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FOREIGN DIRECT INVESTMENT AND TRADE BALANCE IN SUB-SAHARAN AFRICA

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ABSTRACT----------
This study investigates the relationship between foreign direct investment (FDI) and trade balance in Sub-Saharan Africa over the period 2005 – 2022. Employing a quantitative research design, the analysis utilizes balanced panel data from the World Bank. The conceptual framework positions trade balance as the dependent variable and FDI as the independent variable. Empirical analysis is conducted through regression techniques and diagnostic checks to assess the robustness and significance of the relationship. Pooled regression model reveals a statistically significant relationship, with an adjusted R-squared of 0.557, indicating that FDI accounts for 55.7% of the variations in trade balance. The FDI coefficient of 0.704 implies that a 10% increase in FDI leads to a 7.046% improvement in the trade balance. Based on these findings, the study recommends that governments in Sub-Sahara Africa implement policies to attract and sustain FDI, such as offering incentives and enhancing investment climate.
KEY WORDS: *Foreign direct investment, Trade Balance and Sub-Saharan Africa*----------

INTRODUCTION

Sub-Saharan Africa (SSA) has experienced persistent trade deficits over the past five decades, with many economies importing more goods and services than they export. This trade imbalance presents a critical economic challenge, as it often leads to reduced foreign exchange reserves, increased external debt, and vulnerability to global economic shocks. Scholars have highlighted the potential role of foreign direct investment (FDI) in addressing trade imbalances by fostering export-led growth, improving industrial capacity, and enhancing competitiveness in global markets (Asongu & Odhiambo, 2020). However, the impact of FDI on the trade balance in SSA remains a topic of empirical debate, with varying findings across different countries and contexts.

Trade deficits in Sub-Saharan Africa (SSA) stem from structural and external challenges. The region's heavy dependence on commodity exports, such as oil, minerals, and agricultural products, exposes it to volatile global commodity prices and fluctuating demand. Limited diversification into manufacturing and weak integration into global value chains exacerbate this vulnerability, preventing the region from capitalizing on higher-value exports. External shocks, such as the COVID-19 pandemic, further disrupted trade flows, weakened economic stability, and intensified reliance on imports for essential goods, straining trade balances across SSA economies (UNCTAD, 2021; World Bank, 2022).

Addressing these trade imbalances necessitates understanding the interplay between foreign direct investment (FDI) and trade performance. FDI has the potential to bridge gaps in production capabilities and foster industrial growth, but its success depends on policies promoting local value addition, technological transfers, and the development of competitive manufacturing sectors. These measures can reduce the region's dependence on volatile commodity exports and improve its integration into global markets (Lall, 2004; Alfaro et al., 2004).

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This study focuses on the relationship between FDI and trade balance in SSA economies between 2005 and 2022. It explores whether FDI can significantly influence trade outcomes, particularly by supporting export diversification and reducing dependency on imports. While previous research has addressed the broader economic impact of FDI, limited attention has been paid to its specific role in shaping trade balances in SSA. This gap motivates the present study, which seeks to provide evidence-based insights that can inform policies to address trade imbalances and leverage FDI for economic development.

By employing quantitative techniques and balanced panel data, this study aims to contribute to the existing literature and guide policymakers in creating an enabling environment for FDI to maximize its trade-related benefits. The findings are expected to highlight actionable strategies for fostering sustainable trade and investment linkages in SSA economies.

LITERATURE REVIEW

Globally, the relationship between FDI and trade balance has been widely studied. FDI is often seen as a driver of economic growth and trade development, particularly in developing economies. Studies suggest that FDI contributes to the enhancement of export capacity, leading to improved trade balances. For instance, Alfaro et al. (2004) found that countries with developed financial markets benefit more from FDI inflows, as these inflows are effectively channeled into productive investments that foster export growth. However, negative implications of FDI on trade balance, such as increased importation of intermediate goods, have also been highlighted in some economies, indicating mixed outcomes (UNCTAD, 2021).

In SSA, the literature highlights the dual impact of FDI on trade balance. On one hand, FDI has been linked to technology transfer and export diversification, which improve trade performance (Asongu & Odhiambo, 2020). On the other hand, dependency on foreign direct investment (FDI) in resource-based economies often results in significant capital outflows through profit repatriation, which can worsen trade balances and diminish long-term economic benefits (Moran, 1998; Aitken & Harrison, 1999). Research by Busse and Hefeker (2007) emphasized that institutional quality and political stability significantly influence the effectiveness of FDI in promoting positive trade outcomes in SSA.

Locally, studies have examined how FDI impacts trade balances in countries like Uganda and Kenya. Uganda has increasingly attracted FDI in sectors such as manufacturing and agriculture, with evidence suggesting improvements in export performance (Mwaba, 2000). However, challenges like weak infrastructure and reliance on raw material exports limit the potential benefits of FDI (Kasekende & Atingi-Ego, 2003). In Kenya, foreign direct investment (FDI) has been linked to both the expansion of exports and the increased importation of capital goods, highlighting the complexity of its effects on the trade balance (Asongu & Odhiambo, 2020; Adedeji, et al. 2016).

This study is anchored on the Balance of Payments (BOP) Theory, which posits that inflows of foreign capital, such as FDI, can improve trade balance through enhanced production and export capabilities (Salvatore, 2016). However, the theory also acknowledges potential drawbacks, including increased reliance on imported inputs and profit repatriation, which may offset gains in trade balance (Krugman & Obstfeld, 2020). The Dependency Theory further explains that excessive reliance on FDI can lead to economic vulnerabilities, particularly in developing economies like those in Sub-Saharan Africa (Dos Santos, 1970; Todaro & Smith, 2020).

The conceptual framework of this study identifies trade balance as the dependent variable and FDI as the independent variable (Alfaro et al., 2004). The framework assumes that FDI can enhance trade balance through mechanisms such as: Export diversification (Asiedu, 2002), technology transfer (Borensztein et al., 1998), improved production efficiency (UNCTAD, 2021). However, the framework also considers potential negative impacts, such as profit repatriation and increased imports of intermediate goods (Busse & Hefeker, 2007).

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DATA AND METHODS

This study employs a quantitative research design to analyze the relationship between foreign direct investment (FDI) and trade balance in Sub-Saharan African (SSA) economies. Quantitative approaches allow for objective analysis, ensuring consistent and replicable results (Bryman, 2012; Creswell, 2014). A longitudinal panel dataset from 2005 to 2022 is utilized, capturing both temporal and cross-sectional variations across countries. This design is ideal for examining how FDI inflows influence trade balance trends over time (Wooldridge, 2010).

The sample consists of 20 SSA countries (Appendix 7) selected through purposive sampling. The countries were chosen based on the availability of trade balance and FDI data. Purposive sampling ensures the inclusion of countries with consistent data records, reducing biases associated with missing or incomplete datasets (Etikan et al., 2016).

The study relies on secondary data sourced from the World Bank data base, World Development Indicators. This source is globally recognized for its accuracy and comprehensiveness (World Bank, 2022). Trade balance (dependent variable) and FDI inflows (independent variable) are the study variables (Alfaro et al., 2004; Asiedu, 2002).

The research employs pooled regression analysis to estimate the relationship between FDI and trade balance (Greene, 2018). Diagnostic tests include; examining stationarity, normality, heteroskedasticity, and autocorrelation to validate model assumptions (Gujarati & Porter, 2009).

Panel data was chosen due to its ability to control for unobserved heterogeneity and its suitability for longitudinal data analysis (Hsiao, 2014). The selection of secondary data ensures consistency and reliability, given the credibility of the World Bank. Post-estimation diagnostics further enhance the robustness of the findings (Salvatore, 2016).

The model includes;
Dependent Variable: Trade Balance (TB), measured as exports minus imports in absolute terms TB = (|X - M|), reflects the difference between a country's exports (X) and imports (M) and is a key indicator of a nation's economic health and external sector performance (Krugman, Obstfeld, & Melitz, 2018; Salvatore, 2016).
Independent Variable: Net inflows of foreign direct investment (FDI) (BoP, current US$) (World Bank 2022).

Pooled regression model is specified as follows:

$$\text{Trade Balance}_{it} = \alpha + \beta'_j \text{ FDI}_{jit} + \varepsilon_{it} \quad \ldots\ldots(1)$$

Where; $i = 1,2, \ldots, n$
$t = 1,2, \ldots, T$
$j = 1,2, \ldots, K$

α and $\beta'_j = (\beta_1, \beta_2, \ldots, \beta_K)$ are common intercept and slope respectively, FDI_{jit} is the regressor for country *i* and time *t*. $\text{Trade Balance}_{it}$ is the dependent variable, ε_{it} is the error term. (Green 2018).

RESULTS

Descriptive statistics provide an overview of the study variables' central tendencies and variability. The mean, standard deviation, minimum, and maximum values for each variable are summarized in Appendix 1. The average values for LNTB (trade balance) and LNFDI (foreign direct investment) suggest moderate levels of trade balance and FDI in the sample over the study period. The relatively high standard deviations for both variables indicate substantial variability in trade balance and FDI across the countries and years analyzed, highlighting differing economic conditions within the sample.

The positive skewness for LNTB suggests that the trade balance data is right-skewed, meaning that there are more countries with relatively low trade balances, with fewer countries exhibiting very high trade balances (Asongu, 2014). In contrast, the negative skewness for LNFDI indicates that most of the values are clustered towards the higher end of the scale, implying that the sample is characterized by more countries experiencing higher FDI levels (Bahmani-

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- Peer Review Journal

Oskooee & Alse, 1993). Both variables exhibit leptokurtic distributions, indicating that their distributions have higher peaks compared to a normal distribution, suggesting more frequent extreme values than expected under normality assumptions.

The low probability value for LNTB (0.000001) indicates that it deviates significantly from a normal distribution, suggesting non-normality in the data. On the other hand, the probability for LNFDI (0.046471) suggests a less severe deviation, as it is closer to the threshold of 0.05, implying a more normal distribution for FDI compared to the trade balance (Pesaran et al., 2001; Rose, 2015).

Pooled regression model results (Appendix: 4)

$\widehat{\text{LNTB}} = 8.847036 + 0.704570\text{NFDI}$

The constant term of 8.847036 in the regression model represents the baseline level of trade balance in Sub-Saharan Africa when Foreign Direct Investment (FDI) is zero. This value indicates the average trade balance in the absence of FDI inflows.

The coefficient of FDI ($\beta_1 = 0.704570$) is statistically significant ($p = 0.0000$), meaning that FDI has a positive and robust effect on the trade balance in SSA. Specifically, a 10% increase in FDI is associated with a 7.05% improvement in trade balance.

The adjusted R-squared value of 0.557405 indicates that approximately 55.7% of the variation in the trade balance is explained by the model, with Foreign Direct Investment as the only explanatory variable. This suggests a moderate fit of the model, meaning that FDI accounts for more than a half of the variations in trade balance. Results of; unit root tests (Appendix 2 & 3), normality test (Appendix 5), heteroskedasticity test (Appendix 6) are also provided.

DISCUSSION

Results of this study provide valuable insights into the relationship between Foreign Direct Investment (FDI) and trade balance in Sub-Saharan Africa (SSA). Specifically, the positive and statistically significant coefficient of FDI ($\beta_1 = 0.704570$, $p = 0.0000$) reveals a robust connection between FDI inflows and trade balance. A 10% increase in FDI is associated with a 7.05% improvement in trade balance, highlighting the substantial role of FDI in boosting the region's trade performance. This finding aligns with the results of previous studies that suggest FDI can have a positive impact on trade balance by enhancing export capabilities, technology transfer, and production efficiency (Chenery & Strout, 1966; Blomström & Kokko, 1998).

In contrast to other regions, where the relationship between FDI and trade balance may be more complex or weaker, SSA exhibits a relatively strong linkage. For instance, Asiedu (2002) found that FDI in Africa often leads to increased export production, thereby improving the trade balance. Similarly, empirical research by Adedeji, et al. (2016) and Keller (2000) has documented the positive effect of FDI on trade balance in developing economies, particularly in the context of technology and efficiency improvements. Our findings confirm and extend this body of work, specifically within the SSA context, emphasizing the region's reliance on FDI to enhance trade outcomes.

However, the adjusted R-squared value of 0.557405 indicates that FDI alone explains only 55.7% of the variation in trade balance. While this suggests a moderate model fit, it also underscores additional factors, such as institutional quality, infrastructure, and global market conditions, are likely influencing trade outcomes in SSA. This aligns with the work of Rodrik (1999), who argued that other macroeconomic factors and policies also play a significant role in shaping trade balances in developing countries. Aitken et al. (1997) similarly highlighted that factors beyond FDI, including domestic policies and the structure of industries, contribute to trade balance dynamics.

In line with the theoretical framework, the positive relationship between FDI and trade balance is consistent with the Balance of Payments (BOP) theory, which suggests that FDI can stimulate production, exports, and economic growth, thereby improving the trade balance (Chenery & Strout, 1966). However, it is important to recognize potential drawbacks, such as profit repatriation and increased imports of intermediate goods, which may offset the benefits of

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- Peer Review Journal

FDI on trade balance in the long run (Blomström & Kokko, 1998). These limitations were acknowledged in the study's conceptual framework, but were not captured in the model.

Overall, the study's findings contribute to the literature by emphasizing the significant, though not exclusive, role of FDI in improving SSA's trade balance. It also highlights the need for further research to identify and incorporate other key determinants of trade balance in the region, such as institutional factors, infrastructure development, and global trade dynamics, which may explain the remaining variation not accounted for by FDI alone.

LIMITATIONS

While the study provides valuable insights into the relationship between Foreign Direct Investment (FDI) and trade balance in Sub-Saharan Africa (SSA), it is not without limitations. These shortcomings, which pertain to the study's design, sample, and data analysis, may have affected the findings in several ways.

The study uses secondary data from the World Bank, which, although comprehensive, may have inconsistencies across countries or regions due to differences in data collection methods or reporting standards. The reliance on publicly available data may also omit important variables that could influence the trade balance, such as informal trade flows or non-financial aspects of FDI, which are often difficult to capture in conventional datasets (Moran, 1998; Aitken & Harrison, 1999). Additionally, data limitations, such as missing values or measurement errors, could distort the results and limit the generalizability of the findings (Maddala, 2001).

The model applied in the study only considers Foreign Direct Investment (FDI) as the only explanatory variable for trade balance. While this provides a clear understanding of the relationship, the model fails to account for other macroeconomic and structural factors that could influence trade balance, such as fiscal policy, government debt, exchange rates, and domestic savings rates (Rodrik, 1999; Sahoo, 2006). As noted by Blomström and Kokko (1998), the exclusion of these factors may lead to an incomplete understanding of the trade balance dynamics in SSA.

Furthermore, while the model focuses on FDI as a key explanatory variable, other important factors influencing trade balance, such as government policies, political stability, and regional trade agreements, were not included. Omitting relevant variables could lead to omitted variable bias, and the results may not fully capture the complexity of the relationship between FDI and trade balance (Stock & Watson, 2011).

The study covers the period from 2005 to 2022, which, although relevant, may not fully capture long-term trends or changes in global trade and investment patterns. The recent period, characterized by economic shocks such as the COVID-19 pandemic and global financial crises, could have significantly influenced trade balances in ways that the model cannot account for (Baldwin, 2009). These events may have led to temporary or atypical shifts in the relationship between FDI and trade balance, potentially skewing the results.

The significant probability value of the Jarque-Bera test indicates that the residuals deviate from normality, suggesting that the model may suffer from non-normal errors. This non-normality could affect the reliability of inference tests (e.g., t-tests) and the validity of the model's results (Bera & Jarque, 1981). Although the regression estimates may still be consistent, non-normality can introduce bias, particularly in smaller samples.

The Durbin-Watson statistic of 0.515472 suggests the presence of autocorrelation in the residuals, which implies that the error terms are not independent (Wooldridge, 2010). This autocorrelation could bias the standard errors and lead to incorrect conclusions regarding the statistical significance of the coefficients. The issue of autocorrelation may stem from omitted variables or model specification errors (Greene, 2012).

The rejection of the null hypothesis of homoskedasticity implies that the residuals exhibit heteroskedasticity, meaning the variance of errors is not constant across observations (White, 1980). Heteroskedasticity can lead to inefficient

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International Journal of Southern Economic Light (JSEL)
- Peer Review Journal

estimates and biased test statistics, impacting the precision of the regression results. While robust standard errors could address this issue, it still represents a limitation that could affect the validity of the findings.

The use of a pooled regression model assumes that the relationship between FDI and trade balance is homogenous across all Sub-Saharan African countries. This assumption may not hold true, as different countries in the region have varying levels of institutional development, trade openness, and economic structures, which could cause the effects of FDI on trade balance to differ (Asiedu, 2002; Sahoo, 2006). Future studies could benefit from employing more sophisticated models, such as fixed or random effects, to account for country-specific variations.

Another limitation is the potential endogeneity between FDI and trade balance. FDI could be attracted to countries with improving trade balances, creating a bidirectional relationship that the study's design does not explicitly account for. As noted by Aitken et al. (1997), such reverse causality could lead to biased estimates unless appropriate instruments or techniques, such as instrumental variable approaches, are employed.

The global economic environment, characterized by trade tensions, inflationary pressures, and fluctuations in commodity prices, may have influenced trade balances across the region. These external shocks are difficult to capture within the confines of a single study and could limit the generalizability of the findings (Keller, 2000).

CONCLUSION

This study investigates the relationship between Foreign Direct Investment (FDI) and trade balance in Sub-Saharan Africa (SSA) over the period 2005 to 2022. The findings offer valuable insights into how FDI can influence the trade balance in the region, highlighting both its potential benefits and challenges.

The study establishes that FDI plays a statistically significant positive role in improving trade balance, demonstrating that a 10% increase in FDI can lead to a 7.05% improvement in trade balance. This aligns with the broader literature that suggests FDI can enhance production capacity, export diversification, and technological transfers (Blomström & Kokko, 1998; Adedeji, et al. 2016). However, the findings also underscore the complexity of this relationship, with potential challenges such as increased reliance on imported inputs and profit repatriation, which could neutralize some of the positive effects of FDI on trade balance.

While FDI is a significant driver of trade balance in SSA, the study also reveals the moderate fit of the model, with an adjusted R-squared of 0.557, indicating that other unexamined factors are also at play. The study therefore suggests that future research should explore additional variables, such as institutional quality, infrastructure, and policy environments, which may further explain the variation in trade balance outcomes across SSA countries (Asiedu, 2002; Rodrik, 1999).

The findings of this study are particularly relevant for policymakers in Sub-Saharan Africa, as they highlight the importance of fostering a conducive environment for FDI to stimulate economic growth and improve trade balance. However, it is equally critical for policymakers to address the potential negative impacts of FDI, such as profit outflows and dependency on external factors. As SSA countries continue to integrate into the global economy, the balancing act between attracting FDI and mitigating its potential drawbacks will remain a key challenge for sustainable economic development.

In conclusion, this study provides empirical evidence that supports the positive role of FDI in improving the trade balance of Sub-Saharan African economies. However, it also emphasizes the need for a comprehensive approach to FDI policy that maximizes the benefits while minimizing the risks associated with foreign investments.

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- Peer Review Journal

RECOMMENDATIONS

Based on the findings of this study, recommendations are provided to enhance the positive impact of Foreign Direct Investment (FDI) on trade balance in Sub-Saharan Africa (SSA). These recommendations are aligned with the study's results and aim to address some of the challenges identified in the analysis.

The study's finding that FDI positively affects trade balance suggests that governments in SSA should create favorable environments for FDI, especially in export-oriented sectors. Governments could introduce incentives such as tax breaks, infrastructure development, and regulatory reforms aimed at attracting investment in industries that can enhance export diversification (Narula & Dunning, 2010). FDI inflows into sectors like manufacturing and agriculture can improve production capacity and export capabilities, thereby positively impacting trade balance (Alfaro, 2003).

Although FDI inflows can improve trade balance, the study acknowledges potential drawbacks such as increased reliance on imported inputs and profit repatriation. To mitigate these risks, governments should encourage FDI that contributes to local value-added production. This could include policies that foster technology transfer and skill development, which would enable local industries to upgrade production processes and increase their competitiveness in international markets (Lall, 2004).

The study indicates that factors such as institutional quality and infrastructure development are crucial in moderating the relationship between FDI and trade balance. Governments should prioritize improving institutional frameworks and governance standards to reduce corruption, enhance transparency, and improve the ease of doing business. Strong institutions are fundamental in creating an enabling environment for FDI to contribute effectively to trade balance (North, 1990).

Governments should develop targeted programs that focus on attracting FDI specifically for export-oriented industries. This includes offering incentives to foreign investors in sectors such as textiles, technology, and agribusiness, where SSA countries have comparative advantages. Tailored FDI programs can maximize the benefits of foreign investment by linking it to export growth, which directly influences trade balance (Cleeve, 2008).

To mitigate the negative impacts of FDI such as over-reliance on foreign inputs, SSA countries could implement programs that focus on capacity building and technology transfer. These initiatives would help local firms improve their productivity and innovation capacity, making them more competitive in global markets. This would not only enhance trade balance but also foster long-term economic growth (Sethi et al., 2003).

While this study focused on FDI and trade balance, future research should consider additional macroeconomic variables, such as inflation, exchange rates, and interest rates, to gain a more comprehensive understanding of the factors that influence trade balance in SSA. Expanding the scope of the analysis could help identify other key determinants and refine the policy recommendations (Akinlo, 2004).

Given the heterogeneity among SSA economies, further research should explore the role of FDI in specific countries or regions within SSA. Country-level analysis can provide more nuanced insights into how local factors, such as political stability, infrastructure, and labor markets, influence the effectiveness of FDI in improving trade balance (Kinoshita, 2000).

Future research could also explore the long-term effects of FDI on trade balance by conducting longitudinal studies that track the impact of FDI over extended periods. This would help to assess whether the positive effects of FDI persist over time or if diminishing returns or other structural factors affect the relationship in the long run (Borensztein et al., 1998). By addressing these recommendations, Sub-Saharan African governments and policymakers can harness the full potential of FDI to improve trade balance and foster sustainable economic growth.

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International Journal of Southern Economic Light (JSEL)
- Peer Review Journal

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Volume: 13, Issue: 1 January 2025| Impact Factor (SJIF 2024):8.311 | Journal DOI: 10.36713/epra2712 ISSN: 2277 – 5692
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APPENDICES

Appendix 1: Descriptive statistics

	LNTB	LNFDI
Mean	22.72312	19.69439
Median	22.66982	19.69771
Maximum	26.29797	24.42848
Minimum	20.05782	14.76046
Std. Dev.	1.303215	1.382474
Skewness	0.608428	-0.040787
Kurtosis	3.596138	3.634458
Jarque-Bera	27.54177	6.137868
Probability	0.000001	0.046471
Sum	8180.323	7089.98
Sum Sq. Dev.	609.7144	686.133
Observations	360	360

Volume: 13, Issue: 1 January 2025| Impact Factor (SJIF 2024):8.311 | Journal DOI: 10.36713/epra2712 ISSN: 2277 – 5692
International Journal of Southern Economic Light (JSEL)
- Peer Review Journal

Appendix 2: Unit root test, LNTB (in Level)

Panel unit root test: Summary
Series: LNTB
Date: 12/01/24 Time: 21:08
Sample: 2005 2022
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-6.10733	0.0000	20	320
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-3.31145	0.0005	20	320
ADF - Fisher Chi-square	70.6565	0.0020	20	320
PP - Fisher Chi-square	90.7962	0.0000	20	340

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Appendix 3: Unit root test, LNFDI (in Level)

Panel unit root test: Summary
Series: LNFDI
Date: 12/01/24 Time: 21:09
Sample: 2005 2022
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-2.88326	0.0020	20	320
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-3.19233	0.0007	20	320
ADF - Fisher Chi-square	83.9120	0.0001	20	320
PP - Fisher Chi-square	113.739	0.0000	20	340

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Volume: 13, Issue: 1 January 2025| Impact Factor (SJIF 2024):8.311 | Journal DOI: 10.36713/epra2712 ISSN: 2277 – 5692
International Journal of Southern Economic Light (JSEL)
- Peer Review Journal

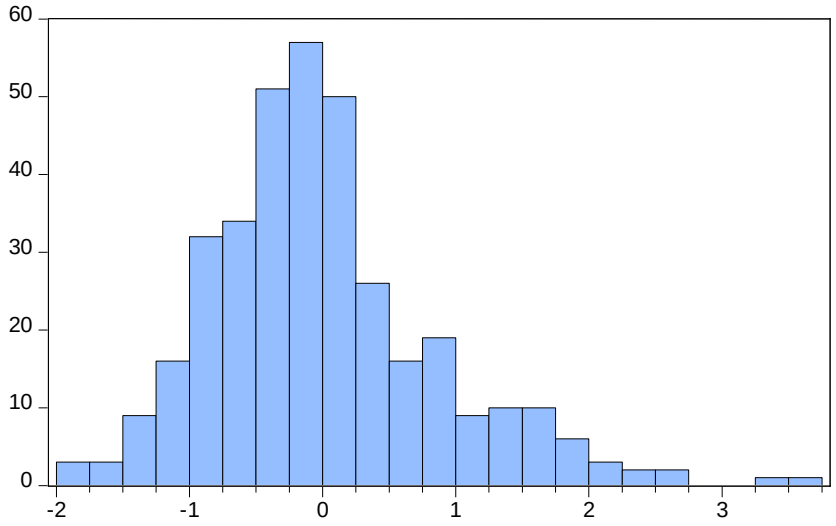
Appendix 4: Pooled regression model results

Dependent Variable: LNTB
Method: Panel Least Squares
Date: 12/01/24 Time: 21:15
Sample: 2005 2022
Periods included: 18
Cross-sections included: 20
Total panel (balanced) observations: 360

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNFDI	0.704570	0.033099	21.28676	0.0000
C	8.847036	0.653464	13.53867	0.0000

R-squared	0.558638	Mean dependent var	22.72312
Adjusted R-squared	0.557405	S.D. dependent var	1.303215
S.E. of regression	0.867000	Akaike info criterion	2.557984
Sum squared resid	269.1046	Schwarz criterion	2.579574
Log likelihood	-458.4372	Hannan-Quinn criter.	2.566569
F-statistic	453.1260	Durbin-Watson stat	0.515472
Prob(F-statistic)	0.000000		

Appendix 5: Normality test



Series: Standardized Residuals
Sample 2005 2022
Observations 360

Mean	-2.59e-15
Median	-0.106161
Maximum	3.600025
Minimum	-1.951423
Std. Dev.	0.865792
Skewness	0.878473
Kurtosis	4.438814
Jarque-Bera	77.35569
Probability	0.000000

Volume: 13, Issue: 1 January 2025| Impact Factor (SJIF 2024):8.311 | Journal DOI: 10.36713/epra2712 ISSN: 2277 – 5692
International Journal of Southern Economic Light (JSEL)
- Peer Review Journal

Appendix 6: Heteroskedasticity test

Panel Period Heteroskedasticity LR Test
Null hypothesis: Residuals are homoskedastic
Equation: UNTITLED
Specification: LNTB LNFDI C

	Value	df	Probability
Likelihood ratio	29.99729	20	0.0699

LR test summary:

	Value	df
Restricted LogL	-458.4372	358
Unrestricted LogL	-443.4385	358

Unrestricted Test Equation:
Dependent Variable: LNTB
Method: Panel EGLS (Period weights)
Date: 12/01/24 Time: 21:23
Sample: 2005 2022
Periods included: 18
Cross-sections included: 20
Total panel (balanced) observations: 360
Iterate weights to convergence
Convergence achieved after 5 weight iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNFDI	0.762271	0.031723	24.02898	0.0000
C	7.693808	0.629607	12.22001	0.0000

Weighted Statistics

R-squared	0.617273	Mean dependent var	24.36447
Adjusted R-squared	0.616204	S.D. dependent var	5.424712
S.E. of regression	0.870834	Akaike info criterion	2.474659
Sum squared resid	271.4899	Schwarz criterion	2.496248
Log likelihood	-443.4385	Hannan-Quinn criter.	2.483243
F-statistic	577.3918	Durbin-Watson stat	0.542208
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.554724	Mean dependent var	22.72312
Sum squared resid	271.4912	Durbin-Watson stat	0.600502

Volume: 13, Issue: 1 January 2025| Impact Factor (SJIF 2024):8.311 | Journal DOI: 10.36713/epra2712 ISSN: 2277 – 5692
International Journal of Southern Economic Light (JSEL)
- Peer Review Journal

Appendix 7: List of Sub-Saharan Africa countries in the study

Angola	Gambia, The	Mauritania	Senegal	Tanzania
Benin	Kenya	Namibia	Seychelles	Togo
Burkina Faso	Madagascar	Niger	Sierra Leone	Uganda
Cabo Verde	Mali	Rwanda	South Africa	Zambia