarithmic function. According to Greene (2018), the use of logarithmic functions reduces problems of non-normality in data residuals, whereas the coefficients can be interpreted as elasticities. The model was developed by adapting the empirical specifications by Jin et al. (2021), Kang et al. (2018) and Yu et al. (2022), which employ the DID methodology. Our econometric DID model is shown in Equation (1).

$$\ln FDI_{it} = \beta_0 + \beta_1 TREAT_i * POST_{it} + \beta_2 \ln MKS_{it} + \beta_3 INF_{it} + \beta_4 PS_{it} + \beta_5 \ln TO_{it} + \lambda_i + \mu_t + \varepsilon_{it} \quad (1)$$

where FDI_{it} is the net Chinese outward FDI in southern African BRI countries at time t for country i , $POST_{it}$ is the BRI policy time variable for whether BRI was in effect: the time of BRI introduction, 2013 and subsequent years, equals 1; otherwise, 0. $TREAT_i$ equals 1 for BRI countries and 0 for non-BRI countries. $TREAT_i * POST_{it}$ is a dummy variable for

whether a country has implemented the BRI policy at time t (yes = 1; no = 0). MKS_{it} is the market size of the host country, proxied by real GDP at market prices at time t for country i , INF_{it} is the level of inflation, measuring macroeconomic stability, proxied by the annual GDP deflator at time t for country i , PS_{it} is the level of political stability in host country i and time t , proxied by the Political Stability Index (PSI), TO_{it} is the degree of openness to trade proxied by the ratio of trade to GDP (trade openness index), in host country i and time t , ε_{it} is the error term, and λ_t and u_i are time-fixed effects and individual-fixed effects, respectively. β_0 is the regression intercept, and β_1 to β_5 are the regression estimates, among which β_1 is the impact of the BRI on FDI. The model is estimated using the least squares approach. We use Eviews version 13 to estimate the model. Before estimating the econometric model, the researcher conducted several validation tests, including tests for parallel trends and dynamic effects, propensity score matching (PSM), and a placebo test. PSM is carried out to check for robustness of the DID estimation, and the PSM-DID methodology helped in mitigating heterogeneity problems. To confirm the parallel-trend assumption, we performed visual inspections to ensure that, in the absence of treatment, the outcomes of the control and treatment groups show relatively parallel trends.

3.2. Definitions and operationalization of variables

The dependent variable in the study is FDI, and the independent variables are the level of BRI infrastructure development, market size, trade openness, natural resource endowment, and macroeconomic stability.

3.2.1. Foreign direct investment ($\ln FDI_{it}$)

The dependent variable, FDI, is measured by China's FDI inflows to selected African countries in millions of US dollars. Basically, FDI is defined as a form of investment in business control or ownership in a host country by a foreign entity (UNCTAD, 2021).

3.2.2. BRI policy ($\ln BRI_{it}$)

BRI-driven infrastructure development is the variable of interest in this empirical study and is the treatment variable. BRI infrastructure development in southern African BRI countries is proxied using the DID methodology for the period 2003 to 2013, that is, the period before the BRI was in effect is assigned a value of 0 and the period after 2013 (post-BRI) is assigned a value of 1. Thus, the variable for BRI infrastructure development in southern African countries is captured by a dummy variable based on the DID methodology. This main variable of interest regarding the BRI policy is represented by the dummy variable $TREAT_i * POST_{it}$. Previous studies, such as Yu et al. (2019), find that BRI positively impacts Chinese outward FDI activities in BRI countries. Hence, in this study, we expect to find a positive impact of BRI infrastructure investment on FDI.

3.2.3. Trade openness ($\ln TO_{it}$)

Our other independent variable is trade openness. Prabhakar et al. (2019) define trade openness as the extent to which a host country is accessible to and flexible for foreign investors and international trade. Previous studies, such as Khadaroo and Seetanah (2010) and Nketiah-Amponsah and Sarpong (2019), include trade openness in their FDI models and find that it has positive and statistically significant impacts on FDI. According to Kalitsi (2020), it is a standard assumption that trade openness promotes FDI. Trade openness is usually measured by the ratio of trade (imports plus exports) as a percentage of GDP (Khadaroo & Seetanah, 2010). Hence, we use the ratio of trade to real GDP as a proxy for a country's degree of openness. A positive impact on FDI is therefore expected.

3.2.4. Market size ($\ln MKS_{it}$)

The study also includes market size as an independent variable, as it is considered a determinant of FDI. According to Ahmad et al. (2015),

the size of the host market is considered an important element by foreign investors who wish to invest in a certain country. This is because market size determines the economic conditions and potential demand in the host country (Ahmad et al., 2015). Real GDP per capita is used as a proxy variable for market size. Previous studies, such as Khadaroo and Seetanah (2010) and Barzelaghi et al. (2012), find positive impacts, hence, we expect to see a positive impact.

3.2.5. Macroeconomic stability (INF_{it})

Another widely documented determinant of FDI is macroeconomic stability. According to eclectic theory, the economic stability of the host country is among the locational advantages in foreign investment decisions (Batschauer da Cruz et al., 2020). In general, macroeconomic stability is described as the degree of volatility in key economic indicators, such as employment, prices, interest rates, and investment. According to Şiklar and Kocaman (2018), macroeconomic stability in a host country determines the level of FDI inflows. The measures mostly used for macroeconomic stability are real exchange rates and inflation rates. However, given uncertainty in exchange rate policies in southern African countries, such as Zimbabwe, using the exchange rate as proxy for macroeconomic stability is not practical. Therefore, in this study, macroeconomic stability is measured using the annual inflation rate proxied by the annual GDP deflator in the selected southern African countries. Ahmad et al. (2015) find a positively significant impact of macroeconomic stability, proxied by real exchange rates, on FDI. However, when we use the inflation rate as the proxy variable, we anticipate a negative relationship. A negative relationship between inflation and FDI is also found by Michiels (2018).

3.2.6. Political stability (PSI_{it})

Because it is a determinant of FDI, political stability is included among our independent variables in the empirical analysis. Álvarez-García et al. (2018) define political stability as the degree of stability of a government and its potential for collapse due to politically weak institutions. According to Sabir et al. (2019), political stability in the host country is a significant and critically important factor considered by foreign investors. Nugent and Lu (2021) highlight that frequent political disorder creates an unfavorable business climate, which erodes the confidence of risk-averse foreign investors, thereby reducing FDI. In most of the literature, a positive impact between political stability and FDI inflows is found. Hence, we anticipate similar results. In this study, political stability is proxied by the Political Stability Index.

3.3. Data and data sources

We collected data for the period 2003 to 2021 on eight southern African BRI countries. The control group consists of the Democratic Republic of Congo, Eswatini, Mauritius, and Comoros whereas the treatment group comprises South Africa, Botswana, Zambia, and Angola. These countries and time period were selected based on data availability of the variables—that is, southern African countries that lacked some data on the variables are omitted. The annual time series data come from various sources, as shown in Table 1, where the variables are defined.

4. Results and discussion

4.1. Results of empirical analysis

This section presents the results of the empirical analysis. Table 2 summarizes the descriptive statistics for the variables. FDI is measured by China's FDI inflows in million US dollars, and trade openness is measured using the ratio of trade to real GDP. Real GDP per capita in US dollars is used to proxy for market size, and macroeconomic stability is measured using the annual inflation rate in percentage terms proxied by the annual GDP deflator.

Table 1
Definition of the variables.

Variable label	Variable	Source(s)
FDI	Chinese outward FDI inflows in BRI southern African countries in million US dollars	CARI database (http://www.sais-cari.org/chinese-investment-in-africa/) and the Statistical Bulletins on China's outbound FDI
BRI	Dummy variable	Nedopil (2022)
MKS	Market size of the host country proxied by GDP (billion US dollars)	World Bank's World Development Indicators
INF	Level of inflation measuring macroeconomic stability proxied by the annual GDP deflator (annual %)	World Bank's World Development Indicators, central statistical offices, and central statistical offices
TO	Degree of openness to trade proxied by the ratio of trade to real GDP	World Bank's World Development Indicators, UNCTAD and central statistical offices
PS	Degree of political stability proxied by the political instability index	World Bank's World Development Indicators and CEIC database (https://info.ceicdata.com).

Table 2
Summary of descriptive statistics.

Variable	Obs.	Mean	Median	Max.	Min.	Std. Dev.	Sum
$\ln FDI_{it}$	152	1.885	3.492	8.478	−6.908	4.155	286.583
$\ln MKS_{it}$	152	2.788	2.681	6.127	−0.604	1.706	423.85
$\ln INF_{it}$	152	8.97	5.69	93.93	−16.76	11.41	1363.81
PS_{it}	152	−0.13	−0.14	1.12	−1.49	0.72	−19.59
$\ln TO_{it}$	152	4.291	4.374	5.148	3.501	0.370	652.30

Source: Results from Eviews version 13.

In Table 2, the mean is 1.885 for $\ln FDI_{it}$ and 2.788 for $\ln MKS_{it}$. The mean is −0.13 for political stability, proxied by PSI, indicating that on average the Political Stability Index for southern African countries is −0.13 percent. This indicates relative political instability in the southern African region. The mean is 4.291 for trade openness ($\ln TO_{it}$), which implies that most southern African countries are open to international trade.

Table 3 presents the results of the tests of stationarity, confirmed by the augmented Dickey-Fuller (ADF), Levin, Lin, and Chu (LLC), and Phillips-Perron (PP) unit-root tests at the 5 percent level of significance.

Based on the results of the LLC, ADF, and PP unit-root tests, Table 3 shows that four variables—the dependent variables ($\ln FDI_{it}$, $\ln MKS_{it}$, $\ln INF_{it}$, and $\ln TO_{it}$)—are stationary at level, that is, integrated of order zero [I (0)]. The control variable PS_{it} has unit roots at level and is stationary after the first difference, implying that the series are I (1). Thus, the results indicate that it is safe to proceed with the linear regression estimates of the econometric specification presented earlier. The results of the multicollinearity test are presented in Table 4. The pairwise correlation test estimates correlation coefficients that are less than 0.8, and

Table 3
Panel unit-root stationarity tests.

Variable	Level			First difference			Trend and/or intercept
	LLC	ADF	PP	LLC	ADF	PP	
$\ln FDI_{it}$	−4.569*	39.76*	49.53*				Intercept
$\ln MKS_{it}$	−3.83*	26.20	72.65*				Intercept
$\ln INF_{it}$	−2.05**	31.58**	46.58*				Intercept
PS_{it}	−0.88	16.92	27.15**	0.56	40.40*	111.96*	Intercept
$\ln TO_{it}$	−2.32**	24.32**	32.95**				Intercept

Note: ***p < 0.05.

Table 4
Correlation matrix.

Variable	$TREAT_i * POST_{it}$	$\ln MKS_{it}$	$\ln INF_{it}$	dPS_{it}	$\ln TO_{it}$
$TREAT_i * POST_{it}$	1.000				
$\ln MKS_{it}$	0.413** (0.000)	1.000			
$\ln INF_{it}$	0.045 (0.059)	0.229** (0.006)	1.000		
dPS_{it}	0.403** (0.000)	0.168** (0.045)	−0.065 (0.433)	1.000	
$\ln TO_{it}$	−0.04 (0.640)	0.086 (0.302)	0.081 (0.336)	0.205** (0.014)	1.000

Note: **p < 0.05; p-values are in parentheses.

most of them are statistically significant at the 5 percent level. Therefore, the results in Table 4 imply that the effect of each independent variable can be isolated.

Table 5 presents the baseline results from the OLS regression for a robustness check, showing that the results in Model (2), which includes time-fixed effects but not country-fixed effects, are more robust than those in Model (1). Three variables ($TREAT_i * POST_{it}$, $\ln MKS_{it}$, and dPS_{it}) are statistically significant, and two control variables ($\ln INF_{it}$ and $\ln TO_{it}$) are statistically insignificant. The core variable for the BRI policy ($TREAT_i * POST_{it}$) is statistically significant at the 5 percent level. The coefficient of $TREAT_i * POST_{it}$ is positive and statistically insignificant ($\beta = 1.119$; $p = 0.0073 < 0.01$). The results imply that the BRI policy has significant positive effects on China's FDI in the southern African region.

After confirming all the assumptions, we perform the PSM-DID analysis, and the results are in Table 6.

Two different models are estimated with PSM-DID in Tables 6 and in which Model (1) includes control variables (or covariates) for FDI, but not Model (2). However, the results from Model (2) are statistically significant, therefore they represent the benchmark PSM-DID model in the study. The PSM-DID model has good predictive power, with an estimated R^2 of 0.926—which shows that about 92.6 percent of the variations in Chinese outward FDI flows to southern African countries are explained by the BRI policy, whereas the remaining 7.4 percent are

Table 5
Baseline regression results: Dependent variable: $\ln FDI_{it}$.

Variable	Model (1)	Model (2)
C	−6.765** (2.701)	−6.882** (2.881)
$TREAT_i * POST_{it}$	1.639* (0.601)	1.119* (0.797)
$\ln MKS_{it}$	1.701* (0.145)	1.669* (0.151)
$\ln INF_{it}$	0.025 (0.024)	0.041 (0.027)
dPS_{it}	−1.870** (0.344)	−0.761** (0.372)
$\ln TO_{it}$	0.760 (0.625)	0.811 (0.650)
Observations	144	144
R^2	0.62	0.65
Adjusted R^2	0.60	0.59
Time-fixed effects	No	Yes
Country-fixed effects	No	No

Note: *, ** and *** significant at $p < 0.01$, $p < 0.05$, and $p < 0.1$, respectively; robust standard errors are in parentheses.

Source: Results from Eviews version 13.

Table 6
Results of PSM-DID estimations.

Variable	Model (1)	Model (2)
$TREAT_i * POST_{it}$	0.422 (0.675)	1.937* (0.659)
Observations	144	152
R^2	0.943	0.926
Adjusted R^2	0.928	0.910
Controls (or covariates)	Yes	No
Time-fixed effects	Yes	Yes
Country-fixed effects	Yes	Yes

Note: *, ** and *** significant at $p < 0.01$, $p < 0.05$, and $p < 0.1$, respectively; robust standard errors are in parentheses.

Source: Results from Eviews version 13.

explained by other factors or policies not included in the model. These results also show that data fit the model well.

The coefficients of the BRI dummy variable ($TREAT_i * POST_{it}$) for Model (2) are statistically significant at the 1 percent level and positive, implying that the BRI policy has significant positive impacts on FDI in the southern African countries that successfully implemented the BRI policy. This positive impact supports our hypothesis.

Moreover, the results reveal a significantly positive effect of market size on China's outward FDI inflows to the southern African region. The results imply that the market size of southern African countries is a key determinant of FDI flows from China.

However, the statistically insignificant effect of INF_{it} implies that China's outward FDI flows to the southern African countries is not influenced by macroeconomic stability in the host countries, because the focus of the BRI policy is infrastructure development. The results are in line with those by Ma et al. (2019), which also find that inflation has insignificant effects on China's outward FDI. Lee et al. (2022) also determine that inflation has no significant influence on China's outward FDI in BRI countries. However, the results contradict those of Di Vito (2019), which find that inflation inhibited China's outward FDI in Africa.

Furthermore, the results show that political instability in the host southern African countries is detrimental to China's outward FDI inflows to the southern African region. The results imply that political instability has significantly negative effects on FDI inflows to southern African countries.

The results also indicate that trade openness has a statistically insignificant positive coefficient for China's outward FDI flows to the southern African host countries. The results imply that opening up southern African economies to international trade does not significantly attract China's outward FDI flows to the host countries.

4.2. Discussion of findings

The PSM-DID estimation results reveal that the BRI policy has significantly positive impacts on FDI in the southern African countries that successfully implemented it. Similarly, Ma et al. (2019), who examine the effect of Chinese BRI on FDI in Europe also find that the BRI has significant positive impacts on FDI. Our results support those by Khadaroo and Seetanah (2010), who find that the development of transportation infrastructure positively attracts FDI to SSA as well as those by Rehman et al. (2022), which reveal that BRI implementation attracts FDI. Our results also corroborate those by Yu et al. (2022), obtained from using the DID approach, which reveal that BRI significantly facilitates Chinese firms' outward FDI in host African countries. However, Jin et al. (2021) find that BRI has insignificant effects on FDI, and so do Kang et al. (2018).

Moreover, our results reveal a significantly positive effect of market size on China's outward FDI inflows to the southern Africa region. Our results concur with Dunning's "eclectic" theory, which predicts that market size determines the location of FDI in host countries. In addition, the results confirm the findings in previous studies—for example,

Shahriar et al. (2020) find that market size is a main determinant of Chinese outward FDI in BRI countries. Di Vito (2019), who examines the effect of the BRI on Chinese outward FDI in Africa, also indicates that market size attracts Chinese investors to host BRI African countries. However, other studies such as Lee et al. (2022) find that market size has no significant effect on China's outward FDI in BRI countries.

The statistically insignificant effect for INF_{it} implies that China's outward FDI flows to southern African countries are not influenced by macroeconomic stability in the host countries, because the focus of the BRI policy is infrastructure development. These results are in line with those by Ma et al. (2019), which finds that inflation has insignificant effects on China's outward FDI. Lee et al. (2022) also find that inflation has no significant influence on China's OFDI in BRI countries. These results nonetheless contradict those by Di Vito (2019), who determines that inflation inhibits China's OFDI in Africa.

Furthermore, our results show that political instability in the host southern African countries is detrimental to China's outward FDI inflows to the southern African region. These results imply that political instability has significantly negative effects on FDI inflows to southern African countries. Nanwani (2020), in arguing against the BRI, states that political unrest in most African countries fundamentally harms China's favorable attitude toward financing BRI projects and investing in these countries. Our results also support the findings by Wang et al. (2020), which determines that political instability has significantly negative effects on FDI. In contrast, Di Vito (2019) finds that political risk has no significant effects on FDI.

Our empirical results also indicate that trade openness has a statistically insignificant positive coefficient on China's outward FDI flows to southern African host countries. These results imply that opening up southern African economies to international trade does not significantly attract Chinese outward FDI flows to the host countries. Our results confirm the finding by Lee et al. (2022) that trade openness has no significant influence on Chinese outward FDI in BRI countries. However, Wang et al. (2020) and Von Heeren (2022) and others find that trade openness has significant effects on FDI, findings that contradict those in this study.

5. Conclusions

This study investigates the association between the BRI and FDI inflows to the southern African region due to China's BRI using a PSM-DID regression. Our results show a significantly positive effect of the BRI policy on attracting FDI in the southern African region. These results lead to the conclusion that, by welcoming the Chinese BRI, governments in southern Africa may attract significantly more FDI inflows and enhance economic growth in developing economies in the southern African region. Based on the results, the study also concludes that market size and political stability have significantly positive effects on FDI inflows to the southern Africa region whereas macroeconomic stability and trade openness have insignificant effects on FDI inflows from China.

Therefore, the governments and development policy makers in southern African countries need to come up with supportive policies to ensure that the BRI efforts by the Chinese government result in sustainable FDI inflows that will help achieve sustainable economic growth. Moreover, governments and policy makers in the southern African region should implement policies and measures that promote political stability in order to ensure conducive environments for FDI and offer more foreign investment opportunities.

However, the context of our study is specific to the southern African region, hence, the results might not be generalizable to other regions in Africa or all of Africa. This context represents only the "tip of the iceberg," so similar studies on other regions or the entire African continent are needed.

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