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## Article

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# Determining the optimal threshold of foreign direct investment for sustainable improvement in Ghana's trade balance

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## Abstract

**Purpose** – The main purpose of this study is to evaluate the threshold impact of foreign direct investment (FDI) on Ghana's trade balance.

**Design/methodology/approach** – The study used annual time-series data, spanning 1980–2022. The study employed the autoregressive distributed lag (ARDL) models, error correction models and smooth threshold regression techniques to establish the relationship between FDI and trade balance.

**Findings** – The result of the study shows a positive and significant effect of FDI on trade balance in the short and long run on the Ghanaian economy. The study further revealed that the threshold value of FDI that would induce a positive trade balance for Ghana is 7.825%. Moreover, it was established that there is a unidirectional causality between trade balance and FDI flowing from FDI to trade balance.

**Practical implications** – Ghanaian policymakers ought to establish an FDI threshold monitoring mechanism to ensure inflows surpass 7.825%, promote investment diversification to mitigate reliance risks, enhance the investment climate and regulatory framework, strengthen export promotion initiatives and invest in human capital and technology transfer across key sectors for a favourable and sustainable trade position.

**Originality/value** – This study is the first among its kind in Ghana and the first to apply both the ARDL and smooth threshold regression techniques in the same study.

**Keywords** Autoregressive distributed lag, Foreign direct investment, Ghana, Threshold, Trade balance, Eclectic paradigm

**Paper type** Research paper

## 1. Introduction

Trade balance, reflecting the gap between a nation's exports and imports, is a critical determinant of economic stability and growth, especially in developing economies (Tandra *et al.*, 2022). It goes beyond mere accounting metrics, embodying a country's competitiveness, productivity, and global integration. Therefore, achieving a favourable trade balance is crucial for developing nations heavily reliant on international trade for economic sustenance. This balance acts as a gauge of economic well-being, impacting key macroeconomic indicators like exchange rates, inflation, and employment (Kim and Le, 2024). Thus, surplus signals competitiveness, export-driven growth, and potential for foreign reserve accumulation, while persistent deficits strain reserves, leading to currency devaluation and macroeconomic vulnerabilities (Nwagu *et al.*, 2022; Akoto and Sakyi, 2019). However, a well-managed deficit, backed by sustainable foreign capital inflows, can fuel economic growth by facilitating technology transfer and investment (Xiao and Abula, 2023), essential for developing countries to mitigate external shocks and stimulate domestic industries (Husain, 2024).

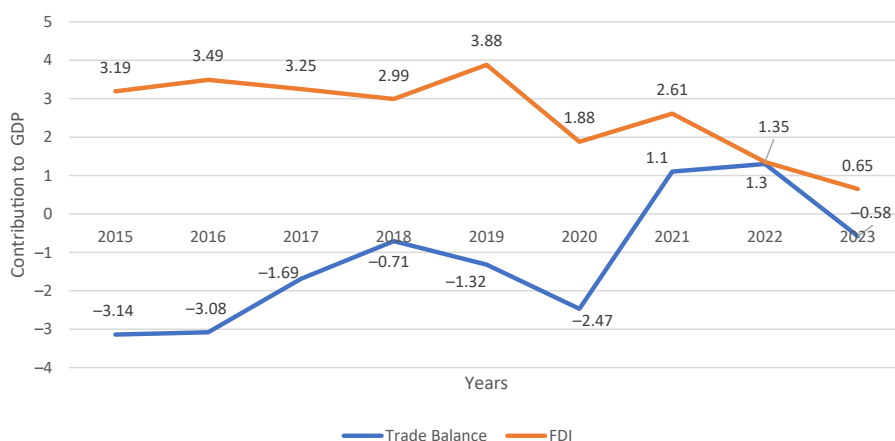


Trade's essential role in global economic growth, with developing nations' escalating participation, is evident (World Bank, 2023; UNCTAD, 2023). Yet, impacts vary among developing countries, with resource-rich ones facing unique challenges in managing deficits due to high imports for resource extraction (World Bank, 2023). This is where Foreign Direct Investment (FDI) holds promise for developing economies, injecting capital for infrastructure, technology transfer, and job creation (Otieno and Aduda, 2022). FDI's influence on exports varies, with potential for growth in sectors with strong backward linkages (Fosu, 2021; Asiamah *et al.*, 2019), but resource-focused FDI may exacerbate deficits (Mukherjee, 2021).

Ghana presents a compelling economic narrative marked by contrasting realities as observed in Figure 1. Trade is an important driver for Ghana's economy, with trade in goods and services averaging 68.2% of GDP annually from 2010 to 2021 (UNCTAD, 2023). Despite a setback in 2020 due to the pandemic, trade in goods rebounded in 2021, reaching \$28.4 billion, though with slower export growth compared to imports (OEC, 2024). This subdued export performance was mainly due to decreased volumes of gold and crude oil exports. In contrast, trade in services has been on the rise, constituting 28.2% of GDP by 2021, driven by multinational corporations offering business services within Ghana (OEC, 2024).

Ghana's trade surplus decreased to US\$1.1 billion in 2021, primarily due to a surge in imports post-pandemic, despite a slight increase in exports. Notably, the country experienced fluctuating trade balances over the years, with deficits persisting until 2019, followed by deficits in 2020 and a surplus in 2021. In April 2022, Ghana's trade balance expanded to US \$1.3 billion, driven by higher export prices of gold and crude oil (OEC, 2024). However, Gross International Reserves declined due to portfolio investment repatriation. Although Ghana ranks among the top exporters globally, it faces challenges in maintaining a favourable trade balance, with deficits observed in recent years despite sporadic improvements.

Foreign Direct Investment (FDI) on the other hand is significant in shaping Ghana's economic environment, particularly in sectors like extractives, agriculture, and manufacturing. From Figure 1, while FDI inflows have fluctuated over the years due to both domestic and global factors, notable growth was observed in 2021, reaching \$2.61 billion, mainly fuelled by investments in extractive industries (UNCTAD, 2022). Noteworthy projects include an \$850 million gold mining facility and a cement factory construction by a Moroccan company. However, despite the rebound in overall FDI inflows, data from the Ghana Investment Promotion Centre (GIPC) in 2022 indicated a decline in registered FDI projects in



Source(s): Ghana Investment Promotion Centre and International Trade Centre (2024)

Figure 1. Trend of FDI and trade balance in Ghana (2015–2023)

2021, dropping by 51% to \$1.35 billion (GIPC, 2024). The services sector attracted the highest number of projects, while oil and gas and manufacturing also received significant investments. China led in the number of projects, while Singapore led in terms of value, followed by Australia and India.

Yet, ongoing economic uncertainties, both globally and domestically, pose potential challenges to FDI inflows in Ghana. In 2022, FDI witnessed a significant decline of 39%, amounting to USD 1.47 billion, reflecting uncertainties amidst the lingering effects of COVID-19 and other global financial concerns (OEC, 2024). Despite this, Ghana remains a significant FDI recipient in West Africa, with investments primarily concentrated in oil and gas, gold mining, agriculture, and export fruits, with notable investors from South Africa, the Netherlands, France, Mauritius, and China.

Regardless of abundant natural resources like gold and cocoa driving impressive GDP growth, a chronic trade deficit persists, averaging 4.2% of GDP between 2019 and 2021 (World Bank, 2023). This deficit stems from substantial imports of capital and consumer goods, revealing the urgency to bolster domestic production and exports. Leveraging Foreign Direct Investment (FDI) poses a particular challenge, with Ghana seeking to harness its resource wealth for development without exacerbating the trade deficit (Akorsu and Okyere, 2023). Research suggests a potential threshold effect for FDI, wherein moderate inflows benefit export diversification while surpassing this threshold could yield unintended consequences (Ato-Mensah and Long, 2021). Thus, large-scale FDI, notably in resource sectors like gold mining, may not translate into significant export diversification (Ablo and Boadu, 2020), potentially exacerbating the “Dutch Disease” phenomenon (Anetor et al., 2020).

Also, ignoring FDI’s threshold effect entails significant financial and economic costs. A persistent trade deficit can lead to currency depreciation, inflating import costs and fuelling inflation (Boateng and Kwevor, 2022). Ghana’s reliance on resource extraction further exposes it to volatile commodity prices, jeopardizing long-term stability (IMF, 2021). Ineffective FDI management risks hindering diversified, resilient economic development, leaving Ghana vulnerable to external shocks and impeding sustainable growth.

Empirical studies suggest a positive correlation between FDI inflows and export performance in Ghana, albeit with understating across sectors (Akorsu and Okyere, 2023; Mawutor et al., 2023). For instance, the mining sector, which has attracted significant FDI, has contributed substantially to Ghana’s export earnings, particularly in gold and cocoa (Egyir et al., 2020). Moreover, investments in infrastructure and manufacturing industries have bolstered export capacity and diversified the country’s export base (Baffour and Yeboah, 2023). Nonetheless, challenges such as limited backward linkages, technology spillovers, and governance constraints highlight the need for targeted policies to maximize the developmental impact of FDI on trade balance. Therefore, this study seeks to this study is to determine the optimal threshold of FDI that can foster sustainable improvement in Ghana’s trade balance.

The study is imperative due to its policy relevance, offering insights crucial for Ghana’s economic competitiveness and sustainable development goals. The findings will aid policymakers to devise targeted strategies to attract investment, foster export-led growth, and mitigate external vulnerabilities. Moreover, achieving sustainable improvement in trade balance is indispensable for ensuring macroeconomic stability, given Ghana’s susceptibility to global shocks. Furthermore, understanding how FDI can contribute to sustainable trade positions to ensure growth, job creation, and technology transfer is crucial and warrants this study.

The rest of the paper is structured as follows. Section 2 examines the theoretical and empirical literature on the impact of foreign direct investment on Ghana’s trade balance. Section 3 goes into the methodology comprising of data sources and techniques used. Section 4 summarizes and discusses our empirical findings. Finally, Section 5 concludes the paper.

## 2. Literature review

### 2.1 Theoretical review

The main underpinning theory for this study is the Eclectic Paradigm (OLI Framework). The Eclectic Paradigm, also known as the OLI Framework, stands as a cornerstone in the theoretical model of international business. Introduced by John Dunning in the late 1970s, this framework offers a comprehensive lens through which to understand the complex motivations behind foreign direct investment (FDI) (Wagner, 2020). It posits three key determinants influencing FDI decisions: Ownership-specific advantages (O), Location-specific advantages (L), and Internalization advantages (I). These factors collectively shape the strategic calculus of firms seeking to expand across national borders (Batschauer da Cruz *et al.*, 2022). While the framework provides a robust foundation for analysing the drivers of FDI, critics contend that its simplification of real-world complexities and static nature may limit its explanatory power in dynamic global contexts. Nonetheless, the OLI Framework remains widely applicable and influential, offering valuable insights into the interplay of firm-specific capabilities, host country attributes, and internalization strategies in shaping international investment patterns (Jones *et al.*, 2020).

Despite its strengths, the Eclectic Paradigm exhibits certain limitations that warrant consideration. Its static nature and oversimplification of FDI determinants may overlook critical factors such as political risk, cultural dynamics, and evolving market conditions (Wagner, 2020; Jones *et al.*, 2020). Moreover, while the framework offers descriptive insights into why firms engage in FDI, it provides limited prescriptive guidance on optimal strategic decision-making in international business (Batschauer da Cruz *et al.*, 2022). Nonetheless, understanding the OLI Framework is crucial for determining the optimal threshold of FDI that can sustainably improve Ghana's trade balance. Thus, each component of the OLI paradigm offers insights into the conditions under which FDI is most beneficial. For ownership Advantages, the threshold level of FDI must consider the quality of the foreign firms' ownership advantages. Thus, high-quality ownership advantages ensure that the FDI brings superior technology, efficient management practices, and innovation, which can enhance local industries and improve trade balances. Also, on location Advantages, Ghana's location advantages must be adequately leveraged to attract FDI. The optimal threshold would be influenced by factors such as the stability of the macroeconomic environment, availability of skilled labour, and infrastructure. The government's policies to improve these location advantages play a critical role in attracting sustainable FDI. Finally, for Internalization Advantages, the degree to which foreign firms choose to internalize their operations in Ghana impacts the threshold level of FDI. Thus, strong internalization advantages may mean more significant control over the value chain, ensuring higher quality and consistency in production, which can lead to a more positive trade balance.

Therefore, by analysing these factors, this study can identify the optimal threshold of FDI that maximizes sustainable improvements in Ghana's trade balance while minimizing risks associated with external dependence and market volatility.

### 2.2 Theoretical rationales

Several rationales underpin the relationship between FDI and trade balance, and understanding these rationales is important for policymakers in making decisions. FDI influences trade balance through supply chain integration, as multinational corporations (MNCs) invest to integrate host country economies into global value chains (Dhaigude *et al.*, 2021). This stimulates both exports and imports of intermediate goods and capital, impacting the overall trade balance. Additionally, export-platform FDI strategically positions production facilities to serve global markets, enhancing export competitiveness (Davies and Markusen, 2021). FDI also fosters technological spillovers, improving productivity and innovation in host country industries (Sultana and Turkina, 2023). Import substitution and domestic supply enhancement, facilitated by FDI, reduce reliance on imports, potentially improving the trade

balance (Sahoo and Dash, 2022). Policymakers must consider these factors to harness the positive impacts of FDI on trade balance effectively.

### 2.3 Review of empirical literature

This literature review presents several studies that explore the relationship between Foreign direct investments (FDI) and trade in various regions and has been a subject of extensive empirical investigation over the years. However, the interest of this study is understanding the optimal threshold of FDI for sustainable improvement in Ghana's trade balance. Earlier studies on FDI and trade explored the possibility of a "crowding-out" effect, where FDI displaces domestic firms and leads to a trade deficit (Fonseca *et al.*, 2009; Akin and Avci, 2020; Sujianto and Azmi, 2020). However, subsequent research painted a deeper picture, thus Naqvi and Noman (2022) highlighted the positive contribution of FDI to exports in developing countries, suggesting technology transfer and increased competitiveness. Likewise, Keller (2022) found a positive association between FDI and exports in a meta-analysis, emphasizing the role of FDI in boosting production capacities.

Empirical studies often distinguish between developed and developing economies because the context of the recipient country plays a crucial role. In developed economies, FDI may have a limited impact on trade due to established industries and strong domestic competition (Naqvi and Noman, 2022). Other studies focusing on developed countries have yielded mixed findings. For instance, Voica *et al.* (2021) found a positive relationship between FDI and exports in developed countries, while other research suggests that the impact of FDI on trade may vary depending on factors such as market size and firm productivity (Mondal and Pant, 2020). Conversely, developing countries often benefit more from technology transfer and export diversification associated with FDI (Nambiar and Balasubramaniam, 2016; Yiheyis and Mulisa, 2018). For instance, Xiong and Sun (2021) examined the impact of FDI on exports in developing countries, highlighting the potential positive effects of FDI on export growth. Similarly, Jithin and Babu (2023) found evidence suggesting that FDI contributes positively to export performance in emerging economies.

In addition, several empirical studies have investigated the relationship between financial development and trade balance across different geographical contexts, including Asia, Europe and Africa. Thus, Cote d'Ivoire, Vietnam, Southeast Europe, Country income groups, and South-Asian economies. These studies highlight the variability in this relationship across countries and regions, emphasizing the need for context-specific analysis. For example, Keho (2020) focused on the relationship between FDI and trade balance in Cote d'Ivoire while Al-Rubaie and Ahmed (2023) focused on Iraq. Nga (2020) delved into the context of Vietnam. Qehaja *et al.* (2022) analysed Southeast-European countries, and Ismail (2022) investigated Arab countries while Osabuohien-Irabor and Drapkin (2022) explored country income groups.

Moreover, empirical studies employ diverse methodological approaches to examine the relationship between FDI and trade. The various methodological approaches employed across studies include dynamic panel data analysis, autoregressive distributed lag-bound testing, pooled mean group estimations, and threshold effect models. These methodological choices enable researchers to capture the dynamic and complex relationships between FDI and trade balance. For example, Keho (2020) and Al-Rubaie and Ahmed (2023) employed the autoregressive distributed lag (ARDL) model, while Ismail (2022) employed the Ordinary least squares regression. Qehaja *et al.* (2022) used panel data techniques, Osabuohien-Irabor and Drapkin (2022) employed the Differenced and two-step system GMM while Iqbal *et al.* (2019) used the Panel ARDL technique. However, Panel data analysis is commonly utilized, enabling researchers to control for country-specific heterogeneity and time dynamics, thus enhancing the robustness of empirical estimates.

Furthermore, empirical findings exhibit considerable heterogeneity, reflecting the complexity of the relationship between FDI and trade. Foreign Direct Investment (FDI) has a significant impact on the trade balance of countries. The effect of FDI on trade balance varies

across different countries and periods. Some studies find that FDI has a positive and significant effect on the level of exports and imports, but the effect on imports is greater (Qehaja *et al.*, 2022; Ismail, 2022). However, other studies show that FDI adversely affects the trade balance, leading to a worsening of the trade deficit (Keho, 2020; Nga, 2020; Al-Rubaie and Ahmed, 2023). The relationship between FDI and trade balance can be complementary, with FDI investment causing an increase in trade flow in certain countries (Osabuohien-Irabor and Drapkin, 2022). The impact of FDI on trade balance depends on factors such as the type of investment, the absorptive capacity of the recipient country, and the economic development of both the host and home countries (Iqbal *et al.*, 2019; Yiheyis and Mulisa, 2018). Also, the results of these studies provided insights into the impact of FDI on trade balance and the factors influencing trade imbalances, such as GDP, exchange rates, and the openness of the economy.

Beyond the direct impact on trade balances, empirical studies have uncovered additional insights into the FDI-trade relationship, particularly regarding threshold effects. For instance, Razaq *et al.* (2021) found that FDI stimulates technological spillovers, enhancing export competitiveness in host countries, which can lead to long-term improvements in trade balances, but only after reaching a certain level of investment. Similarly, research by Kalai *et al.* (2024) in BRICS countries indicated that FDI has a non-linear relationship with trade balance, where benefits become apparent only after surpassing a threshold of approximately 2% of GDP. Additionally, studies conducted in Latin America, such as by Jenkins (2022), demonstrated that while low levels of FDI could negatively affect trade balances due to increased imports, higher thresholds could yield positive effects, particularly when paired with robust local policies. Moreover, UNCTAD (2020) emphasized that the effectiveness of FDI in improving trade balances is contingent upon factors such as policy coherence and institutional quality, particularly in developing countries like Ghana. These thresholds indicate that while FDI can drive trade balance improvements, its success depends on achieving specific conditions. Further studies in Southeast Asia, particularly by Asada (2020), highlighted that a maximum FDI inflow of around 5% of GDP is often necessary to trigger significant positive impacts on the trade balance.

While these findings indicate that can drive trade balance improvements, its success is contingent on achieving specific conditions and thresholds. However, studies on Ghana's specific context are relatively limited. This study stands out in its originality by delving into a deeper examination of the relationship between Foreign Direct Investment (FDI) and Ghana's trade balance, which is a specific indicator of economic growth. Unlike many previous works that have explored broader aspects of FDI and trade, this study's focus on the specific impact of FDI on the trade balance in Ghana offers a fresh perspective. Furthermore, the study's approach of employing both time series Autoregressive Distributed Lag (ARDL) and Smooth Threshold regression techniques is distinguished. Therefore, by doing so it seeks to identify and establish the optimal threshold of FDI that leads to sustainable improvements in Ghana's trade balance. This dual-method approach not only adds methodological rigour to the analysis but also provides a more comprehensive understanding of the complex dynamics among the variables.

In terms of contribution, this study significantly advances the understanding of the FDI-trade balance relationship by offering targeted insights that are directly applicable to Ghana and potentially other developing economies facing similar challenges. Unlike more generalized studies, this research emphasizes a context-specific approach, providing actionable recommendations tailored to the unique economic and policy environment of Ghana. This specific focus highlights the importance of considering local dynamics, which is often overlooked in broader studies. Additionally, the application of Smooth Threshold Regression is a key methodological contribution, offering a more sophisticated lens through which the non-linear relationship between FDI and trade balance can be analysed. This technique enhances the precision of findings, enabling policymakers to better gauge the threshold levels of FDI necessary for generating positive trade balance effects. By doing so, the



### 3. Data and methodology

#### 3.1 Econometric model

The paper adapts [Maggiore's \(2022\)](#), [Rothert's \(2020\)](#), and [Akoto and Sakyi's \(2019\)](#) imperfect substitution model of foreign trade to create a reduced form of the trade balance. Drawing from these influential models, the study incorporates a solid theoretical foundation, allowing for a comprehensive and nuanced analysis of the factors influencing the trade balance. Maggiore's model provides insights into the role of exchange rate dynamics, while Rose's model emphasizes the importance of country-specific factors in trade. Akoto and Sakyi's work contributes contextual elements relevant to Ghana's trade activities. Therefore, by merging these models, the study can capture a wide range of determinants affecting the trade balance, offering a more realistic representation of the complexities involved. The trade balance is expressed as follows in a partially reduced form:

$$TB = f(rE, Y^*, Y) \quad (1)$$

However, after modification, the functional form is represented as:

$$TB = f(FDI, GEX, AGR, INF, rE) \quad (2)$$

where the variable TB represents trade balance, FDI is Foreign Direct Investment, GEX is Government expenditure, AGR is agricultural growth, INF is inflation, rE represents real exchange rate. The equation takes FDI, GEX, INF and rE as control variables.

Since the model is being estimated on annual data, the maximum lag order in the baseline ARDL model is 2, and the trend is included. As in terms of time series data analysis, the classical unit root test by [Dickey and Fuller \(1979\)](#) is employed in two forms of equations:

Form 1: Unit root test with intercept:

$$\Delta y_t = \alpha + \gamma y_{t-1} + \delta_1 \Delta y_{t-1} + \dots + \delta_{p-1} \Delta y_{t-(p-1)} + \mu_t \quad (3)$$

Form 2: Unit root test with intercept and trend:

$$\Delta y_t = \alpha + \beta t + \gamma y_{t-1} + \delta_1 \Delta y_{t-1} + \dots + \delta_{p-1} \Delta y_{t-(p-1)} + \mu_t \quad (4)$$

where  $\Delta y_t$  is the differenced series at time  $t$ ;  $\alpha$  is the constant term;  $\beta$  is the coefficient on the time trend;  $t$  is the time trend;  $\gamma$  is the coefficient on the lagged level of the series;  $\delta_1, \dots, \delta_{p-1}$  are coefficients on the lagged differences of the series, and  $\mu_t$  is the error term.

After the stationarity test the ARDL financial development and trade balance equation in its general form is represented as follows:

$$\begin{aligned} \Delta TB_t = & \beta_0 + \sum_{i=1}^n \beta_{1i} \Delta TB_{t-i} + \sum_{i=0}^n \beta_{2i} \Delta FDI_{t-i} + \sum_{i=0}^n \beta_{3i} \Delta AGR_{t-i} + \sum_{i=0}^n \beta_{4i} \Delta GEX_{t-i} \\ & + \sum_{i=0}^n \beta_{5i} \Delta INF_{t-i} + \sum_{i=0}^n \beta_{6i} \Delta REER_{t-i} + \delta_7 TB_{t-1} + \delta_8 FDI_{t-1} + \delta_9 AGR_{t-1} \\ & + \delta_{10} GEX_{t-1} + \delta_{11} INF_{t-1} + \delta_{12} REER_{t-1} + \varepsilon_t \end{aligned} \quad (5)$$



where  $\Delta$  refers to the first difference operator, and  $n$  is the lag order to the  $n$ th.  $\Delta TB_{t-i}$  describes the changes in the lagged dependent variable.  $\beta_0$  is the drift term which can be split to  $c_0 + c_1$  representing constant and trend, and  $\varepsilon_t$  is the residual in the model.  $\delta_7 - \delta_{12}$  are the long-run multipliers while  $\beta_1 - \beta_6$  represent the short-run dynamic coefficients.

Following the Akaike info criterion (AIC), the ARDL (1,0,0,1,1,0) model is selected eventually after confirming the long-run relationship. After finding the long-run association between variables, the study uses the error correction model (ECM) to find the short-run dynamics. The ECM general form of Equation (5) is deduced as in Equation (6):

$$\begin{aligned} \Delta TB_t = & \beta_0 + \sum_{i=1}^n \beta_{1i} \Delta TB_{t-i} + \sum_{i=0}^n \beta_{2i} \Delta FDI_{t-i} + \sum_{i=0}^n \beta_{3i} \Delta AGR_{t-i} + \sum_{i=0}^n \beta_{4i} \Delta GEX_{t-i} \\ & + \sum_{i=0}^n \beta_{5i} \Delta INF_{t-i} + \sum_{i=0}^n \beta_{6i} \Delta REER_{t-i} + \lambda ECM_{t-1} + v_t \end{aligned} \quad (6)$$

where  $\lambda$  is the coefficient of  $ECM$  for short-run dynamics.  $ECM$  shows the speed of adjustment in long-run equilibrium after a shock in the short run. It is important to note that in the short-run estimation, only variables with significant contributions to the error correction mechanism are retained, following the principle of parsimony (Kripfganz and Schneider, 2023). This approach also minimizes overparameterization and ensures a more robust and interpretable model (Kripfganz and Schneider, 2023).

The study further examined the threshold effect by employing the smooth threshold regression by Teräsvirta (1994). The Smooth Threshold Regression (STR) model excels in capturing nonlinear relationships and gradual regime shifts in time series data, making it more flexible and realistic than traditional linear models (Zhang, 2020). It allows for time-varying coefficients, smooth structural breaks, and avoids overfitting by offering a middle ground between flexibility and stability (Teräsvirta, 2018). STR provides clear economic interpretations based on threshold values of theoretical inflexion points rather than a literal value a country must reach, making it valuable for real-world applications like macroeconomic policy analysis and financial modelling (Teräsvirta, 2018). The functional model is expressed as:

$$TB_t = \beta'_0 + \beta'_1 FDI_t + \beta'_2 FDI_t \delta(z_t; \gamma, c) + \varepsilon_t \quad (7)$$

where  $TB_t$  is the dependent variable at time  $t$ ;  $FDI_t$  is the independent variable at time  $t$ ;  $\beta_1$  and  $\beta_2$  are the parameter vector for the regime.  $\delta(z_t; \gamma, c)$  is a smooth transition function that captures the threshold effect.  $Z_t$  is the threshold variable,  $\gamma$  is the smoothness parameter,  $c$  is the threshold parameter,  $\varepsilon_t$  is the error term.

After establishing the short-run, long-run equation and the threshold effect the study sought to determine the causality between financial development and Trade balance. To determine that the study employed the Granger causality test which was specified as:

$$\Delta Y_t = \gamma_0 \sum_{i=1}^n \phi Y_{t-i} + \sum_{i=1}^m \varpi \Delta X_{t-i} + u_t \quad (8a)$$

$$\Delta X_t = \pi_0 \sum_{i=1}^n \eta X_{t-i} + \sum_{i=1}^m \psi \Delta Y_{t-i} + v_t \quad (8b)$$

where  $u_t$  and  $v_t$  are mutually uncorrelated white noise error terms such that  $\Delta Y$  and  $\Delta X$  are the non-stationary dependents, and independent variables, while  $n$  and  $m$  are the optimal lag order.

**3.2 Data**  
The study used annual time series data from 1980 to 2022, a 42-year secondary data source. This period was dictated by the availability of data. From [Table 1](#), all data series, except real exchange rate, inflation, and trade balance are from the World Bank’s Development Indicators. Data on inflation was obtained from the International Monetary Fund (IMF) database. In addition, information on currency exchange rates was obtained from the Bank of Ghana while data on the trade balance was sourced from the International Trade Commission database. The decision to use quarterly time-series data spanning these years is made because this extended time frame allows for a comprehensive analysis of long-term trends and short-term patterns, offering a deeper understanding of the relationship between FDI and trade balance over different economic cycles.

**4. Results and discussion**  
The study provided descriptive statistics to provide an overview of key economic indicators for Ghana spanning the period from 1980 to 2022. From [Table 2](#), the mean trade balance for Ghana is approximately  $-0.105\%$  suggesting that, on average, Ghana has a slight deficit in its trade balance over this period. Also, foreign direct investment in Ghana is approximately  $8.147\%$  indicating that, on average, Ghana received a positive inflow of foreign direct investment over this period. Agricultural output in Ghana is approximately  $1.537\%$ , suggesting that, on average, there has been moderate growth in agricultural output over this period. Moreover, the mean government expenditure, inflation [\[1\]](#) and exchange rate in Ghana are approximately  $1.002\%$ ,  $1.305\%$  and  $2.204\%$  respectively indicating that, on average, government expenditure, inflation and effective exchange rate have been at a moderate level over this period.  
Furthermore, the correlation analysis in [Table 2](#) explored the relationships between Trade Balance (TB) and several key economic variables in Ghana spanning the period. [Table 2](#) revealed that there is a moderately positive relationship between FDI and trade balance, and

**Table 1.** Variable description, measurement and expected sign

	Variable	Description	Measurement	Source
Explained variable	TB	Trade balance	Annual difference between trade export and import of goods and services	International Trade Commission
	FDI	Foreign direct investment	Annual net foreign inflows (% of GDP)	World Development Indicators
	GEX	Government expenditure	Annual total amount of money spent by a government on goods and services, including public infrastructure, education, healthcare, defence, and social welfare programs (% of GDP)	World Development Indicators
Explanatory variables	REER	Exchange rate	A weighted average of the Ghanaian currency relative to a basket of other major currencies, adjusted for inflation	Bank of Ghana
	INF	Inflation rate	Annual average % increase in consumer prices	International Monetary Fund
	AGR	Agricultural growth	The annual net output of the agricultural sector after adding up all outputs and subtracting intermediate inputs (% of GDP)	World Development Indicators

**Note(s):** An increasing REER indicates appreciation of the Ghanaian currency  
**Source(s):** Authors’ construct, 2024

**Table 2.** Descriptive and correlation statistics

	Descriptive statistics					
	TB	FDI	AG	GEX	INF	REER
Mean	−0.105	8.147	1.537	1.002	1.305	2.204
Median	−0.026	8.135	1.559	0.996	1.249	2.041
Maximum	0.796	9.541	1.776	1.185	2.089	3.546
Minimum	−1.842	6.301	1.238	0.767	0.853	1.811
Std. Dev.	0.704	1.054	0.152	0.091	0.299	0.413
Skewness	−0.896	−0.055	−0.408	−0.346	0.734	1.931
Kurtosis	3.281	1.761	2.125	3.193	3.278	5.972
Jarque-Bera	5.491	2.514	2.389	0.862	3.719	38.585
Probability	0.064	0.284	0.303	0.649	0.156	0.051
Sum	−4.216	317.729	61.498	40.054	52.237	85.965
Sum Sq. Dev.	19.379	42.262	0.904	0.322	3.4891	6.475
Observations	42	42	42	42	42	42

## Correlation matrix

	TB	FDI	GEX	REER	INF	AG
TB	1.000					
	—					
FDI	0.346***	1.000				
	0.001	—				
GEX	0.349***	0.293***	1.000			
	0.001	0.006	—			
REER	−0.697***	0.429***	−0.086	1.000		
	0.000	0.000	0.427	—		
INF	−0.309***	0.715***	0.173	0.166	1.000	
	0.003	0.000	0.106	0.122	—	
AGR	0.148	0.712***	0.575***	−0.080	0.643***	1.000
	0.169	0.000	0.000	0.457	0.000	—

**Note(s):** Dependent variable: trade balance. \*, \*\*, and \*\*\* indicate the rejection of the null hypothesis of no correlation at 10%, 5%, and 1% significance levels

**Source(s):** Produced from BoG, IMF and WDI data, 2024

government expenditure and trade balance. However, exchange rate and inflation are seen to have a moderately negative correlation between Trade Balance under the study period.

The selection of lag order is important for accurate model construction, capturing temporal dependencies. Lag order selection determines the lagged observations included in the model. Results in Table 3 suggest lag 1 as optimal based on AIC and SC criteria, favouring model fit while penalizing complexity. Thus, AIC guides toward a parsimonious yet effective model, supporting the ARDL (1,0,1,1,0) model. Stationarity checks are crucial to avoid erroneous results and determine the estimation approach. Unit-root tests, including ADF and PP tests, ascertain stationarity. Table 3 presents unit-root test results, indicating all the variables are integrated at order one (I (1)) except Inflation and agricultural growth which are integrated on levels. This implies stationarity for trade balance, government expenditure, foreign direct investment, and real effective exchange rate as percentages of GDP or rates while agricultural growth and inflation are stationary on levels.

After initial ARDL estimation, a bound test model is applied to confirm the long-run relationship. The ARDL model, pioneered by Pesaran and Shin (1995) and extended by Pesaran *et al.* (2001), offers a simplified single co-integration equation, facilitating implementation and interpretation. Its versatility in handling both I (0) and I (1) independent variables and its long-term efficiency with unbiased estimates make it ideal for

**Table 3.** Lag order selection, stationarity and bound test

Lag order selection						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	107.564	NA	1.22e−10	−5.804	−5.537	−5.712
1	232.648	200.135*	7.73e−13	−10.894*	−9.028*	−10.249*
2	269.784	46.685	8.77e−13*	−10.959	−7.493	−9.7626
Stationarity tests						
Variable	ADF test Const. and trend Levels	Const. and trend 1st difference	PP test Const. and trend Levels	Const. and trend 1st difference		
FDI	−2.795	−5.281***	−2.907	−5.235***		
GEX	−3.041	−6.109***	−3.195	−8.286***		
INF	−4.002**	−6.313***	−5.485***	−17.662***		
REER	−2.524	−6.482***	−1.862	−6.831***		
AGR	−2.491	−6.937***	−2.439*	−8.262***		
TB	−0.030	−4.428***	−0.136	−6.254***		
Bound test						
<i>F</i> -statistics	90% upper bound		95% upper bound		99% upper bound	
6.692	3.79		4.25		5.23	
	90% lower bound		95% lower bound		99% lower bound	
	2.75		3.12		3.93	
<b>Note(s):</b> * indicates lag order selected by the criterion. LR: sequential modified LR test statistic (each test at 5% level); FPE: Final prediction error; AIC: Akaike information criterion; SC: Schwarz information criterion; HQ: Hannan-Quinn information criterion. Also, *, **, and *** indicate the rejection of the null hypothesis of non-stationary at 10%, 5%, and 1% significance levels						
<b>Source(s):</b> Produced from BoG, IMF and WDI data, 2024						

this study. Additionally, variable-specific lag lengths enhance flexibility. The bounds test for co-integration, integral to the ARDL approach, informs the estimation of long-run relationships and error correction models. Table 3 presents *F*-statistics and confidence intervals, with the rejection of the null hypothesis at the 1% significance level thus, *F*-statistic = 6.692 > 99% upper bound, indicating a long-run connection. Further model estimation is warranted to establish this relationship definitively.

4.1 Results for the long-run and short-run effect of FDI on trade balance

Table 4 contains the level relationship coefficients, i.e. the long-run ARDL (1,0,0,1,1,0) trade balance and foreign direct investment equations. According to the long-run FDI results, REER, INF, and AG are statistically significant independent variables that affect the trade balance in the model. Only these variables account for the fluctuation in the trade balance when all other variables are held constant.

Table 4 presents the long-run ARDL (1,0,0,1,1,0) equations for trade balance and foreign direct investment (FDI). Significant coefficients indicate REER, INF, and AG’s influence on trade balance when other variables are constant. FDI positively affects the trade balance in Ghana in both long and short terms, with a notable impact of 0.425% and 0.268%, respectively. This suggests FDI influx benefits the trade balance, attracting investments in sectors like construction and finance. Contrary to prior studies, this aligns with Qehaja *et al.* (2022). Conversely, for REER, an increase in the Real Effective Exchange Rate (REER) leads to a

**Table 4.** Results for the long-run and short-run effect of FDI on trade balance from the ARDL model

Variable	Coefficient	Std. error	T-statistics	Prob.
<i>Long-run estimates</i>				
FDI	0.425	0.104	4.069	0.000***
GEX	0.221	0.479	0.461	0.648
REER	−0.953	0.167	−5.689	0.000***
INF	−0.521	0.217	−2.404	0.023**
AGR	1.291	0.734	1.756	0.093*
C	−2.550	2.192	−1.163	0.255
<i>Short-run estimates</i>				
$\Delta$ (FDI)	0.268	0.155	1.733	0.094*
$\Delta$ (REER)	−0.517	0.146	−3.535	0.002***
$\Delta$ (INF)	−0.224	0.071	−3.139	0.004***
CointEq (−1)*	−0.768	0.152	−5.059	0.000***
C	−1.391	0.223	−6.238	0.000***
@TREND	0.002	0.002	0.987	0.332
R-squared	0.677	Akaike info criterion		1.084
Adjusted R-squared	0.647	Schwarz criterion		1.205
Log-likelihood	27.283	Durbin-Watson stat		2.059
F-statistic	15.46	Prob (F-statistic)		0.000

## Granger causality test results

Null hypothesis	F-statistic	Prob.
TB does not Granger cause FDI	0.726	0.492
FDI does not Granger cause TB	5.881	0.007***

**Note(s):** Dependent variable: trade balance. \*, \*\*, and \*\*\* indicate the rejection of the null hypothesis of no effect or causality at 10%, 5%, and 1% significance levels

$\Delta$ (AGR) was excluded due to its lack of significant contribution in the short run, guided by the principle of parsimony

**Source(s):** Produced from BoG, IMF and WDI data, 2024

deterioration in Ghana's trade balance by 0.953% in the long term and 0.517% in the short term. This suggests that a stronger currency reduces export competitiveness, worsening the trade balance by decreasing exports and increasing imports. Similarly, inflation adversely affects trade balance by 0.521% and 0.022% in the long and short terms, respectively, reflecting higher production costs and reduced competitiveness (Sujianto and Azmi, 2020). Conversely, AG enhances trade balance by 1.291% in the long term, incentivizing agricultural growth. However, due to AG negligible impacts in the short run, it was excluded from the final short-run results to ensure a parsimonious result (Kripfganz and Schneider, 2023). Short-run dynamics converge to equilibrium at 76.81% after an exogenous shock, with significant joint forecasting power with an *F*-statistic of 15.46, at a 1% significant level.

#### 4.2 Results for the threshold effect of FDI on trade balance

After establishing the long-run and short-run effect of FDI on the trade balance in Ghana, the study further uncovered potential nonlinearities and thresholds that may characterize this relationship. The results presented in Table 5 provide insights into how FDI impacts the trade balance, with a particular focus on identifying threshold effects.

The threshold value is estimated to be 7.825% and statistically significant at a 1% level of significance. This suggests that the effect of FDI on the trade balance changes direction significantly once FDI surpasses this threshold. Also, the coefficient for FDI is 1.411 as a non-linear threshold variable represents the nonlinear effect of FDI on the trade balance above the

**Table 5.** Results for the threshold effect of FDI on trade balance from the smooth threshold regression model

Variable	Coefficient	Std. error	t-Statistic	Prob.
<i>Threshold variables (linear part)</i>				
C	46.269	18.166	2.547	0.013**
FDI	−1.416	0.656	−2.157	0.034**
<i>Threshold variables (nonlinear part)</i>				
C	−37.781	17.541	−2.154	0.034**
FDI	1.411	0.658	2.143	0.035**
<i>Non-threshold variables</i>				
REER	−0.305	0.039	−7.765	0.000***
AGR	0.271	0.092	2.938	0.004***
INF	−0.084	0.027	−3.032	0.003***
GEX	0.022	0.019	1.113	0.269
<i>Slopes</i>				
SLOPE	0.938	0.535	1.753	0.084*
<i>Thresholds</i>				
THRESHOLD	7.825	0.753	95.385	0.000***
R-squared	0.764	Akaike info criterion		3.687
Adjusted R-squared	0.736	Schwarz criterion		3.968
F-statistic	28.056	Durbin-Watson stat		1.984
Prob (F-statistic)	0.000			

**Note(s):** Dependent variable: trade balance. \*, \*\*, and \*\*\* indicate the rejection of the null hypothesis of no effect at 10%, 5%, and 1% significance levels

**Source(s):** Produced from BoG, IMF and WDI data, 2024

threshold of 7.82%. The positive sign indicates that beyond this threshold, an increase in FDI leads to an increase in the trade balance. However, the coefficient for FDI is −1.416 as a linear threshold variable represents the linear effect of FDI on the trade balance below a certain threshold. The negative sign suggests that an increase in FDI leads to a decrease in the trade balance up to the threshold value of 7.825%.

Empirically the findings suggest that, for the Ghanaian economy when FDI surpasses this threshold, its impact on the trade balance becomes significantly positive, with a coefficient of 1.411 indicating that additional FDI leads to an improvement in the trade balance. This positive relationship above the threshold can be attributed to factors such as enhanced industrial capacity, improved infrastructure, and increased export potential resulting from higher FDI inflows. Conversely, below the threshold, the coefficient for FDI is −1.416, suggesting that increased FDI leads to a deterioration in the trade balance. This negative impact could be due to the initial stages of investment where the inflow of capital is primarily directed towards import-heavy industries, leading to higher imports than exports. This threshold effect highlights the non-linear nature of FDI’s influence on the trade balance, where the benefits of FDI are only realized once a certain level of investment is achieved, shifting the dynamics from a deficit-inducing to a surplus-enhancing effect.

Case studies from other developing economies, such as Vietnam and Malaysia, where similar threshold effects have been observed, further support this interpretation. In Vietnam, for example, the positive impact of FDI on the trade balance was only noted after substantial investments were made in the manufacturing sector, aligning with the threshold effect observed in Ghana (Nguyen *et al.*, 2021). Similarly, Malaysia experienced a significant positive shift in its trade balance post-FDI influx in technology and export-oriented industries (Athukorala and Nguyen, 2023). These cases show the importance of reaching and surpassing critical FDI thresholds to harness its full potential benefits on the trade balance.

The findings support the OLI framework by demonstrating how ownership, location, and internalization advantages interact to influence the impact of FDI on Ghana's trade balance. Thus, initially, ownership advantages like proprietary technology and managerial expertise attract FDI, while Ghana's locational advantages, including natural resources and strategic positioning, further entice investment. Initially, FDI might negatively impact the trade balance due to import-heavy activities. However, once FDI surpasses the 7.825% threshold, the internalization benefits such as cost savings and increased efficiency lead to a positive trade balance, illustrating the dynamic and non-linear effects predicted by the OLI framework. The findings confirm the study of [Derindag et al. \(2023\)](#) in India on the relationship between FDI and trade openness.

The sensitivity analysis in [Table 6](#) reveals that the discrete threshold regression analysis, with a threshold value of 7.171%, corroborates these findings. The significant positive coefficient of 3.435% above this threshold reinforces the robustness of the smooth threshold effect. Below this threshold, the insignificance of the FDI coefficient suggests that FDI's impact on the trade balance is minimal or overshadowed by other economic factors.

In exploring the intricate dynamics between Foreign Direct Investment (FDI) and trade balance, the analysis has uncovered compelling evidence of a threshold effect, indicating that the impact of FDI on the trade balance undergoes a significant shift once a critical threshold is reached. Therefore, building upon this foundational insight, the study compelled to perform a grander causality test, to unravel deeper causal relationships and feedback mechanisms that govern this complex nexus between FDI inflows and trade balance dynamics as presented in [Table 4](#). The Granger causality tests confirm a unidirectional relationship between FDI to trade balance in Ghana during the study period.

[Table 7](#) summarizes efficiency tests validating the models' econometric properties. Results show the absence of serial correlation and heteroskedasticity, with statistically insignificant probability values. Diagnostic tests confirm normality and functional form stability. Following, parameter stability is assessed via CUSUM and CUSUMSQ graphs, adjusting statistics iteratively to identify breakpoints. Results, depicted in [Figure 2](#), show all parameter plots within 5% significance boundaries, indicating coefficient stability throughout the analysis. Thus, the model's findings are reliable, with trade balance coefficients and explanatory variables remaining constant over time.

**Table 6.** Sensitivity analysis for the threshold effect of FDI on trade balance from the discrete threshold regression model

Variable	Coefficient	Std. error	t-Statistic	Prob.
<i>FDI &lt; 7.171</i>				
FDI	−0.061	0.164	−0.371	0.713
<i>7.171 ≤ FDI</i>				
FDI	3.435	0.785	4.375	0.000***
<i>Non-threshold variables</i>				
REER	−0.389	0.074	−5.257	0.000***
AG	0.137	0.031	4.419	0.000***
INF	−0.158	0.059	−2.669	0.012**
GEX	0.005	0.008	0.605	0.549
R-squared	0.803	Akaike info criterion		2.804
Adjusted R-squared	0.773	Schwarz criterion		3.057
S.E. of regression	0.918	Durbin-Watson stat		1.596

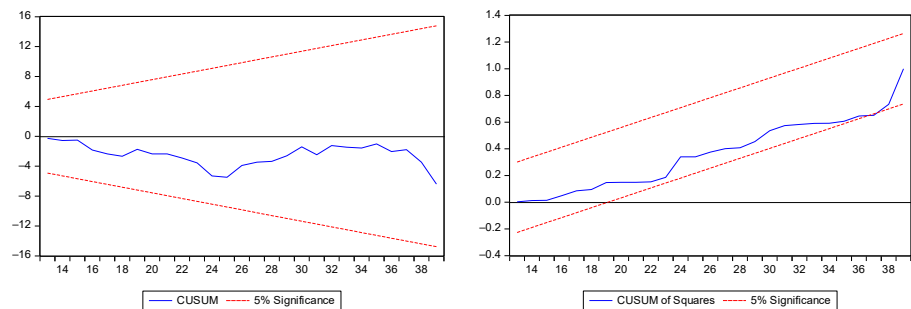
**Note(s):** Dependent variable: trade balance. \*, \*\*, and \*\*\* indicate the rejection of the null hypothesis of no effect at 10%, 5%, and 1% significance levels

**Source(s):** Produced from BoG, IMF and WDI data, 2024



**Table 7.** Residual diagnostic test results

Assumption	Test	Probability
Functional form	Ramsey's reset test	0.501
Heteroscedasticity	Breusch-Pagan-Godfrey	0.197
Normality	Jarque-Bera test	0.752
Serial correlation	Breusch-Godfrey LM test	0.438
<b>Source(s):</b> Produced from BoG, IMF and WDI data, 2024		



**Source(s):** Produced from BoG, IMF and WDI data (2024)

**Figure 2.** CUSUM and CUSUMSQ Plot

**5. Concluding remarks**

This study explored Ghana’s FDI and trade balance using annual time series data from 1980 to 2022, the study estimated the trade balance as a function of foreign direct investment, real effective exchange rate, inflation, government spending, and agricultural growth. The co-integration test determines if the variables are related in the long run. FDI, inflation, and effective exchange rate are found to be long-run and short-run drivers of trade balance holding other factors constant. In Ghana, Agriculture expansion improves exports, resulting in a positive trade balance only in the long run. The study further revealed that the threshold value of FDI that would induce a positive trade balance for Ghana is 7.825%. Moreover, it was established that there is a unidirectional causality between trade balance and FDI flowing from FDI to trade balance.

For the policymakers in Ghana responsible for Trade and Foreign Direct Investment (FDI), several recommendations emerge from the findings provided. Firstly, the Ministry of Trade and Industry ought to establish an FDI Threshold Monitoring Mechanism to track FDI inflows, ensuring they remain above the identified threshold value of 7.825%, beyond which the positive impact on the trade balance strengthens. Secondly, the Ghana Investment Promotion Centre should promote Investment Diversification to mitigate risks associated with overreliance on specific FDI sources or sectors, thereby enhancing trade balance stability.

Thirdly, both the Ministry of Trade and Industry and the Ghana Investment Promotion Centre should enhance the Investment Climate and Regulatory Framework essential for attracting sustainable FDI inflows, necessitating streamlined administrative procedures and incentives for foreign investors. Furthermore, the Ministry of Trade and Industry in collaboration with the Ghana Export Promotion Authority ought to strengthen Export Promotion Initiatives given the unidirectional relationship between FDI and trade balance, emphasizing the need to boost exports for a more favourable trade balance.

Finally, the Ministry of Education, the Ministry of Science, Technology and Innovation, and the Ministry of Trade and Industry should invest in human capital development and technology transfer to maximize FDI benefits by enhancing productivity, innovation, and competitiveness across key sectors, thereby contributing to sustainable economic development.

This study recommends that, aside from the study's limitation on the availability of data for some variables not employed, further studies can be looked at the impact of sectoral FDI inflows on Ghana's trade balance, while including additional variables such as tax rates, labour force participation, and political stability to enhance the changes in trade balance dependent on the availability of data.

## Notes

1. The reported inflation values (INF) represent the growth rate of inflation, calculated to reduce the high level of variation typically observed in raw inflation data. This transformation was performed by taking the annual percentage change in inflation and scaling it appropriately to linearise the dataset ensuring a robust statistical modelling and clearer interpretation of results without any potential biases.

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