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Impact Of Foreign Direct Investment On Domestic Investment In Brazil

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ABSTRACT
In an era marked by rapid globalization and intricate economic interconnections, FDI has emerged as a critical driver of economic growth in many developing nations. Brazil, as the largest economy in Latin America, has witnessed significant fluctuations in FDI inflows over the past decades. The question of whether FDI can stimulate domestic investment remains a topic of considerable interest among economists, policymakers, and scholars. This study delves into the complex relationship between FDI and domestic investment in Brazil, employing historical data, economic indicators, and existing scholarly research. Brazil, as a prominent emerging economy and a global economic force, has consistently attracted international investors and governments. The nexus between economic development and FDI has garnered global attention. FDI not only involves the allocation of financial resources from foreign entities but also entails technology transfer, managerial expertise, and access to international markets. While these inflows have the potential to stimulate local investment, economic growth, and job creation, concerns exist regarding their possible displacement or crowding-out effect on domestic investments. Understanding the intricate correlation between FDI and domestic investment in Brazil is of paramount importance, shaping investment policies within the country and offering valuable insights for other emerging economies seeking to strike a balance between foreign and domestic capital. This study examines the impact of FDI on domestic investment in Brazil, analyzing historical data, economic indicators, and existing literature to provide a comprehensive understanding of this complex relationship. The research draws on economic theories such as the neoclassical growth hypothesis, endogenous growth theory, and crowding-out hypothesis to explore the potential effects of FDI on domestic investment. It considers the regional disparities in FDI distribution and the sector-specific impacts of FDI in Brazil. Additionally, the study evaluates the role of government policies, trade openness, and financial development in moderating the relationship between FDI and domestic investment. Ultimately, this research aims to shed light on the multifaceted dynamics between FDI and domestic investment in Brazil. By addressing the positive and negative aspects of this relationship, it seeks to provide valuable insights for policymakers, economists, and businesses not only in the Brazilian context but also for other nations navigating the challenges and opportunities of FDI. The findings contribute to the global discourse on the impact of FDI on a nation's economic trajectory and offer guidance for informed policy decisions.

KEYWORDS: Foreign Direct Investment; FDI; Domestic Investment; Brazil.

ABBREVIATIONS
FDI: Foreign Direct Investment; GDPG (Gross Domestic Product Growth); AIC: Akaike Information Criterion; SIC: Schwarz Information Criterion; ARDL: Auto Regressive Distributive Lag; ECM: Error Correction Model; VIF: Variance Inflation Factor;

1. INTRODUCTION

In an epoch distinguished by swift globalization and intricate economic interconnections, FDI has emerged as a pivotal catalyst for economic growth in numerous developing nations. Brazil, which holds the distinction of being the largest economy in Latin America, has had notable changes in the inflow of FDI throughout the preceding decades. The topic of whether FDI can stimulate domestic investment continues to generate significant attention among economists, policymakers, and scholars (Djokoto, 2023). Although FDI has the potential to facilitate the transfer of technology, provide managerial knowledge, and grant access to international markets, there are apprehensions regarding its potential to displace or overshadow domestic investments. Comprehending the correlation between FDI and domestic investment in Brazil holds significant importance, as it not only informs the formulation of investment policies within the country but also provides valuable insights for other emerging economies seeking to achieve an optimal equilibrium between foreign and domestic capital. This study examines the influence of FDI on

domestic investment in Brazil by analyzing historical data, economic indicators, and existing scholarly works. The aim is to provide a full understanding of the complex dynamics between these two factors (Dinga *et al*., 2023).

Brazil, as the most prominent economy in Latin America and a significant emerging economic force on the global stage, has consistently garnered the interest of international investors and governments. The interconnection between economic development and growth is closely associated with the influx of FDI, which has garnered significant attention in the global economy. (Jawadi *et al*., 2014). FDI encompasses not solely the allocation of monetary assets from foreign entities but also the implementation of novel technology, managerial proficiency, and the opportunity to reach global markets. The inflows above are perceived as a prospective stimulant for local investment, economic growth, and the generation of employment opportunities. However, similar to any detailed economic interaction, the influence of FDI on domestic investment is multidimensional and characterized by intricate dynamics. (Bakari *et al*., 2019).

The concept of FDI as a means to promote economic development has sparked a dual discourse within academic, economic, and policy spheres. One perspective suggests that FDI has the potential to serve as a substantial catalyst for domestic investment, fostering economic growth and development within the nations where it is received. However, there exist apprehensions over the potential negative impact of excessive dependence on foreign capital since it may impede domestic investments and hinder a country's capacity to foster its businesses and infrastructure. (Kurtović *et al*., 2022). Comprehending the intricate relationship between FDI and domestic investment in Brazil is of utmost significance not only for the nation's development but also for deriving useful insights applicable to other emerging countries. The global pursuit of achieving an optimal equilibrium between foreign and domestic investments is a matter of great importance for states. In this context, Brazil's experience emerges as a significant case study. Hence, the primary objective of this study is to conduct a thorough examination of the "Effect of FDI on Domestic Investment in Brazil." Through a comprehensive analysis of historical data, economic indicators, and current literature, our objective is to elucidate the intricacies and intricacies of this relationship, thereby offering valuable insights that can inform and shape future policy decisions, not only within the context of Brazil but also in a broader global perspective (Farla *et al*., 2016).

In the subsequent sections, we shall examine the historical backdrop of FDI in Brazil, analyze the theoretical foundations that underlie the relationship between FDI and domestic investment, and critically evaluate the available empirical data. The aim of this study is to present a comprehensive analysis of the impact of FDI on domestic investment in Brazil, examining both its potential as a catalyst and its potential as an impediment. In conclusion, it is our intention that this research will provide a more comprehensive comprehension of the worldwide discourse pertaining to the impact of FDI on the economic trajectory of nations. Furthermore, we aim to offer guidance to policymakers in their endeavor to make well-informed choices regarding Brazil's economic prospects.

2. BACKGROUND

The examination of the influence of FDI on domestic investment in Brazil has garnered substantial attention from both academic scholars and policymakers. Comprehending this correlation is imperative for governmental policymakers and stakeholders in the business sector, given that FDI assumes a pivotal function in the advancement of the Brazilian economy. (Nazim, 2022)This comprehensive background section will discuss the historical context, the significance of FDI in Brazil, and the primary reasons propelling this interconnection. The historical context of a certain event or period refers to the social, political, economic, and cultural factors that influenced and shaped Brazil, the most extensive nation in South America and the possessor of a multifaceted economic past. (Gaskins, 2019). Throughout its history, the Brazilian economy has exhibited a pattern of experiencing phases of expansion, stagnation, and economic downturns. A multitude of elements has influenced the economic configuration of the nation, encompassing but not limited to natural resources, historical remnants of colonialism, political volatility, and worldwide economic patterns. During the latter part of the 20th century and the early years of the 21st century, Brazil experienced a substantial metamorphosis, positioning itself as a prominent emerging economy on the global stage. Brazil has successfully drawn significant FDI as a crucial factor in its economic growth and change. (Farla *et al*., 2016).

FDI inflows have played a significant role in Brazil's economic growth by augmenting capital investment, spurring the creation of employment opportunities, and facilitating the transfer of technology. The application of this technology has contributed to the modernization of several sectors and the augmentation of production. FDI has played a crucial role in facilitating the advancement of infrastructure initiatives in Brazil, including various sectors including transportation, electricity, and telecommunications. These developments have not only enhanced the local infrastructure but have also enhanced the country's appeal to foreign investors. Numerous international firms engage in investment activities in Brazil with the objective of accessing its substantial domestic market and utilizing the nation as a strategic export hub for the broader South American region. This phenomenon has resulted in a notable augmentation in exports and the subsequent generation of foreign exchange revenue. (Sahoo and Bishnoi, 2021).

FDI has been instrumental in generating substantial employment prospects, both in a direct and indirect manner, across diverse sectors. This phenomenon has the utmost importance in the context of mitigating the challenges of unemployment and poverty. Foreign corporations frequently provide cutting-edge technology and innovative practices to Brazil, thus enhancing the local industries and bolstering their competitiveness on the global stage. FDI has the potential to contribute to the stabilization of Brazil's balance of payments by facilitating the inflow of foreign currency through investments and exports. This influx of foreign currency has the capacity to alleviate trade deficits. For Brazilian enterprises, FDI presents potential avenues to reach global markets, acquire worldwide visibility, and extend their business activities overseas. (Nazim, 2022). The substantial and expanding local market in Brazil holds considerable appeal for foreign investors. The extensive consumer base in Brazil presents a compelling motivation for global firms to allocate resources toward investment in order to secure a portion of the market. Brazil possesses a significant abundance of natural resources, encompassing a wide range of agricultural items, minerals, and energy resources. This phenomenon elicits FDI, notably in industries such as agriculture, mining, and energy. Investor trust in Brazil has been bolstered by the presence of a stable political climate, particularly in recent years. The presence of political stability has a pivotal role in fostering sustained FDI. (Pao and Tsai, 2011)The Brazilian government has enacted a range of policies aimed at enticing international investment, including tax incentives, investment guarantees, and trade agreements. Establishing a robust legal and regulatory framework plays a crucial role in fostering an environment conducive to attracting and retaining investors.

Prevailing global economic trends and investment patterns also shape the allure of Brazil for FDI. FDI exhibits a positive correlation with global economic conditions that are deemed favorable. The implementation of ongoing infrastructure development projects in Brazil has resulted in increased accessibility and enhanced attractiveness to foreign investors. The presence of enhanced transportation and communication networks has the potential to decrease the financial burdens associated with conducting corporate operations within the country. Several industries in Brazil, including agribusiness, renewable energy, and information technology, have exhibited significant potential for growth, rendering them particularly appealing to international investors. The changes in exchange rates can have an impact on FDIA favorable exchange rate has the potential to enhance the attractiveness of Brazilian assets among overseas investors (Akpan and Ibidunni, 2023). The correlation between FDI and domestic investment in Brazil is a complex and interconnected phenomenon intricately linked to the nation's economic past, policy choices, and global economic forces. The influence of FDI on domestic investment in Brazil holds considerable importance and exhibits diverse effects, rendering it a crucial subject for scholarly investigation and examination. Comprehending this correlation is crucial for politicians, economists, and enterprises endeavoring to navigate the intricate economic terrain of Brazil (Bakari *et al*., 2019).

3. LITERATURE REVIEW: IMPACT OF FDI ON DOMESTIC INVESTMENT IN BRAZIL

The correlation between FDI and domestic investment is a subject of extensive discourse within the fields of international economics and development studies. Given Brazil's status as one of the BRICS nations and its significant influence on the global economic scene, comprehending this interconnection assumes heightened importance. This literature review examines the extant scholarly and empirical literature pertaining to the influence of FDI on domestic investment in Brazil (Ahmad *et al*., 2021).

Numerous economic theories have been proposed in order to elucidate the correlation between FDI and domestic investment. The neoclassical growth hypothesis posits that FDI has the potential to serve as a capital source, hence fostering heightened levels of investment and economic expansion. Furthermore, endogenous growth theory emphasizes the significance of FDI in facilitating the transfer of technology, fostering innovation, and promoting the development of human capital (Ayed Mouelhi, 2009). Nonetheless, the 'crowding-out hypothesis' posits that FDI may diminish domestic investment by displacing local enterprises or intensifying competition to levels that are not sustainable (Korna, 2013). Brazil has emerged as a highly appealing location for foreign investors, particularly in the period after 1990, subsequent to the implementation of substantial economic changes. It has been observed that rising economies such as Brazil, which possess well-established financial markets, tend to derive greater advantages from FDI, resulting in a notable increase in their domestic investment. One area of scholarly research has concentrated on examining the sector-specific effects of FDI in Brazil. Researchers have discovered that FDI in the industrial sector of Brazil has resulted in improvements in efficiency (Tsaurai, 2022).

However, it has also led to heightened rivalry, which in turn has prompted certain domestic firms to decrease their investments. In contrast, FDI in the agriculture sector exhibited a complimentary association with domestic investment, maybe attributable to the transfer of technology. The effects of FDI exhibit heterogeneity within the Brazilian context. Research has indicated that the regions of Brazil with higher levels of development, particularly the Southeast, have been the primary recipients of FDI (Korna, 2013). These regions witnessed a more substantial increase in domestic investments compared to less-developed areas. In contrast to the advantages associated with FDI, certain research has identified potential adverse consequences. The scholars engaged in a discourse about potential situations in which FDI may result in the displacement of domestic enterprises, particularly when local businesses are unable to effectively compete against international corporations.

This phenomenon has the potential to result in a decrease in domestic investment within specific sectors or geographical areas. Numerous scholars have emphasized the beneficial externalities resulting from FDI. Scholars have posited that FDI, particularly in areas such as technology and services within the Brazilian context, has engendered knowledge and technology spillovers, hence conferring advantages upon local enterprises and fostering augmented domestic investments. The significance of government regulations in regulating the influence of FDI on domestic investment should not be underestimated (Dias, 2014). Research has indicated that the liberalization of investment regimes and the implementation of tax incentives in Brazil throughout the latter part of the 20th century had a significant influence on the extent and direction of the impact of FDI on domestic investment. Although the major emphasis lies on investment, several studies have also examined the indirect ramifications of FDI, positing that FDI may exert an influence on domestic investments through its impact on employment and pay rates. In the specific context of Brazil, the influx of FDI has the potential to provide a positive impact on employment rates and income levels. This, in turn, may lead to a boost in domestic consumption and savings, so exerting an influence on the patterns of domestic investment (Kurtović *et al*., 2022).

The inclusion of a time viewpoint is crucial. A comprehensive cross-country study encompassing Brazil proposed that although the immediate effects of FDI on domestic investment may differ, the enduring consequences generally exhibit a positive trend owing to the transfer of knowledge and the enhancement of capabilities (Ng and Kee, 2017). The existing body of research pertaining to the influence of FDI on domestic investment in Brazil encompasses a wide range of viewpoints. Although there exists a general agreement regarding the potential advantages of FDI, such as the transfer of technology and influx of cash, apprehensions persist regarding the crowding-out impact and regional inequities. As the evolution of Brazil and the shifting dynamics of the global economy persist, it is imperative to engage in ongoing research and scholarly investigation of the intricacies inherent in this relationship (Egan, 2015).

The neoclassical growth hypothesis, as formulated by economists, suggests that FDI can exert a favorable influence on domestic investment within the context of Brazil. Based on the theoretical framework, FDI plays a role in fostering capital accumulation, subsequently resulting in heightened levels of domestic investment and overall economic growth (Olutuase *et al*., 2020). The influx of foreign enterprises investing in Brazil contributes to the augmentation of native industries through the introduction of capital, technologies, and knowledge (Kurtović *et al*., 2022). The endogenous growth theory, which has gained prominence among scholars, posits that FDI has the potential to stimulate domestic investment in Brazil through the facilitation of technology transfer and innovation. Multinational organizations frequently provide cutting-edge technologies and managerial strategies, hence facilitating knowledge transfer to domestic enterprises and augmenting their operational efficiency (Albayati *et al*., 2020). Within the specific context of Brazil, FDI has the potential to facilitate the advancement of domestic technological skills and the dissemination of information, resulting in a subsequent rise in domestic investment in research and development (RandD). The crowding-out hypothesis, as posited by certain economists, offers an alternative viewpoint. The argument posits that FDI has the potential to diminish domestic investment in Brazil due to the displacement of local enterprises by international investors (Cassiolato, 2013).

This phenomenon can occur when international companies surpass domestic companies in competition, resulting in a decrease in their market share and profitability. In instances of this nature, domestic enterprises have the potential to decrease their investments, so impacting the overall levels of domestic investment. The dependence theory, which holds significant influence in the Latin American context, posits that FDI has the potential to sustain economic dependency and impede indigenous investment. Certain advocates of this idea contend that FDI frequently leads to the exploitation of significant resources from Brazil, perhaps lacking in benefits for the domestic economy (Kurtović *et al*., 2022). This phenomenon has the potential to impede domestic investment in industries that heavily depend on these resources. Throughout its history, Brazil has consistently implemented industrial policy measures with the aim of attracting FDI and stimulating local investment. These strategies frequently consider the unique requirements and capacities of various sectors. The industrial policy framework of Brazil is a key driver for attracting FDI in vital areas, including oil and gas, as well as renewable energy. The policies are theoretically grounded in the notion that focused FDI has the potential to foster enduring growth within domestic industries. The involvement of Brazil in global value chains and international trade exerts influence over the landscape of FDI and domestic investment (Capozza *et al*., 2021). Trade theories, such as the concept of comparative advantage and the gravity model, offer theoretical foundations for comprehending the potential of FDI in bolstering Brazil's global competitiveness and fostering domestic investment in businesses focused on exports (Bortoluzzo *et al*., 2013) .

Research has placed significant emphasis on the uneven distribution of FDI in Brazil. Throughout history, it has been seen that regions that possess well-developed infrastructure and larger customer bases, particularly the Southeast and South regions, tend to receive the majority of FDI. The regional concentration of economic activities has significant implications for the patterns of domestic investment. Various regions in Brazil possess distinct attractions for FDI that are specialized to particular sectors (Mohammad and Qadri, 2019). As an illustration, the Northeast region, characterized by its extensive coastline, has experienced significant investments in the tourism industry and other associated industries. Conversely, the Amazon region,

renowned for its abundant biodiversity, has garnered FDI mostly in the agricultural and forestry sectors. Numerous scholars have emphasized that places characterized by superior infrastructure tend to exhibit a greater propensity for attracting FDI. Consequently, there is a further chain reaction whereby domestic investment is influenced, as enhanced infrastructure has the potential to stimulate heightened levels of local business operations. The spillover effects of FDI exhibit varying degrees of prominence across different locations. According to scholarly research, areas characterized by a greater concentration of Indigenous suppliers and industries tend to observe more pronounced beneficial effects from FDI in terms of knowledge diffusion, skill development and heightened local investment (Tsaurai, 2022).

The influence of FDI on domestic investment might exhibit variability contingent upon its inherent characteristics. FDI in the form of mergers and acquisitions, for example, may not necessarily contribute to the overall capital stock and could potentially displace domestic enterprises. On the contrary, greenfield investments have the potential to result in the establishment of fresh industrial capacities (Mustafa *et al*., 2016). The advent of global firms has the potential to heighten competitiveness within specific industries. According to the crowding-out theory, it is possible that this phenomenon could result in the displacement of less competitive local enterprises from the market, thus causing a decline in domestic investment within these sectors. Scholars have shown that the phenomenon known as the crowding-out effect may exhibit greater prominence in markets characterized by limited size or nearing their maximum capacity (Castro *et al*., 2013). In the situations above, a rise in FDI may result in the displacement of local enterprises by foreign companies, leading to a loss of market shares for the latter. There exists a body of research that has examined the possibility of FDI exerting pressure on the financial resources accessible to domestic enterprises. The borrowing activities of foreign corporations from domestic financial markets have the potential to exert upward pressure on interest rates and limit the availability of financial capital for domestic investors. There is a lack of consensus among studies regarding the existence of the crowding-out effect (Gondim *et al*., 2018). Several scholars contend that FDI has the potential to stimulate domestic investment through the enhancement of market efficiency and the introduction of new business practices (Pao and Tsai, 2011)The existence of multinational firms can also contribute to improving the overall business climate, resulting in a rise in domestic investment in supporting industries.

4. THE MODEL

The research was based on a dynamic investment equation that considers FDI in the host country as well as certain control variables. One dynamic characteristic of the model arises from the presence of a trailing dependent variable in the set of explanatory factors that will be examined in the following sections.

Given this logic, the fundamental investment equation can be written in the following linear form:

$$DI_{i,t} = \beta_0 + \beta_1 DI_{i,t-1} + \beta_2 FDI_{i,t} + \beta_3 CDPG_{i,t} + \beta_4 FD_{i,t} + \beta_5 OPEN_{i,t} + \beta_6 EU_{i,t} + \beta_7 EF_{i,t} + \varepsilon_{i,t}$$

Where (i) is the host country index, (t) is the time index, (β) s is the unknown parameters to be evaluated, and (ε) is the usual term for random perturbation. The dependent variable (DI) is domestic investment as a percentage of GDP. The main interest of this empirical study is the sign and value (β2) (i.e., the impact of FDI inflows on domestic investment in the host country).

The pertinent existing empirical literature influenced the selection of control variables discussed earlier and the accessibility of data. The anticipation of a favorable investment climate, shown by the previous level of domestic investment, was expected to incentivize domestic investors to increase their investment activities (Bortoluzzo *et al*., 2013) . This phenomenon can be attributed to the positive feedback effect. The utilization of the growth rate of real GDP was employed to capture the conventional acceleration effect, with the anticipation of a favorable impact due to the rise in income, which would, in turn, promote domestic investment. Furthermore, it is anticipated that the rapidly expanding economy will have a significant impact on future projections and, consequently, domestic investment as investors contemplate the future. The measurement of the host country's trade openness (OPEN) was determined by calculating the combined value of exports and imports as a proportion of the gross domestic product (GDP). It was hypothesized that a greater degree of trade openness would result in a corresponding rise in domestic investment. The application of credit extended to the private sector as a proportion of Gross Domestic Product (GDP) was employed as an indirect measure to assess the level of financial development, with the anticipation of observing an optimistic impact. Researchers have ultimately discovered that the presence of political freedom fosters domestic investment by enhancing the development of human capital (Kang, 2010). Consequently, it was anticipated that democracy would provide a satisfactory influence on domestic investment.

5. THE DATA

The data on all variables except the economic freedom variable (EF) is taken from World Bank Indicators (WDI) online from 1973-2022. The regime durability indicator from the Penn World Table (PWT) is used as a proxy for political stability (economic freedom in our model). Gross fixed capital formation (%GDP) represents domestic investment. Trade openness is measured as

the sum of exports and imports as the ratio of GDP. Credit provided to the private sector by banks is used as a proxy for Financial Development (FD) (Anwar, 2023). Economic uncertainty is measured by Using Principal Component Analysis (PCA) to create an indicator that takes into account a linear mix of inflation and foreign debt stocks; we were able to determine how much macroeconomic volatility affected international remittances. By doing this, we can create a single index that incorporates both the fiscal and monetary components of macroeconomic volatility. In layman's terms, PCA is a "mathematical technique which preserves as much 'variability' (i.e., statistical information) as possible, while reducing the dimensionality of data set" (Jolliffe and Cadima, 2016:1). Through the creation of new, fake variables known as principle components, this process reduces dimensions. Using PCA to create a macroeconomic instability index has two key benefits. First, utilizing two or more macroeconomic instability indicators in tandem allows us to prevent the multi-collinearity problem from inheriting. Descriptive statistics of the variables are given below.

Table 1: Descriptive Statistics.

	DI	FDI	GDPG	EU	FD	OP	EF
Mean	19.5868	2.0869	3.0993	31.5591	49.8258	0.1840	15.32
Median	19.2030	1.7435	3.1811	30.8849	41.4301	0.1864	12.5
Maximum	26.9028	5.0339	13.9687	59.0962	133.0759	0.2876	37
Minimum	14.5590	0.1345	-4.3500	15.8672	14.5052	0.0960	0
Std. Dev.	2.5701	1.4611	3.8216	11.1885	24.0706	0.0721	11.3289
Skewness	0.3976	0.3752	0.1474	0.4969	1.6737	0.1372	0.4101
Kurtosis	3.0638	1.7655	3.2778	2.4022	6.2878	1.4296	1.8574
Observations	50	50	50	50	50	50	50

This Table provides a summary of statistical information for seven different variables, presumably related to economic or financial data. Each row in the Table represents a different statistic, and each column corresponds to a specific variable. Here's a breakdown of the information in this Table:

DI (Direct Investment): This variable has a mean of 19.58674, a median of 19.20301, a maximum value of 26.90279, and a minimum value of 14.55899. The standard deviation is 2.570067, indicating moderate variability. The skewness and kurtosis values suggest a slightly positively skewed and moderately leptokurtic distribution.

FDI: The mean for FDI is 2.0869, with a median of 1.74351. The maximum FDI value is 5.033917, and the minimum is 0.134513. The standard deviation is 1.461098, showing moderate variability. The skewness is positive, suggesting a right-skewed distribution and the kurtosis indicates a moderately leptokurtic distribution.

GDPG: This variable has a mean of 3.099296 and a median of 3.181066. The maximum GDP growth rate is 13.96872, and the minimum is -4.35. It has a relatively high standard deviation of 3.821555, indicating substantial variability. The skewness is close to zero, suggesting a nearly symmetric distribution and the kurtosis is relatively high, indicating a leptokurtic distribution.

EU (European Union): The mean value for this variable is 31.55905, with a median of 30.88491. The maximum EU value is 59.0962, and the minimum is 15.86719. The standard deviation is 11.18854, suggesting moderate variability. The skewness is positive, indicating a right-skewed distribution and the kurtosis is relatively high, suggesting a leptokurtic distribution.

FD (Foreign Direct): This variable has a mean of 49.82579, a median of 41.43007, a maximum value of 133.0759, and a minimum.

6. METHODOLOGY

As the data is time series data. A time series comprises successively ordered observations of a defined variable made at uniform intervals over a given duration. The most popular frequency ranges for series are annual, quarterly, monthly, weekly, and daily. Economic time series data frequently have distinctive characteristics, such as a distinct trend, a high degree of shock persistence, increased volatility with time, and a meandering pattern that shares co-movements with other series. Such

characteristics of time series data must be adequately understood and addressed by researchers. Understanding the characteristics of variables, their interactions with each other and integration over time is important for Time Series Analysis.

First stationarity of variables is tested through a unit root test. The Augmented Dickey-Fuller (ADF) test and the Phillips-Perron test are frequently utilized in order to ascertain whether a variable exhibits stationarity or requires differencing. Suppose the variables are Integrated of Order zero, i.e., I(0), or Integrated of Order one, i.e., I(1), or having mixed order. In that case, the ARDL model is an appropriate technique widely used in time series regression analysis. The results of the Unit Root test are presented as follows.

Table 2: Unit Root Test.

Unit Root Test Results Table (ADF)								
Null Hypothesis: the variable has a unit root								
At Level								
		DI	FDI	GDPG	FD	TO	EU	EF
With Constant	t-Statistic	-3.0862	-0.3077	-5.571	-2.8884	0.0453	-2.6246	0.7510
	Prob.	***0.0343***	***0.9148***	***0.0000***	***0.0552***	***0.9580***	***0.0951***	***0.9921***
		**	n0	***	*	n0	*	n0
With Constant and Trend	t-Statistic	-4.219	-2.3255	-5.8045	-2.9625	-2.4252	-2.7231	-3.3425
	Prob.	***0.0087***	***0.4112***	***0.0001***	***0.1545***	***0.3626***	***0.2324***	***0.0715***
		***	n0	***	n0	n0	n0	*
Without Constant and Trend	t-Statistic	-0.7284	0.8632	-4.2445	0.0132	2.2983	-0.5227	2.1136
	Prob.	***0.3955***	***0.8923***	***0.0001***	***0.6818***	***0.9942***	***0.4851***	***0.9909***
		n0	n0	***	n0	n0	n0	n0
At First Difference								
		d(DI)	d(FDI)	d(GDPG)	d(FD)	d(TO)	d(EU)	d(EF)
With Constant	t-Statistic	-5.5321	-3.2603	-10.8937	-7.227	-6.9718	-4.9896	-8.8806
	Prob.	***0.0000***	***0.0237***	***0.0000***	***0.0000***	***0.0000***	***0.0001***	***0.0000***
		***	**	***	***	***	***	***
With Constant and Trend	t-Statistic	-5.4634	-3.274	-10.8463	-7.1455	-7.0405	-4.9356	-8.8588
	Prob.	***0.0003***	***0.0853***	***0.0000***	***0.0000***	***0.0000***	***0.0011***	***0.0000***
		***	*	***	***	***	***	***
Without Constant and Trend	t-Statistic	-5.5492	-3.0151	-10.9935	-7.2676	-2.643	-5.0301	-0.135
	Prob.	***0.0000***	***0.0035***	***0.0000***	***0.0000***	***0.0093***	***0.0000***	***0.6306***
Order of Integration		**I(0)**	**I(1)**	**I(0)**	**I(1)**	**I(1)**	**I(1)**	**I(1)**

As it is evident the variables have mix order of integration, so we use the ARDL technique. The next step in the ARDL process is to check the lag selection criteria and the lag length of the variables. There are many lag selection criteria used in the literature. The AIC is a mathematical method for evaluating how well a model fits the data it was generated from. In statistics, AIC is used to compare different possible models and determine which one is the best fit for the data. Another criterion is SIC. SIC is an index to help quantify and choose the least complex probability model among multiple options. Also called the Bayesian

Information Criterion (BIC), this approach ignores the prior probability and instead compares the efficiencies of different models at predicting outcomes. The results of the lag selection criteria are given in Table 3.

Table 3: Lag Selection criteria.

	DI	FDI	CDPG	FD	TO	EU	EF
R-squared	0.8525	0.8395	0.2823	0.5787	0.9863	0.8636	0.9849
Adj. R-squared	0.7899	0.7715	-0.0222	0.4000	0.9804	0.8057	0.9785
Sum sq. resids	46.8761	16.5466	406.6883	11716.91	0.0034	800.7183	90.6255
S.E. equation	1.1918	0.7081	3.5105	18.8430	0.0101	4.9259	1.6572
F-statistic	13.6209	12.3327	0.9270	3.2378	169.2991	14.9254	153.4389
Log-likelihood	-67.5404	-42.5486	-119.3934	-200.0511	161.411	-135.6524	-83.3618
Akaike AIC	3.4392	2.3979	5.5997	8.9605	-6.1005	6.2772	4.0984
Schwarz SC	4.0239	2.9826	6.1845	9.5452	-5.5157	6.8619	4.6832
Mean dependent	19.5234	2.1215	2.7675	50.5186	0.1868	32.0250	15.7917
S.D. dependent	2.6001	1.4812	3.4722	24.3256	0.0723	11.1764	11.2892
Determinant resid covariance (dof adj.)		4.8336					
Determinant resid covariance		0.3509					
Log-likelihood		-451.6289					
Akaike information criterion		23.1929					
Schwarz criterion		27.2861					
Number of coefficients		105					

Looking at Table 3, AIC has the lowest value, so AIC is the lag selection criterion. The next step is to check the maximum lag length of the variables used in the model. Table 4 describes the maximum lag length.

Table 4: Maximum Lag Length.

VAR Lag Order Selection Criteria						
Endogenous variables: DI FDI GDPG FD TO EU EF						
Exogenous variables: C						
Sample: 1973 2022 Included observations: 46						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-700.5148	NA	53982.92	30.7615	31.0398	30.8658
1	-476.4497	370.1946	27.3810	23.1500	25.3762*	23.9839
2	-429.409	63.4026	34.5714	23.2352	27.4093	24.7988
3	-358.0459	74.4659*	19.9305	22.2629	28.3848	24.5562
4	-279.0613	58.3799	14.2661*	20.9592*	29.0291	23.9822*

According to AIC, the Maximum lag length is 4, while according to SIC, it is 2. Another important aspect of the time series variables is the possibility of multi-collinearity among the independent/explanatory variables. To check for multi-collinearity, the VIF test is applied (Table 5).

Table 5A: Multi-Collinearity Test (VIF).

Variance Inflation Factors			
Sample: 1973-2022 Included observations: 50			
	Coefficient	Uncentered	Centered
Variable	Variance	VIF	VIF
FDI	0.1028	10.3963	3.3736
GDPG	0.0056	2.08670	1.2487
FD	0.0001	6.4727	1.2048
TO	228.3469	139.6122	18.2492
EU	0.0008	14.3593	1.5748
EF	0.0074	41.7552	14.5691
C	4.6154	72.4223	NA

Trade openness (TO) and economic freedom index (EF) have a centered VIF value of more than 10, which is evidence of multicollinearity. To solve this, we have to drop TO or EF. When we drop TO, the VIF-centered value is below 10. Thus, in the final analysis, we exclude the trade openness variable.

Table 5B: Multi-Collinearity Test (VIF).

Variance Inflation Factors			
Sample: 1973-2022 Included observations: 50			
	Coefficient	Uncentered	Centered
Variable	Variance	VIF	VIF
FDI	0.0939	8.8495	2.8716
GDPG	0.0059	2.0815	1.2456
FD	0.0001	6.3713	1.1859
EU	0.0007	10.6415	1.1670
EF	0.0018	9.4635	3.3020
C	1.7002	24.8728	NA

All the centered VIF values are below 10. So, the multicollinearity issue is solved. Thus, our final model is the above model. After checking the multi-collinearity, we run for the short-run and long-run relationship among the dependent variable and the independent variables. To see the presence of long-run co-integration, we use the ARDL bond test. The results of the ARDL bond test are presented in Table 6.

Table 6A: ARDL Bond Test.

Null hypothesis: No levels of relationship	
Number of cointegrating variables: 5	
Trend type: Unrest. constant (Case 3)	
Sample size: 46	
Test Statistic	Value
F-statistic	12.3722
t-statistic	-5.4110

The critical value of the ARDL bond test is as follows.

Table 6B: Critical value of ARDL Bond Test.

	10%		5%		1%	
Sample Size	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
F-Statistic						
45	2.458	3.647	2.922	4.268	4.030	5.598
50	2.435	3.600	2.900	4.218	3.955	5.583
Asymptotic	2.260	3.350	2.620	3.790	3.410	4.680
t-Statistic						
Asymptotic	-2.57	-3.86	-2.86	-4.19	-3.43	-4.79

The critical values of both F- and T-statistics are above the upper critical bond, which confirms the presence of a long-run co-integrating relationship.

7. ARDL SHORT-RUN AND LONG-RUN DYNAMICS

Once we establish the co-integration between variables, the next step is to examine the model's short-run and long-run dynamics. We discuss the short-run and long-run relationship between domestic investment and FDI, along with other determinants, using the (ECM and ARDL long-run model).

Table 7 presents the ECM short-run results. We can observe that the error correction term (CointEq(-1)*) is negative and significant (-0.56***). This shows the speed of adjustment from the short run to the long run. The Table shows that in the short run, FDI positively impacts domestic investment in Brazil. This supports the complementarity hypothesis. This implies that in the short run, FDI inflows to Brazil have positive spillover effects on domestic investment.

Table 7: Short Run Error Correction Model Result.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
COINTEQ*	-0.563	0.060	-9.408	0.000
D(FDI(-1))	0.379	0.156	2.424	0.021
D(GDPG(-1))	-0.557	0.087	-6.365	0.000
D(EF(-1))	0.026	0.073	0.353	0.726
C	3.161	0.352	8.992	0.000
R-squared	0.871	Mean dependent var		-0.078
Adjusted R-squared	0.813	S.D. dependent var		1.624
S.E. of regression	0.703	Akaike info criterion		2.391
Sum squared resid	15.320	Schwarz criterion		2.987
Log-likelihood	-39.983	Hannan-Quinn criterion		2.614
F-statistic	14.943	Durbin-Watson stat		2.180
Prob(F-statistic)	0.000			

The Cointegration term is -0.56 with a significant p-value. Thus, there is evidence of a long-run cointegration relationship. Also, the F test Bond value is above the upper limit I(1) values at all levels of significance. The ARDL long-run results are given as follows.

Table 8: ARDL Long-Run Results.

Variable*	Coefficient	Std. Error	t-Statistic	Prob.
FDI(-1)	-0.69	0.44	-1.56	0.13
FD	0.07	0.01	4.61	0.00
GDPG(-1)	1.61	0.25	6.41	0.00
EU(-1)	0.16	0.05	3.54	0.00
EF(-1)	0.10	0.07	1.48	0.15

The results state that Financial Development positively affects domestic investment in Brazil. Similarly, GDP growth also positively contributes to domestic investment. An interesting result is that the macroeconomic uncertainty variable (EU) is positive and significant. This implies that macroeconomic uncertainty in Brazil is below a threshold level where it can have adverse effects on investment. Economic freedom is a measure of political stability. The results reveal that a more politically stable environment positively affects investment. FDI has a negative sign, but it is statistically insignificant.

8. DIAGNOSTIC TESTS

After we establish a co-integrating relationship, it is important to check the residual diagnostic and stability tests. The residual normality test is the Jarque-Bera test. The results of the J-B test show that residuals are normally distributed. The results of the Breusch-Godfrey serial correlation LM test and Heteroscedasticity tests confirm that there is no serial correlation left in residuals and no problem of heteroscedasticity.

Table 9: Residual Diagnostic and Stability Tests.

		Coefficient	P-value
Normality test	Jarque-Berat Test	1.11	0.57
Serial Correlation Test	Obs*R-Sq	0.99	0.31
Heteroskedasticity Test	Obs*R-Sq	14.71	0.74

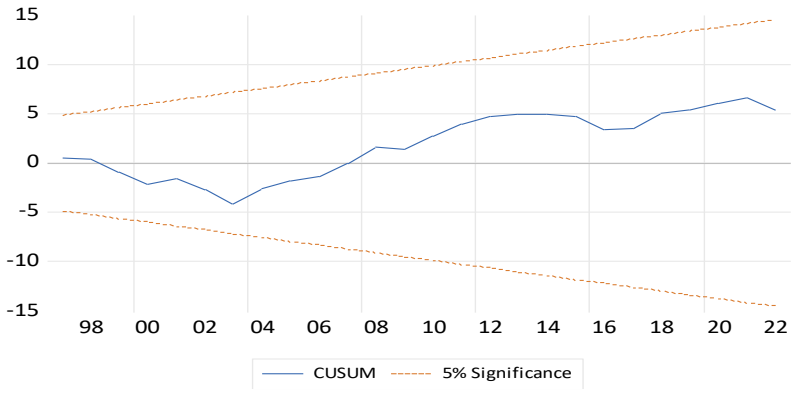
9. STABILITY TESTS

For stability analysis, the Ramsey reset test and CUSUM test are used. Both tests confirm that the model is sTable. The results are presented below.

Table 10: Ramsey Reset Test.

	Coefficient	P-Value
T-statistic	1.09	0.28
F-statistic	1.19	0.28
Likelihood Ratio	2.14	0.14

10. CUSUM TEST



Thus, overall, the model is stable.

11. CONCLUSION

This study provides valuable insights into the dynamics of domestic investment in Brazil and its relationship with various economic and financial variables. The data analysis and model development were conducted meticulously, involving a comprehensive set of variables, time series analysis, and robust econometric techniques. The data used in this study encompassed multiple variables, including political stability, domestic investment, FDI, GDP growth, European Union influence, financial development, and economic freedom. These variables were extracted from reputable sources such as the World Bank Indicators and Penn World Table, ensuring a reliable foundation for the analysis. The study creatively employed Principal Component Analysis to construct a macroeconomic instability index, effectively capturing the combined impact of fiscal and monetary components of macroeconomic volatility. This innovative approach mitigates multicollinearity issues and enhances the robustness of the model. Recognizing the unique characteristics of time series data, the study rigorously addressed concerns such as stationarity. An ARDL model was aptly chosen due to the mixed order of integration in the dataset, and lag selection criteria, including AIC and SIC, further supported this choice. The presence of multicollinearity, a common challenge in econometric modeling, was identified and resolved. By excluding one of the problematic variables (Trade Openness or Economic Freedom), the study effectively eliminated multicollinearity, enhancing the reliability of the final model. The research explored the short-run and long-run dynamics of domestic investment in Brazil, employing an ECM and the ARDL model. The results indicated a significant long-run cointegration relationship, with variables like Financial Development, GDP growth, and macroeconomic uncertainty positively impacting domestic investment. This study also recognized the role of political stability, represented by economic freedom, in supporting investment. After establishing the cointegrating relationship, the study performed comprehensive diagnostic and stability tests. These tests revealed that residuals were normally distributed, and there were no issues of serial correlation or heteroscedasticity. Ramsey reset, and CUSUM tests confirmed the model's stability. In summary, this study provides valuable insights into the complex relationships between domestic investment and various economic and financial factors in the context of Brazil. The methodological approach employed, including the innovative use of PCA and rigorous statistical testing, enhances the credibility and robustness of the findings. These results contribute to a better understanding of the economic landscape in Brazil and have implications for policymakers and investors seeking to make informed decisions in the region.

CONFLICT OF INTEREST

None.

ORCID

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MAHJ –

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