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EFFECT OF FINANCIAL DEVELOPMENT ON TRADE OPENNESS IN SUB-SAHARAN AFRICA

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Abstract

This study investigates the effects of financial development on trade openness in Sub-Saharan Africa using annual time series data which covered the period of 2000 to 2022, panel system generalized method of moment (GMM) as the baseline model as well as fully modified ordinary least squares (FMOLS) and dynamic ordinary least squares (DOLS) as the models for robustness checks. Financial development was stratified into financial institutions and financial markets. Financial institutions were further explored via financial institution depths, financial institution access, financial institution efficiency and financial institution stability; while financial markets were measured via financial market depths, financial market access, financial market efficiency and financial market stability. Findings from system GM revealed that the results of the system GMM, it was discovered that financial development – financial institutions and financial markets have significant positive effects on trade openness in Sub-Saharan Africa. More specifically, this study found that financial institution depths, financial institution access, financial institution efficiency, financial institution stability, financial market depths, financial market access, financial market efficiency and financial market stability have significant positive effects on trade openness in Sub-Saharan Africa. This is also similar to findings made from the results of the robustness check – FMOLS and DOLS. From the results findings, we conclude that financial institution depths, financial institution access, financial institution efficiency, financial institution stability, financial market depths, financial market access, financial market efficiency and financial market stability have significant positive effects on trade openness in Sub-Saharan Africa. Based on these findings, this study recommends that financial development via financial institutions and financial markets as well as their depths, access, efficiency and stability should be improved by the authorities to improve the nature and quality of trade in Sub-Saharan Africa.

Keywords: Trade Openness, Financial Development, Financial Institution, Financial Market.

1. INTRODUCTION

Trade openness is crucial for fostering economic prosperity, promoting innovation, enhancing global cooperation, and improving the overall well-being of societies (McCusker 2001). It refers to the degree to which a country or an economy engages in international trade and allows the free flow of goods, services, labour, and capital across its borders, and also facilitates economic growth by allowing countries to specialize in the production of goods and services in which they have a comparative advantage (Braudel, 1979). Open trade often results in lower prices for consumers due to increased competition and access to a wider variety of goods and services and this enhances consumer welfare and improves living standards, creates new job opportunities, encourages the transfer of technology and know-how across borders, allows countries to allocate their resources more efficiently by optimizing resource utilization, enables diversification of markets and sources of revenue, reducing dependence on any single market or suppliers, promote diplomatic relations and reduce the likelihood of conflicts, contribute to regional and global stability, facilitate the diffusion of environmentally friendly technologies

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and practices, improve skill development and capacity building, promote transparency, good governance, and adherence to international norms and standards and foster cultural exchange and mutual understanding among nations (Clifton & Marxsen 1974). It is therefore essential effective growth and development of every national economy. According to (Patrick, 1966), financial development through robust banking systems, financial markets, and specialized trade finance institutions, provides essential tools and services that facilitate trade openness when properly harnessed by the authorities. It provides instruments like letters of credit, trade credit insurance, factoring, and other financial instruments that mitigate risks and ensure smooth payment flows between exporters and importers.

Financial development is essential for creating an enabling environment that supports and enhances international trade activities. It contributes to economic growth by mobilizing savings, allocating capital efficiently, and promoting investment (Schumpeter, 1911). A growing economy with strong financial systems is better positioned to engage in and benefit from international trade as it provides the necessary financial infrastructure, instruments, and mechanisms that facilitate trade transactions, reduce risks, and promote economic growth and development on both national and global scales (McKinnon, 1973). Efficient financial systems can lower transaction costs associated with international trade and make financial transactions easy, secure and convenient. Costs related to currency exchange, hedging against currency fluctuations, and financing costs can be reduced by financial development tools, which make trade more attractive and feasible for businesses of all sizes (James 2011), which can bolster cross-border trade and local and international payment for goods and services. Furthermore, financial development provides tools and mechanisms to mitigate risks associated with international trade, such as credit risks, political risks, and exchange rate risks such as financial derivatives and hedging instruments which can help businesses manage and mitigate exposure to currency fluctuations (Bah et al. 2016). A well-developed financial system enhances a country's attractiveness to foreign investors by providing a stable and efficient environment for investment. This can lead to increased FDI, which in turn boosts trade by facilitating the establishment of production facilities, joint ventures, and other business operations that contribute to export activities and create employment (Agnes, 2009). As financial development is often accompanies greater currency convertibility and exchange rate stability, it reduces uncertainties for traders and investors, promotes confidence in international transactions, and facilitates price competitiveness in global markets, and encourages technological advancements that enhance productivity and competitiveness in international trade (Shaw, 1973).

Deepening our understanding of the effects of financial development on trade openness, we conducted a thorough investigation of financial development by dissecting it into 2 main sections namely, financial institutions and financial markets (Robinson, 1952). On one hand, financial institutions facilitate shaping the trade environment by providing essential financial services to foster an environment conducive to trade through risk management, investment, and policy advocacy, provide essential trade financing, such as letters of credit and export financing, which facilitate international trade, offer tools like derivatives to manage risks associated with currency fluctuations which makes trade more appealing, encourage trade by

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fostering confidence among traders and investors, contribute to economic growth by mobilizing savings and facilitating investments, which can lead to increased trade openness, facilitate global integration by playing a role in attracting FDI, which can enhance a country's trade openness and global supply chains, provide access to credit for small and medium enterprises which enable businesses to engage in international trade, and enhance financial inclusion which in turn enhances local production capabilities, by contributing to export growth (Levine 1973). On the other hand, financial markets provide international businesses with access to equity and debt financing, essential for scaling operations and entering international markets (Levine 1973). It enables firms to raise funds quickly, facilitating timely trade opportunities, offering derivatives and other tools that allow companies to hedge against currency and interest rate risks, making international trade less risky with the aid of financial markets instruments, contributing to accurate pricing of assets and risks by aiding businesses in making informed decisions regarding trade, increase transparency in financial markets by reducing information asymmetries, encourage foreign portfolio investments by promoting cross-border economic interactions, contribute to overall economic stability by creating a favourable environment for trade expansion, and support efficient payment systems crucial for international trade transactions (Choong et al. 2003). Financial markets significantly shape trade openness by providing access to capital, facilitating risk management, promoting market efficiency, attracting investment, and supporting economic stability. Their role is crucial in fostering a conducive environment for international trade and economic growth.

In the light of above discussions, it would be deduced that financial development contributed effectively to the improvement of trade openness and this has attracted the attention of scholars around the globe (Akinsola & Odhiambo 2017, Bojanic 2012, Uddin et al. 2013, Appiah et al. 2023, Mustafa 2023, Paul 2017, Adam 2022, Bankola 2022). However, previous studies like (Maduka & Onwuka, 2013, Iheanacho 2016, Taofeek & Olumuyiwa, 2016, Obinna 2015, Dandume, 2014, Balango 2014, Okpara 2010, Manasseh et al. 2021, Manasseh et al. 2023) have failed to acknowledge both financial institutions and financial markets while investigating financial development in their respective studies. Thus, given the importance of the duo, we highlight the role of financial institution depths, financial institution access, financial institution efficiency and financial institution stability and also considered the importance of the role of financial markets depths, financial markets access, financial market efficiency and financial market stability while measuring the financial development in Sub-Saharan Africa. Therefore considering the aforementioned, it has become very clear that there is a great need to study the effects of financial development with emphasis on financial institutions and financial markets on trade openness in Sub-Saharan Africa.

Therefore financial institutions which were measured with (financial institution depths, financial institution access, financial institution efficiency, and financial institution stability), and financial markets are measured with (financial market depths, financial market access, financial market efficiency and financial market stability) were all investigated about trade openness in this study. Consequently, this study is guided by the following research questions (1) what are the effects of financial institutions on trade openness? (2) Does financial markets influence trade openness significantly? (3) What is the role of financial institution depths on

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trade openness? (4) Does financial institution access have significant effects on trade openness? (5) In what ways does financial institution efficiency affect trade openness? (6) In what degrees does financial institution stability influence trade openness? (7) To what extent does the financial market depths affect trade openness? (8) Does financial market access significantly influence trade openness in Sub-Saharan Africa? (9) What are the effects of financial market efficiency on trade openness in Sub-Saharan Africa? (10) How does the financial market stability influence trade openness in Sub-Saharan Africa?

To estimate these research questions empirically, we used panel system generalized method of moment (GMM) and robustly checked the findings using the fully modified ordinary least squares (FMOLS) and dynamic ordinary least squares (DOLS), measured financial development with emphasis on financial institutions which was measured with financial institution depths, financial institution access, financial institution efficiency and financial institution stability; and financial markets which were measured with financial market depths, financial market access, financial market efficiency and financial market stability were all investigated about trade openness in Sub-Saharan Africa. The existing empirical literature on financial development and trade openness has made limited efforts to deepen our understanding of the synergy between these indicators (Akinsola & Odhiambo 2017, Bojanic 2012, Uddin et al. 2013, Appiah et al. 2023, Mustafa 2023, Paul 2017, Adam 2022, Bankola 2022).

However, these studies have failed to consider both financial institutions and financial markets indicators like financial institution depths, financial institution access, financial institution efficiency and financial institution stability, financial market depths, financial market access, financial market efficiency and financial market stability. Moreover, some prior research focused on utilizing credit to the private sector to assess the relevance of financial development influence on trade openness (Karimo & Ogbonna, 2017). Thus, at the time of writing this research paper, there is no empirical study that focused on exploring the synergy between financial institution depths, financial institution access, financial institution efficiency and financial institution stability, financial market depths, financial market access, financial market efficiency, and financial market stability on trade openness. This has led to incongruities and flawed findings in the past empirical research, resulting in inconclusive policy outcomes. For example, (Usuabi, Odozi & Adeniyi, 2016, Oniore 2014) found that financial development had negative effects on trade openness, while (Inuoye & Hamori 2019, Makina & Walle 2019) discovered that financial development increases trade openness in their respective studies.

Despite various government policies and financial reforms in Sub-Saharan Africa as well as numerous empirical evidence (Akinsola & Odhiambo 2017, Bojanic 2012, Uddin et al. 2013, Appiah et al. 2023, Mustafa 2023, Paul 2017, Adam 2022, Bankola 2022). However, previous studies like (Maduka & Onwuka, 2013, Iheanacho 2016, Taofeek & Olumuyiwa, 2016, Obinna 2015, Dandume, 2014, Balango 2014, Okpara 2010, Manasseh et al. 2021, Manasseh et al. 2023), trade openness in the region remain low when compared to other regions like Asia, and Europe. Amid this, it has become very imperative to reevaluate trade openness through the lens of the synergy between financial institution depths, financial institution access, financial institution efficiency and financial institution stability, financial market depths, financial

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market access, financial market efficiency, and financial market stability on trade openness to gain a deeper understanding of their relationships.

This research study therefore lends to the body of existing literature in the following ways. First, to the best of our awareness, this study is the first empirical research to examine the synergy between financial development and trade openness in Sub-Saharan Africa. Emphasizing both financial institutions and financial markets to measure linkages between financial development and trade openness, gives us an edge to make substantial policy insights into the need to improve financial development for effective trade openness. Second, we explored the relationship between financial institution depths and trade openness in Sub-Saharan Africa given that financial institutions play a critical role in supporting and enhancing trade openness by providing essential services, managing risks, facilitating access to capital, and ensuring financial stability. Also, banks and financial institutions offer foreign services, enabling businesses to cover currencies for international trade. Third, we explored the effects of financial institution access on trade openness since access to financial institutions is crucial for trade openness as it provides the necessary tools, services, and capital that businesses need to engage in international trade. Financial institutions facilitate trade transactions, manage risks, offer capital, and improve market efficiency. They support SMEs, promote economic stability, enhance global integration, and encourage trade liberalization. Fourth, we examined the effects of financial institution efficiency on trade openness since the efficiency of financial institutions significantly impacts trade openness by reducing transaction costs, improving access to trade financing, enhancing risk management, and facilitating currency exchange and payments. Efficient institutions support SMEs, promote economic stability, foster global integration, and encourage trade liberalization. By improving the effectiveness and reliability of financial services, efficient financial institutions make international trade more accessible and attractive, thereby contributing to a more open and dynamic global trading environment.

Fifth, this study further examined the effects of financial institution stability on trade openness in Sub-Saharan Africa given that the stability of financial institutions is essential for trade openness as it reduces economic uncertainty, ensures reliable access to trade financing, and facilitates effective risk management. It supports currency stability, promotes economic growth, and prevents financial crises. Stable financial institutions also provide consistent support to SMEs, maintain regulatory and compliance frameworks, and enhance overall market integrity. By creating a secure and predictable financial environment, stability in financial institutions encourages businesses to engage in international trade and fosters a more open global trading system. Sixth, we studied the effects of financial market depths on trade openness since the deepening of financial markets plays a crucial role in promoting trade openness by improving access to capital, enhancing liquidity, facilitating risk management, and supporting efficient payment systems. It also benefits SMEs by providing better financial products and services, fostering economic stability and growth, encouraging global integration, and supporting robust policy and regulatory frameworks. As financial markets become more developed and accessible, businesses are better equipped to engage in international trade, leading to a more open and dynamic global trading environment. Seventh, we examined the effects of financial markets access since access to financial markets significantly impacts trade

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openness by providing businesses with the capital needed to engage in international trade, enhancing liquidity and risk management, and supporting efficient payment systems. It benefits SMEs, promotes global market connectivity, and contributes to economic stability and growth. Additionally, access to financial markets supports regulatory compliance and the implementation of trade policies.

Eight, we explored the impact of financial market efficiency on trade openness in Sub-Saharan Africa considering that the efficiency of financial markets is crucial for trade openness as it reduces transaction costs, improves access to capital, enhances risk management, increases liquidity, and supports SMEs. Efficient financial markets also encourage foreign direct investment, promote economic stability, and enhance global integration. By providing a reliable and effective financial infrastructure, efficient markets enable businesses to participate more effectively in international trade, contributing to a more open and interconnected global economy. Ninth, we estimated the relationship between the financial market stability and trade openness in Sub-Saharan Africa because financial market stability is crucial for trade openness as it reduces economic uncertainty, facilitates access to trade financing, enhances risk management, and promotes efficient payment systems. It supports investment and economic growth, encourages global integration, strengthens regulatory frameworks, and mitigates the impact of financial crises. By providing a reliable and predictable financial environment, stable financial markets enable businesses to engage in international trade with greater confidence and efficiency, contributing to a more open and interconnected global economy. Tenth, most of the researchers were confident in the applicability of various techniques they employed to estimate their respective studies. For instance, despite the flaws of each of these techniques (Nwosu, Itodo & Ogbonnaya, 2021, Uddin et al. 2013, and Usuab, Odozi & Adniyi 2016) conducted their research using the autoregressive distributed lag model (ARDL) approach, while (Nizam et al. 2020) utilized the asymmetric co-integration and threshold analytical technique, respectively, without a robust check. However, we utilized the dynamic system generalized method of moment (GMM) as the baseline model and robustly checked the findings using the panel fully modified ordinary least squares (FMOLS) and panel dynamic ordinary least squares (DOLS). While the dynamic GMM is consistent in taking care of endogeneity, specification bias, serial correlation and over identification of instruments, the FMOLS and DOLS models are also consistent in solving cross-sectional dependency problems that exist due to unobserved shocks and spatial effects.

2. REVIEW OF RELATED LITERATURE

2.1 Theoretical Review

Traditional trade theories, such as the Ricardian and Heckscher-Ohlin-Samuelson (HOS) models, focused on constant returns, perfect competition, and homogeneous goods. However, these models failed to explain trade patterns between similar economies, such as the US and EU. This gap led to the emergence of new trade theories, which emphasize economies of scale, product differentiation, and the rise of oligopolistic market structures. These theories highlight the role of increasing returns, both internal and external to firms, and the importance of global

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value chains in shaping production and trade patterns. However, the predictive power of these new theories is limited, particularly due to the possibility of multiple equilibria and strategic behaviours by firms. These new theories introduce concepts like increasing returns within firms, leading to monopolistic or oligopolistic market structures and product differentiation, deviating from the traditional assumptions of constant returns, perfect competition, and homogeneous goods foundational in the Ricardian and Heckscher-Ohlin-Samuelson (HOS) models (Shiozawa, 2017; Ranjan & Raychaudhuri, 2016).

The discussion then shifts to the theories of financial development and economic growth, focusing on the "supply-leading" and "demand-following" hypotheses. Financial development is seen as a key driver of economic growth, influencing productivity and capital efficiency through its impact on savings rates and capital accumulation (Pagano, 1993; Levine, 1997). Schumpeter (1911) was the first to argue that financial sector development spurs technological innovation and economic growth, a view later supported by McKinnon (1973) and Shaw (1973), who emphasized the role of financial liberalization in increasing savings and investment, leading to economic growth. The supply-leading hypothesis posits that financial development drives economic growth by increasing the supply of financial services and efficiently allocating resources. In contrast, the demand-following hypothesis argues that economic growth stimulates financial development as the demand for financial services grows with the expansion of the real sector. The theoretical foundation for these views can be traced to Schumpeter, who highlighted the role of financial sector development in fostering technological innovation and economic growth and was further developed by scholars like McKinnon, Shaw, and Patrick. These theories emphasize the importance of financial development in enhancing productivity, capital accumulation, and overall economic growth.

2.2 Empirical Literature

Empirical reviews regarding synergy between financial institutions and trade openness were reviewed in this section by the researcher. As part of financial development, financial institutions plays crucial roles in improving the trading environment of an economy it encompasses financial institution depths, access, efficiency and stability. Appiah et al. (2023), observe the influence of foreign direct investment (FDI), financial development (FD), and economic growth on improving industrial development for Sub-Saharan African (SSA) nations from 1990–2017. The research discovers that financial development and economic growth improve industrial growth, whereas FDI has an opposing result.

Mustafa (2023) explored the causal effects between FD, trade openness, FDI, and economic growth in four South Asian economies from 1990 to 2019, employing the VECM-Granger Causality test. The outcomes propose that all economies must implement policies to encourage more sectoral financial growth and trade openness, accelerate the investment environment, and entice investments to achieve greater economic growth in the long term. Adam (2022) also examined the nexus between foreign direct investment (FDI), financial development, and sustainable economic growth in Sudan. The study used time series secondary data from 1990 to 2020.

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The results showed that there's evidence of observed causality running from the country's trade openness and the financial sector's development. A study conducted by Nkoro and Uko (2023) examined the role of domestic financial sector development in the relationship between foreign direct investment (FDI) inflows and inclusive growth in Nigeria and found that FDI exerted a significant positive effect on inclusive growth when the domestic financial sector reached a certain minimum level of development. Using time series data extending from 1980 to 2020, Wasurum and Tamunowariye (2022) investigated the impact of foreign trade and the expansion of the financial sector on economic growth in Nigeria. According to their study, loans to the private sector foster economic growth over the long term, whereas export commerce and imports hinder economic growth in Nigeria.

Farouq and Sulong (2021) investigated the dynamic effects of foreign direct investment uncertainty on financial development in Nigeria and the interacting role of financial inclusion and economic growth and found a non-linear unidirectional causality running from economic growth to financial development, foreign direct investment uncertainty to financial development, and financial inclusion to financial development.

In the empirical literature regarding the synergy between financial markets and trade openness was conducted with emphasis on financial markets depths, access, efficiency and stability. Shah et al. (2021) adopted weekly data, cross-sectional and time series OLS regression, CAPM, and Fama and French three-factor models to examine stock return in Pakistan from 2006 to 2018. The study showed that beta cannot explain expected return as revealed in the cross-sectional regression, while the time-series regression suggested that both CAPM and the three-factor model are best in explaining expected returns.

However, the GRS-based test of regression intercepts and regressions R2 indicate that the Fama and French model better captures variations in observed stock returns than the CAPM. Similarly, Mwenda et al. (2021) examined the systematic risk and performance of the stock market in Kenya. The study was underpinned by the efficient market hypothesis, APT, and integration analysis which were used to establish the relationships between the variables of the study.

The study found a significant long-run positive relationship between interest rate, inflation, and the performance of the stock market in Kenya. The study suggests that investment firms and financial analyst should use past data on 91 Treasury bills rate and inflation, in predicting the future performance of the stock exchange for the benefit of investors. In a related study, Umar, et al. (2022) used GARCH analysis to examine the effect of the Covid-19 pandemic on stock market liquidity in China and the four worst-affected countries. They discovered that liquidity in stock markets across all of the sampled countries was severely impacted by the news of the outbreak. Additionally, for all investigated nations, an increase in illiquidity brought on by transient shocks quickly returns to the long-term trend, indicating that the liquidity shocks brought on by the occurrence of COVID-19 were transient.

Abdulkadir, Olatinwo and Afolabi (2022) used the autoregressive distributed lag (ARDL) bounds testing approach to explore the drivers of stock market liquidity in Nigeria and

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discovered that higher market performance and governmental monetary interventions increase stock market liquidity. Additionally, they discovered that although market liquidity persistence exists, but market liquidity is hindered by high price levels. Uhunmwangho and Omorokunwa (2022) investigated the link connecting volatility, liquidity, to stock returns using the generalized method of moments (GMM), and found that volatility significantly and inversely influences returns, while stock market liquidity significantly and positively influences market returns.

2.6 Knowledge Gap

This study examined the effects of financial development on trade openness in Sub-Saharan Africa from 2000 to 2022 and financial development was explored laying much emphasis on financial institutions and financial markets. However, a critical review of the previous empirical studies shows that the synergy between financial development and trade openness has not been well investigated especially in Sub-Saharan Africa. Studies like (Farouq & Sulong 2021, Appiah et al. 2023, Mustafa 2023, Adam 2022, Nkoro & Uko 2023, Wasurum & Tamunowariye 2022) examined the linkages between financial development, foreign direct investment and economic growth; Kpoghul, Okpe & Anjande (2020) examined the synergy between foreign direct investment and economic performance; Umar et al. (2022) investigated the systemic risks and stock markets; while Nwenda et al. (2021) explored the effects of Covid-19 pandemic on stock market.

However, none of the reviewed studies mentioned above established the synergy between financial institution depths, financial institution access, financial institution efficiency, financial institution stability, financial market depths, financial market access, financial market efficiency, financial market stability and trade openness especially in Sub-Saharan Africa despite their significance in improving trade openness, impacting the financial transaction of the manufacturing firms, improvement of business financial commitments, facilitation of cross-border trade, improvement of financial inclusivity, and movement of trade funds. To address these gaps in the literature, we investigated the synergy between financial institution depths, financial institution access, financial institution efficiency, financial institution stability, financial market depths, financial market access, financial market efficiency, financial market stability and trade openness especially in Sub-Saharan Africa unlike previous studies. These proxies are very crucial since many Sub-Saharan African countries have numerous significant trade challenges that affect the economic progress of the nations. Consequently, information obtained from this investigation would aid the stakeholders and policymakers in making policies that would boost international trade in Sub-Saharan Africa.

3. METHODOLOGY

To ensure that we examine the effects of financial development on trade openness, we utilized time series data which covered the period of 2000 to 2022 in 48 Sub-Saharan African countries. The dataset is secondary data that covers the period 2000-2022 due to data availability. We have drawn this data from the following sources. Table 1 below lists the study's data along with the sources from which they were sourced.

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Variable	Definition	Link to the Data	Source
TOPEN	Trade (% of GDP)	https://data.worldbank.org/indicator/NE.TRD.GNFS.ZS	WDI
Financial Institution Measures			
PSC	Private Sector Credit to GDP	https://data.worldbank.org/indicator/FS.AST.PRVT.GD.ZS	WDI
FIA	Financial Institutions' asset to GDP	https://databank.worldbank.org/metadataglossary/global-financial-development/series/GFDD.DI.02	WDI
DEP	Deposits to GDP	https://databank.worldbank.org/metadataglossary/global-financial-development/series/GFDD.DI.08	WDI
NOA	Accounts per thousand adults (commercial banks)	https://databank.worldbank.org/metadataglossary/global-financial-development/series/GFDD.AI.01	WDI
CBB	Branches per 100,000 adults (commercial banks)	https://data.worldbank.org/indicator/FB.CBK.BRCH.P5?skipRedirection=true&view=map	WDI
FCL	% of firms with a line of credit (all firms)	https://databank.worldbank.org/metadataglossary/global-financial-development/series/GFDD.AI.04	WDI
NIM	Net interest margin	https://databank.worldbank.org/metadataglossary/global-financial-development/series/GFDD.EI.01	WDI
LDS	Lending-deposits spread	https://databank.worldbank.org/metadataglossary/global-financial-development/series/GFDD.EI.02	WDI
NII	Non-interest income to total income	https://databank.worldbank.org/metadataglossary/global-financial-development/series/GFDD.EI.03	WDI
CAR	Capital adequacy ratio	https://databank.worldbank.org/metadataglossary/global-financial-development/series/GFDD.SI.05	WDI
AQR	Asset quality ratio	https://databank.worldbank.org/metadataglossary/global-financial-deve	WDI
LR	Liquidity ratios	https://data.worldbank.org/indicator/FD.RES.LIQU.AS.ZS	WDI
Financial Market Measures			
MCAP	Stock market capitalization and outstanding domestic private debt securities to GDP	https://databank.worldbank.org/metadataglossary/global-financial-development/series/GFDD.DM.01	WDI
PRDS	Private Debt securities to GDP	https://databank.worldbank.org/metadataglossary/global-financial-development/series/GFDD.DM.03	WDI
PUDS	Public Debt Securities to GDP	https://databank.worldbank.org/metadataglossary/global-financial-development/series/GFDD.DM.04	WDI

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MACOC	Percent of market capitalization outside of top 10 largest companies	https://databank.worldbank.org/metadataglossary/global-financial-development/series/GFDD.AM.02	
DTDS	The ratio of domestic to total debt securities		
PTDS	The ratio of private to total debt securities (domestic)	https://databank.worldbank.org/metadataglossary/global-financial-development/series/GFDD.DM.05	WDI
TOR	Turnover ratio for the stock market	https://databank.worldbank.org/metadataglossary/global-financial-development/series/GFDD.DM.04	WDI
LC	Liquidity/transaction costs	https://data.worldbank.org/indicator/SI.RMT.COST.OB.ZS	WDI
QBS	Quoted bid-ask spread for government bonds	https://data.worldbank.org/indicator/GC.DOD.TOTL.GD.ZS?skipRedirection=true&view=map	WDI
VOSP	Volatility (standard deviation/average) of stock price index	https://databank.worldbank.org/metadataglossary/global-financial-development/series/GFDD.SM.01	WDI
SBI	Sovereign bond index	https://prosperitydata360.worldbank.org/en/indicator/WB+CCDFS+sovrate	WDI
VEM	Vulnerability to earnings manipulation and Price/earnings ratio	https://www.worldbank.org/en/publication/gfdr/gfdr-2016/background/financial-development	WDI
Control Variable			
M2/GDP	Financial Deepening – ratio of broad money over GDP	https://data.worldbank.org/indicator/FM.LBL.BMNY.ZG?locations=US and https://data.worldbank.org/indicator/NY.GDP.MKTP.CD	WDI
EXR	Exchange Rate	https://databank.worldbank.org/metadataglossary/world-development-indicators/series/PA.NUS.FCRF	WDI

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3.2 Model Specifications

3.2.1. Baseline Model – Panel GMM

The baseline model – system GMM was used to estimate the effects of financial development on trade openness in Sub-Saharan Africa. Amidst different estimation techniques, the GMM model was seen as the best estimator because it can measure the long-run relationship efficiently and deal with endogeneity, overidentification of instruments and simultaneity restriction problems (Arellona and Bond, 1991). As such, it has the ability to estimate the long-run effects of financial development and trade openness in Sub-Saharan Africa. The panel GMM model for the estimation of the relationship in this study is expressed below as follows:

$$W_{i,t} = \infty + \tau W_{i,t-1} + \sigma Y_{i,t-1} + \theta_i + \varepsilon_{i,t} \quad ---------- (1)$$

Where W is the dependent variable, Y stands for a vector of explanatory variables, θ_i is the ttime-invariant country-specific fixed-effect, ε is the disturbance term which follows N (0, δ_2) and the subscripts "i" and "t" represent country and time, respectively.

The system GMM is justified when there is a large cross-section (N) i.e. N must be large and a small number of period (T) i.e. the period must be smaller. Thus, in this study, N=48, while T=22. This estimation technique proves quite insightful, robust and enormously suitable based on its important features identified by Blundell and Bond (1998) as follows. Firstly, the GMM approach is quite appropriate in addressing the problem of endogeneity triggered by the inclusion of the initial value of TOPEN and other endogenous variables in the model using the instrumentation process of the corresponding lags of independent variables. Secondly, it corrects for unobserved country-specific heterogeneity, which is an inherent phenomenon across Sub-Saharan African countries and trade openness over time. Thirdly, it addresses the misspecification problem that usually occurs in a static model because the inclusion of a lagged dependent variable in GMM usually omitted in static models is important since it has robust influence in predicting the contemporaneous response of the dependent variable. Furthermore, it has been explained by Blundell and Bond (1998) that the system GMM estimator is more efficient than the differenced GMM estimator given that the instruments become weak after estimating the first differenced GMM. Fourthly, the system GMM robust estimator makes the standard error consistent even in the presence of persistent series and heteroscedasticity (Blundell and Bond 1998; Bond et al. 2001).

Thus, to estimate equation (1), the dependent variable would need to be lagged to override the country-specific effects and endogeneity problems (Hao 2020). Also, Levine and Zervos (1998) used the initial values of the explanatory variables as instruments to remove the simultaneity problem in the econometric model, but the results resulted in information loss as well as potential consistency loss rendering the estimation inefficient (Beck and Levine, 2004). However, for the model to be efficient and consistent, proper instruments should be used in place of the initial values of the explanatory variables. In this stance, Blundell and Bond (1998) proposed an alternative estimator – system GMM since they discovered that instruments become weak after the first estimation and this is expressed as follows.

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$$W_{i,t} - W_{i,t-1} = \pi(W_{i,t-1} - W_{i,t-2}) + \vartheta(Y_{i,t} - Y_{i,t-1}) + (\varepsilon_{i,t} - \varepsilon_{i,t-1}) - -(2)$$

In equation (2), first-differencing eliminates the intercept and the country-specific effects (η). However, estimation of equation (2) will be biased and inconsistent, as the lagged dependent variable $(W_{i,t-1} - W_{i,t-2})$ and the error term $(\varepsilon_{i,t} - \varepsilon_{i,t-1})$ will be correlated and would render the explanatory variables to be endogenous (Hao, 2006). Therefore, Arellano and Bond (1991) posit that the model must pass the following moment conditions.

$$E[W_{i,t-n}(\varepsilon_{i,t} - \varepsilon_{i,t-1})] = 0 \text{ for } n \geq 2, t = 3, \ldots\ldots\ldots T$$

$$E[Y_{i,t-n}(\varepsilon_{i,t} - \varepsilon_{i,t-1})] = 0 \text{ for } n \geq 2, t = 3, \ldots\ldots\ldots T$$

Thus, to ensure that some estimation issues like identification, simultaneity and restrictions are treated, it is pertinent to shed light on how they are going to be resolved by the model. The statistical test to validate the selected variables is assessed using the Hansen J test of identifications and the null hypothesis of the underlying Sargan Over identifying Restrictions Test should not be rejected for the strictly exogenous variables to explain the dependent variable exclusively via the channel of predetermined or suspected endogenous variables (Beck et al. 2003). Also, we estimated the Arellona-Bond serial correlations which have both AR1 and AR2 to ensure that there is no presence of AR2 in the estimated resul.ts (Arellano & Bond 1991).

3.2.2 Robustness Check Model – FMOLS and DOLS

We further robustly checked the results from the GMM model by using the panel fully modified ordinary least squares (FM-OLS) and panel dynamic ordinary least square (DOLS) (McCoskey and Kao, 1998, Chiang 2000, Phillips & Moon 1999, and Pedroni 2000). The FMOLS and DOLS models can take care of cross-sectional dependency as well as country-specific and heterogeneity issues. The FMOLS technique provides optimal estimates of co-integration consistent with the parameters, even when the sample size is small, and overcomes the problems of endogeneity, serial correlation, and omitted variable bias and measurement errors. It also allows for heterogeneity in the long-run parameters. The long-run correlation between the cointegrating equation and stochastic regressors innovations. The resulting Fully Modified OLS (FMOLS) estimator is asymptotically unbiased and has a fully efficient mixture of normal asymptotics allowing for standard Wald tests using asymptotic Chi-square statistical inference. The FMOLS estimator employs long-run covariance matrices of the residuals. It may be estimated directly from the difference regressions. On the other hand, the dynamic OLS method augments the co-integrating regression with lags and leads, such that the resulting co-integrating equation error term is orthogonal to the entire history of the stochastic regressor innovations. The DOLS model assumes that the introduction of lags and leads of the differenced regressors takes care of all the long-run correlation between the error terms, which makes the model have the same asymptotic distribution (Kurozumi & Hayakawa, 2009) as those obtained from FMOLS. Masih & Masih (1996) also argue that DOLS does not impose additional requirements that all variables should be integrated of the same order [I(1)] and that the regressors themselves should be co-integrated. The advantage of this technique is that, in

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the event of an error in stationarity determination, the DOLS model makes up for the shortcomings. The FMOLS and DOLS are specified as follows:

$$\beta^{*}NT - \beta FMOLS = [\sum_{i=1}^{N} L_{22t}^{-1} \sum_{t=1}^{T} (x_{it} - x_{it})^{2}] \sum_{t=1}^{N} L_{11t}^{-1} L_{22t}^{-1} \left[\left(\sum_{t=1}^{T} (x_{it} - x_{t}) \mu_{it}^{*} - T_{\gamma 1}^{\wedge} \right) \right] - - - (3)$$

Note, that the Dynamic OLS estimator had the same asymptotic distribution as that of the panel FMOLS estimation derived by Pedroni (1996). Both the DOLS and FMOLS estimations were performed as shown to confirm the consistency of the outcome. However, following Stock & Watson (1993), we specified the DOLS model below.

$$Y_t = \alpha + bX_t + \sum_{i=-k}^{i=k} \varphi_i \Delta X_{t+i} + \varepsilon_t - - - - - - - - - - - - - - (4)$$

This model assumes that adding the lags and leads of the differenced regressors soaks up all of the long-run correlation covariance matrices of the residuals and that the least-squares estimates have the same asymptotic distribution as those obtained from FMOLS.

4. EMPIRICAL RESULTS AND DISCUSSION OF FINDINGS

The empirical results obtained in the course of examining the effects of financial development on trade openness in Sub-Saharan Africa were presented and analyzed in this section. We utilized annual time series data which covers 2000 and 2022 which was informed by data availability in the study. Before the analysis, we conducted various econometric tests like descriptive statistics, Spearman's correlation test, normality test, serial correlation test, and white heteroscedasticity tests to ascertain the behaviour of the variables of the model and the outcome of these tests would explain to a great extent the decisions the researcher would take on the variables and the models (Gujarati, 2003). It will also contribute to the general outcome of the study. Thus, below in the next section, we carried out the data description.

4.1 Data Description

To describe the nature of the data and basic characteristics of the data, the descriptive statistics were carried out on the variables. Noteworthy, the descriptive statistics measure the basic summary of the model variables using the measures of central tendency such as mean, median, standard deviation, skewness and Kurtosis. However, the results of the descriptive statistics are presented in Table 2. The results findings show that the total variations in the variables move from -62.35 to 14.03 which represents the least and highest values in the series. In addition, the results show that the values of mean, median, standard deviation, skewness and Kurtosis did not drift so much from each other, while the probability values of the Jarque-Bera statistic for all the variables are less than 0.05 implying that the variables are normally distributed and as such very suitable for the analysis of the relationship that exists between financial development and trade openness in Sub-Saharan Africa.

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Table 2: Results of the Descriptive Statistics

	TOPEN	PSC	FIA	DEP	NOA	CBB	FCL	NIM	LDS	NII	CAR	AQR	LR	MCAP	PRDS	PUDS	MACOC	DTDS	PTDS	TOR	LC	QBS	VOSP	SBI	VEM	M2/GDP	EXR
Mean	2.198	46.22	105.8	7.252	42.261	46.46	37.68	28.31	1.902	2.150	-0.144	-0.569	-0.538	0.587	1.230	0.900	2.719	101.7	-0.673	-0.618	-0.748	2.365	3.166	-2.373	0.774	414.9	296.2
Median	1.924	16.60	0.737	6.466	45.35	30.35	16.16	15.55	3.242	1.198	-0.440	-0.727	-0.750	0.105	0.448	0.896	0.597	83.18	-0.680	-0.694	-0.783	0.914	0.803	-2.301	0.000	4.866	1.729
Maximum	14.03	9.526	1.145	4.255	7.974	2.521	9.722	1.934	7.547	10.72	7.000	1.890	1.990	11.36	6.335	5.066	7.432	4.841	1.196	1.420	1.160	1.210	7.432	4.545	7.075	4.086	4.086
Minimum	-36.20	0.000	-2.226	0.000	1.362	4.366	0.000	0.402	-5.033	-0.267	-2.645	-2.606	-2.445	-0.698	-11.65	-1.588	-6.226	0.102	-2.547	-1.916	-2.450	-6.526	-62.35	-43.77	-1.816	-2.449	-0.845
Std. Dev.	6.344	80.73	3450.	4.462	11.71	42.18	65.44	32.27	2.912	2.713	1.432	0.973	0.900	5.668	4.993	0.720	22.92	81.37	0.678	0.630	0.644	8.729	23.30	9.641	5.330	3155	2429
Skewnes	10.44	4.805	33.13	2.038	-0.378	2.197	7.136	2.304	-0.782	1.617	2.340	0.803	1.096	1.254	5.948	0.245	30.76	1.960	0.074	0.617	0.330	9.404	29.26	0.528	10.01	9.738	11.79
Kurtosis	219.0	37.244	1098.	11.38	3.559	8.548	79.31	8.811	2.273	4.571	10.36	3.029	3.761	4.458	57.82	7.162	989.4	6.885	3.287	2.957	3.028	107.9	923.4	7.229	116.5	103.8	158.0
JB	2167	58194	5530	3996.	40.75	2304.	27726	2531.	136.8	595.1	3501.	118.9	247.8	69.36	1447	808.0	4493	1401.	4.823	70.34	20.15	5232	3912	874.1	6118	4853	1131
Prob	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.089	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Observ	1104	1104	1101	1104	1104	1104	1104	1104	1104	1104	1104	1104	1104	1104	1104	1104	1104	1104	1104	1104	1104	1104	1104	1104	1104	1104	1104

Source: Conceived by the Researcher.

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4.2 Testing for Correlations

Furthermore, we conducted a correlation test on the variables with the major aim of ascertaining if there is existence of correlation between financial development and trade openness in Sub-Saharan Africa or not.

However, Spearman's rank correlation measures the strength and direction of association between two ranked variables. It gives the measure of monotonicity of the relation between two variables i.e. how well the relationship between two variables could be represented using a monotonic function.

The guiding principle for this test is that if the rank is between 0 to ±0.20 there is no correlation, if the rank is between ±0.21 to ±0.40 there is weak, if the ranking is between ±0.41 to ±0.60 we say the correlation is moderate, if the rank is between ±0.61 to 0.80 there is strong correlation, and if the rank is between ±0.81 to ±1.00 is considered very strong correlation.

Findings from the results of the correlation test shows that PSC and FIA have negative and moderate correlations with trade openness, while DEP and NOA showed weak correlation with the trade openness in Africa.

Findings also revealed that variables such as CBB, FCL, NIM, LDS, NII, CAR, AQR, LR, MCAP, and PRDS showed strong negative correlations with the trade openness in Sub-Saharan Africa.

On the contrary, we found that PUDS, MACOC, VOSP and financial deepening (M2/GDP) have strong positive correlations with the trade openness respectively, while PTDS, TOR, LC, QBS, SBI, VEM, and EXR portrayed strong negative correlations on trade openness.

However, haven found that financial institutions indicators as well as financial markets indicators mostly have strong negative correlations with the trade openness, we conclude that negative correlations exists between financial development and trade openness in Sub-Saharan Africa.

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Table 3: Results of the Correlation Test

	TOPEN	PSC	FIA	DEP	NOA	CBB	FCL	NIM	LDS	NII	CAR	AQR	LR	MCAP	PRDS	PUDS	MACOC	DTDS	PTDS	TOR	LC	QBS	VOSP	SBI	VEM	M2/GDP	EXR
TOPEN																											
PSC	-0.545	1																									
FIA	-0.012	-0.017	1																								
DEP	0.065	0.152	-0.013	1																							
NOA	-0.057	0.043	0.763	-0.039	1																						
CBB	-0.780	-0.037	-0.006	-0.239	0.182	1																					
FCL	-0.674	-0.040	-0.011	-0.085	0.104	0.516	1																				
NIM	-0.609	-0.043	0.056	-0.193	0.129	0.739	0.469	1																			
LDS	-0.547	0.125	-0.049	-0.211	-0.189	-0.112	-0.196	-0.018	1																		
NII	-0.744	-0.077	0.702	0.105	0.076	-0.107	-0.2021	-0.073	-0.398	1																	
CAR	-0.838	0.013	-0.012	-0.108	-0.303	0.214	0.116	0.372	0.068	-0.102	1																
AQR	-0.411	0.828	-0.356	-0.216	0.182	0.503	0.285	0.639	0.511	-0.074	0.475	1															
LR	-0.754	0.013	-0.401	-0.248	0.096	0.527	0.293	0.679	0.054	-0.114	0.517	0.947	1														
MCAP	-0.630	0.850	-0.699	0.619	0.592	-0.427	-0.232	0.469	-0.076	-0.144	0.152	0.500	-0.176	1													
PRDS	-0.566	-0.022	-0.475	0.028	-0.057	-0.038	-0.042	-0.043	0.143	-0.042	-0.062	-0.178	-0.113	-0.619	1												
PUDS	0.843	-0.317	0.045	-0.012	0.052	0.019	0.203	0.263	-0.076	0.156	0.068	0.051	0.028	0.850	0.045	1											
MACOC	0.743	-0.018	0.415	-0.043	0.012	0.023	0.014	0.025	0.326	0.033	-0.746	-0.850	-0.012	0.528	0.024	0.270	1										
DTDS	0.407	-0.047	0.018	-0.029	0.191	0.176	0.171	0.154	-0.245	0.010	0.019	0.034	0.044	-0.422	-0.096	0.495	0.044	1									
PTDS	-0.898	-0.465	-0.068	0.054	-0.002	-0.072	0.126	-0.060	-0.264	0.075	0.092	-0.431	-0.008	-0.291	-0.004	0.051	-0.078	-0.159	1								
TOR	-0.516	-0.079	-0.034	-0.074	0.024	-0.019	0.122	0.011	-0.174	0.029	0.035	-0.049	-0.022	0.539	-0.037	0.041	-0.057	-0.121	0.759	1							
LC	-0.606	-0.020	-0.016	-0.037	0.362	-0.842	0.161	-0.032	-0.258	0.094	0.213	-0.353	-0.014	-0.028	-0.021	0.079	-0.040	-0.177	0.867	0.838	1						
QBS	-0.596	-0.023	-0.419	-0.040	-0.016	-0.077	-0.056	-0.056	0.098	-0.099	-0.043	-0.035	-0.217	-0.123	-0.017	0.011	-0.015	-0.105	-0.525	-0.069	-0.012	1					
VOSP	0.923	-0.026	0.013	-0.010	0.009	0.041	0.060	0.015	-0.098	0.076	0.860	0.026	0.048	0.279	0.079	0.031	0.019	0.027	0.023	-0.017	0.036	-0.002	1				
SBI	-0.771	0.944	-0.034	0.049	-0.023	0.011	-0.054	0.035	0.242	-0.151	0.066	0.054	0.045	0.597	0.129	-0.068	0.019	0.074	-0.236	-0.218	-0.308	-0.062	0.020	1			
VEM	-0.537	-0.985	-0.425	-0.075	-0.084	-0.058	-0.053	-0.043	0.116	0.105	0.063	-0.056	-0.084	-0.251	0.176	0.300	0.107	-0.015	0.236	-0.004	-0.096	0.045	0.027	0.619	1		
M2/GDP	0.899	-0.019	0.012	0.007	-0.089	-0.255	-0.029	-0.015	-0.108	0.078	-0.032	-0.019	-0.013	-0.087	0.031	-0.054	-0.003	-0.240	-0.026	0.020	0.006	-0.027	-0.814	0.045	-0.016	1	
EXR	-0.803	0.212	-0.037	-0.050	0.021	0.070	0.009	0.058	-0.041	0.193	0.033	0.065	0.063	0.850	-0.039	-0.010	-0.151	-0.040	0.122	0.146	0.145	-0.021	-0.444	-0.044	-0.032	-0.013	1

Source: Conceived by the Researcher.

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4.3 Testing for Stationarity

This study also carried out unit root tests on the model variables to check if the variables have unit root problems or not and to know if they are integrated of I(0) or I(1) as provided in the assumptions of the econometrics rules of thumb (Gujarati, 2003). As such, we utilized various panel unit root tests such as (LLC) – Levine Lin and Chu (2002), (IPS) – Im, Pesaran and Shin (2004), Fisher-ADF and Fisher-PP (Madala and Wu, 1999). This test has the null hypothesis of "unit root" and alternative hypothesis of "no unit root" and the decision rule is to reject the null hypothesis if the probability value is less than 0.05, otherwise, accept the alternative. Thus, the results of the unit root tests are presented in Table 3 below. From the result findings, we detect that there is no form of a unit root in the series and the variables are purely integrated of Level I(0) and first difference I(1).

Table 4: Summary of Unit Root Results

Variable	LLC	IPS	Fisher-ADF	Fisher-PP	Level	First Diff.
TOPEN	-16.58*** (0.000)	-17.36*** (0.000)	464.4*** (0.000)	458.4*** (0.000)	I(0)	–
PSC	-14.95*** (0.000)	-16.69*** (0.000)	484.6*** (0.000)	511.8*** (0.000)	–	I(1)
FIA	-6.838*** (0.000)	-10.32*** (0.000)	307.2*** (0.000)	312.1*** (0.000)	I(0)	–
DEP	-12.90*** (0.000)	-16.66*** (0.000)	499.4*** (0.000)	671.6*** (0.000)	–	I(1)
NOA	13.69*** (0.000)	-4.566*** (0.000)	161.2*** (0.000)	161.1*** (0.000)	–	I(1)
CBB	8.296*** (0.000)	-6.995*** (0.000)	240.9*** (0.000)	237.8*** (0.000)	–	I(1)
FCL	-4.748*** (0.000)	-15.75*** (0.000)	489.2*** (0.000)	481.2*** (0.000)	–	I(1)
NIM	5.747*** (0.000)	-4.943*** (0.000)	226.1*** (0.000)	216.5*** (0.000)	–	I(1)
LDS	-7.463*** (0.000)	-5.402*** (0.000)	197.2*** (0.000)	189.9*** (0.000)	I(0)	–
NII	-8.893*** (0.000)	-8.636*** (0.000)	262.8*** (0.000)	253.4*** (0.000)	I(0)	–
CAR	-21.58*** (0.000)	-19.85*** (0.000)	521.9*** (0.000)	546.2*** (0.000)	I(0)	–
AQR	-18.73*** (0.000)	-22.47*** (0.000)	643.3*** (0.000)	600.1*** (0.000)	I(0)	–
LR	-10.90*** (0.000)	-18.60*** (0.000)	530.9*** (0.000)	517.9*** (0.000)	I(0)	–
MCAP	-36.03*** (0.000)	-26.72*** (0.000)	859.5*** (0.000)	884.3*** (0.000)	–	I(1)
PRDS	-6.555*** (0.000)	-9.349*** (0.000)	285.6*** (0.000)	285.3*** (0.000)	I(0)	–
PUDS	-10.48*** (0.000)	-11.93*** (0.000)	315.7*** (0.000)	314.6*** (0.000)	–	I(1)
MACOC	-26.88*** (0.000)	-15.96*** (0.000)	696.3*** (0.000)	555.0*** (0.000)	I(0)	–
DTDS	-7.009***	-7.812***	230.9***	238.6***		–

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	(0.000)	(0.000)	(0.000)	(0.000)	I(0)	
PTDS	-28.80*** (0.000)	-26.54*** (0.000)	706.8*** (0.000)	797.7*** (0.000)	–	I(1)
TOR	-26.57*** (0.000)	-23.52*** (0.000)	622.6*** (0.000)	659.3*** (0.000)	–	I(1)
LC	-27.79*** (0.000)	-25.09*** (0.000)	666.1*** (0.000)	743.9*** (0.000)	–	I(1)
QBS	-10.67*** (0.000)	-11.39*** (0.000)	328.7*** (0.000)	300.0*** (0.000)	I(0)	–
VOSP	-30.44*** (0.000)	-16.59*** (0.000)	705.7*** (0.000)	652.1*** (0.000)	I(0)	–
SBI	-5.276*** (0.000)	-4.854*** (0.000)	176.1*** (0.000)	174.9*** (0.000)	I(0)	–
VEM	-6.020*** (0.000)	-8.389*** (0.000)	247.4*** (0.000)	245.0*** (0.000)	I(0)	–
M2/GDP	-5.946*** (0.000)	-3.447*** (0.000)	384.8*** (0.000)	239.3*** (0.000)	I(0)	–
EXR	-5.474*** (0.000)	-5.031*** (0.000)	234.7*** (0.000)	222.9*** (0.000)	I(0)	–

Source: Conceived by the Researcher. Note all variables are expressed in natural logarithm, while ***, ** and * represent 1%, 5% and 10% levels of significance and (.) is the probability value

4.4 Testing for Cointegration

After describing the data and ascertaining the basic behaviour of the model variables, as well as discovering that there is no trace of unit root and observing that the variables are integrated at level I(0) or first difference I(1), we furthered our investigation by conducting the cointegration tests on the models to ascertain if there is existence of cointegration between financial development and trade openness in Sub-Saharan Africa or not. Therefore, we utilized the Pedroni (2004) cointegration test as main cointegration test and Kao (1999) cointegration test for robustness checks respectively. As proposed by Pedroni (2004), seven (7) cointegration tests which include panel v-statistic, panel rho-statistic, panel pp-statistic, and panel ADF-statistic under "within dimension" as well as group rho-statistic, group pp-statistic and group ADF-statistic under "between dimension" were used to test for cointegration.

The test has a null hypothesis – no cointegration and an alternative hypothesis – cointegration as well as a decision rule to reject the null hypothesis if the probability value is less than 0.05. However, we present the results of the cointegration tests in Table 4 below. Worthy to note that our cointegration test in this study was done based on the synergy between financial institutions and trade openness and financial markets and trade openness to enable us make effective policies. Findings from the results of both financial institutions and financial markets revealed that that the null hypothesis "no cointegration" be rejected since at least 5 out of 7 Pedroni cointegration tests are statistically significant. This led us to conclude that there is an existence of cointegration between financial development (financial institutions and financial markets) and trade openness in Sub-Saharan Africa. However, from the results of the robustness check – the Kao (1999) it was also confirmed that there is the existence of cointegration between

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financial development (financial institutions and financial markets) and trade openness in Sub-Saharan Africa since the probability values of the ADF statistics are less than 0.05.

Table 5: Summary of Cointegration Results

PEDRONI COINTEGRATION TEST		
Tests	**Financial Institutions**	**Financial Markets**
Within Dimension		
Panel v-Statistic	0.745 (0.227)	-1.759 (0.960)
Panel rho-Statistic	7.119*** (0.000)	2.348*** (0.006)
Panel PP-Statistic	-13.11*** (0.000)	-2.827*** (0.002)
Panel ADF-Statistic	-2.088** (0.018)	4.949*** (0.000)
Between Dimension		
Group rho-Statistic	9.719*** (0.000)	6.697*** (0.000)
Group PP-Statistic	-9.533*** (0.000)	-1.782** (0.037)
Group ADF- Statistic	5.261*** (0.000)	1.907 (0.971)
KAO (1999) COINTEGRATION TEST (ROBUSTNESS CHECK)		
ADF- Statistic	-4.236*** (0.000)	-4.889*** (0.000)

4.5 Baseline System GMM Analysis

Solely, the aim of this study centered on investigating the effects of financial development on trade openness in Sub-Saharan Africa and this was estimated using the system GMM as the baseline model. The rationale for using the system GMM is based on its ability to take care of endogeneity, heterogeneity, serial correlations, specification bias, and over identification problems which some estimation techniques like the ARDL cannot account for. However, in this analysis, financial development was viewed from financial institutions and financial markets point of views. Specifically, in financial institutions, we further considered financial institutions depths, financial institutions access, financial institution efficiency, and financial institution stability; whereas for financial markets we considered financial markets depths, financial markets access, financial market efficiency and financial markets stability to give us a holistic overview of the effects of financial development on trade openness in Sub-Saharan Africa.

4.5.1 Analysis of Measures of Financial Institutions

This section contains the analysis of the relationships that exists between financial institutions depths, financial institutions access, financial institutions efficiency and financial institutions stability on trade openness in Sub-Saharan Africa. The rational for measuring financial development in this regard is to avail the researcher the opportunity to make insightful policy concerning the effect of financial institutions on trade openness in Sub-Saharan Africa. In this

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light, our analysis were categorized based on financial institutions depths, access, efficiency and stability in the preceding sections.

Financial Institution Depths

From the results of financial institutions depths variables and trade openness presented in Table 5, it could be deduced that across the models, the past values of trade openness have significant contributions in the current values of trade openness in Sub-Saharan Africa. We also found that financial institutions depth indicators – private sector credit to GDP (PSC), and deposit to GDP (DEP) have significant positive effects on trade openness, while financial institution access to GDP (FIA) portrayed significant negative effect on trade openness in Sub-Saharan Africa. The results further shows that the control variables – financial deepening showed a negative and significant effects on trade openness in model 1, but positive and significant effects on TOPEN in models 2 and 3 respectively. More so, the exchange rate had insignificant effect on TOPEN in model 1, but showed significant positive effects on trade openness in Sub-Saharan Africa in model 2 & 3 respectively. We also found that the instruments of the models were not over identified, and there is not traces of second order serial correlations (AR2) in the models. These findings are therefore in line with earlier findings made by (Akinsola & Odhiambo 2017, Bojanic 2012, Uddin et al. 2013, Appiah et al. 2023, Mustafa 2023, Paul 2017, Adam 2022, Bankola 2022). However, previous studies like (Maduka & Onwuka, 2013, Iheanacho 2016, Taofeek & Olumuyiwa, 2016) among others.

Table 5: Results for Financial Institution Depth

Variable	1	2	3
TOPEN (-1)	0.024*** (0.000)	2.165* (0.041)	0.016*** (0.009)
PSC	0.018*** (0.000)		
FAI		-0.042*** (0.000)	
DEP			0.015*** (0.000)
M2/GDP	-0.014*** (0.007)	0.013** (0.031)	0.0567*** (0.000)
EXR	-1.137 (0.904)	0.019*** (0.000)	0.029*** (0.000)
No of Obs.	766	760	766
AR1	-4.204 (0.000)	-3.016 (0.092)	-3.033 (0.366)
AR2	-1.475 (0.160)	-1.675 (0.593)	-1.688 (0.691)
Hansen	1985 (0.045)	6.355 (0.055)	86.26 (0.051)
R-squared	0.530	0.883	0.758

Source: As Concieved by the Researcher. NB: ***, ** and * represents the 1%, 5% and 10% significance levels, while () is the probability value and the variables are expressed in natural logarithms

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Financial Institutions Access

In the context of financial institution access results presented in Table 6 below, we discovered that the past values of trade openness (TOPEN) has positive and significant contributions to the current values of trade openness in Sub-Saharan Africa as shown in models 2 & 3, but negative and insignificant effects in model 1. Findings from financial institutions access indicators shows that accounts per thousand adults (NOA) showed a negative and significant effect on trade openness in Sub-Saharan Africa, while branches per 100,000 adults (CBB) and % of firms with line of credit (FCL) have significant positive effects on trade openness in Sub-Saharan Africa.

Furthermore, financial deepening (control variable) had significant positive effects on trade openness in model 1&3, but showed insignificant positive effect on trade openness in model 2. Further explorations shows that the exchange rate (EXR) significantly affects trade openness in Sub-Saharan Africa across models 1 – 3. We also found that the models does not have over identification problem as well as trace of second-order serial autocorrelations (AR2). Thus, these findings are in line with previous findings by (Akinsola & Odhiambo 2017, Bojanic 2012, Uddin et al. 2013, Appiah et al. 2023, Mustafa 2023, Paul 2017, Adam 2022, Bankola 2022). However, previous studies like (Maduka & Onwuka, 2013, Iheanacho 2016, Taofeek & Olumuyiwa, 2016) among others.

Table 6: Summary of Results for Financial Institution Access

Variable	1	2	3
TOPEN (-1)	-5.316 (0.313)	0.763*** (0.000)	0.818*** (0.000)
NOA	-0.302*** (0.000)		
CBB		0.228*** (0.000)	
FCL			0.103*** (0.000)
M2/GDP	0.064*** (0.000)	0.060 (0.192)	0.066*** (0.002)
EXR	-0.103*** (0.000)	0.016*** (0.000)	0.036*** (0.000)
No of Obs.	766	766	766
AR1	-4.484 (0.000)	4.115 (0.000)	-4.116 (0.000)
AR2	-1.451 (0.146)	-1.333 (0.182)	-1.217 (0.223)
Hansen	38.57 (0.041)	598.2 (0.005)	496.7 (0.015)
R-squared	0.677	0.713	0.851

Source: As Concieved by the Researcher. NB: ***, ** and * represents the 1%, 5% and 10% significance levels, while () is the probability value and the variables are expressed in natural logarithms

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Financial Institutions Efficiency

The efficiency of financial institutions were analyzed in this section. Findings from the results shows that the past values of trade openness (TOPEN (-1)) significantly contributed to the current values of trade openness (TOPEN) in models 1 & 2, but had insignificant effects on the current values of TOPEN in model 3. We also found that financial institution efficiency indicators – net interest margin (NIM), lending-deposits spread (LDS) and non-interest income to total income (NII) have significant positive effects on trade openness in Sub-Saharan Africa. More so, we found that financial deepening (M2/GDP) has significant positive effects on trade openness in models 1 & 3, but showed insignificant effects on trade openness in model 2. Similarly, we found that the exchange rate had insignificant positive relationship with the trade openness in models 1&3, but showed a positive and significant effect on trade openness in model 2 in Sub-Saharan Africa. We also discovered that there is no traces of second order serial correlations (AR2) which are cable of invalidating the findings of the results, and we further discovered from the Hansen results that the instruments of the models are not overidentified. Thus, these findings are in line with earlier findings made by scholars such as (Akinsola & Odhiambo 2017, Bojanic 2012, Uddin et al. 2013, Appiah et al. 2023, Mustafa 2023, Paul 2017, Adam 2022, Bankola 2022). However, previous studies like (Maduka & Onwuka, 2013, Iheanacho 2016, Taofeek & Olumuyiwa, 2016) among others.

Table 7: Results for Financial Institution Efficiency

Variable	1	2	3
TOPEN (-1)	0.021*** (0.000)	0.997*** (0.000)	0.109 (0.188)
NIM	0.011*** (0.000)		
LDS		0.042*** (0.000)	
NII			0.025*** (0.000)
M2/GDP	0.013*** (0.008)	0.015 (0.154)	0.028** (0.028)
EXR	2.899 (0.955)	0.027*** (0.000)	0.012 (0.971)
No of Obs.	766	766	766
AR1	-4.155 (0.004)	-4.279 (0.037)	-3.992 (0.000)
AR2	-1.289 (0.197)	-1.243 (0.213)	-1.324 (0.185)
Hansen	69.37 (0.021)	114.8 (0.016)	6205 (0.078)
R-squared	0.833	0.646	0.823

Source: As Concieved by the Researcher. NB: ***, ** and * represents the 1%, 5% and 10% significance levels, while () is the probability value and the variables are expressed in natural logarithms

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Financial Institution Stability

To deepen our analysis, we estimated the results of financial institutions stability in this section given that stability of financial institutions can foster financial development and trade openness in Sub-Saharan Africa. From the estimated results of system GMM, we discovered that the past values of the trade openness (TOPEN(-1)) have significant positive contributions to the current values of trade openness (TOPEN) in Sub-Saharan Africa. Furthermore, it was discovered that the financial institutions stability indicators – capital adequacy ratio (CAR) has significant negative effects on trade openness in Sub-Saharan Africa, liquidity ratio (LR) has negative and insignificant effects on trade openness in Sub-Saharan Africa, while asset quality ratio (AQR) showed significant positive effects on trade openness in Sub-Saharan Africa. The results also evidenced that financial deepening and exchange rates have significant effects across the models on trade openness in Sub-Saharan Africa. In addition, we discovered that the models have not trace of second order serial correlations (AR2), no trace of instrument overidentification and the results of R-squared entails that explanatory variables greatly cause variations in the trade openness in Sub-Saharan Africa. These findings corresponds with the previous findings by (Akinsola & Odhiambo 2017, Bojanic 2012, Uddin et al. 2013, Appiah et al. 2023, Mustafa 2023, Paul 2017, Adam 2022, Bankola 2022). However, previous studies like (Maduka & Onwuka, 2013, Iheanacho 2016, Taofeek & Olumuyiwa, 2016) among others.

Table 8: Results of Financial Institution Stability

Variable	1	2	3
TOPEN (-1)	0.864*** (0.000)	0.796*** (0.000)	0.846*** (0.000)
CAR	-0.046*** (0.000)		
AQR		0.347*** (0.000)	
LR			-0.028 (0.052)
M2/GDP	-0.045*** (0.000)	0.056** (0.040)	-0.402*** (0.006)
EXR	0.027*** (0.000)	0.018*** (0.000)	0.387*** (0.006)
No of Obs.	766	766	766
AR1	-2.962 (0.873)	-2.795 (0.875)	-4.169 (0.000)
AR2	-1.623 (0.884)	-1.560 (0.988)	-0.969 (0.332)
Hansen	140.8 (0.055)	6672 (0.292)	463.5 (0.012)
R-squared	0.651	0.713	0.826

Source: As Concieved by the Researcher. NB: ***, ** and * represents the 1%, 5% and 10% significance levels, while () is the probability value and the variables are expressed in natural logarithms

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4.5.2 Analysis of Measures of Financial Markets

This section contains the results and analysis of financial markets – a measure of financial development and their relationships with trade openness in Sub-Saharan Africa. In this regard, the researcher stratified financial markets into 4 in this manner – financial market depths, financial market access, financial market efficiency and financial market stability and the analysis was carried out in that manner in the preceding sections to avoid ambiguity.

Financial Market Depths

Financial markets depths results were presented and analyzed in this section. Findings shows that the past values of trade openness positively and significantly contributed to the current values of trade openness in Sub-Saharan Africa. Similarly, financial market depths indicators – stock market capitalization (MCAP), private debt securities (PRDS), and public debt securities (PUDS) showed significant positive effects on the trade openness in Sub-Saharan Africa respectively. In relation to this, we found that financial deepening has significant positive effects on trade openness, while exchange rate (EXR) showed insignificant effects on trade openness in Sub-Saharan Africa. Findings also shows that there is no trace of second order serial correlations (AR2) in the models and the instruments were not overidentified in the models. The results of the R-squared also shows that the explanatory variables greatly explained trade openness in Sub-Saharan Africa. These findings rhymed with the previous findings made by scholars like (Akinsola & Odhiambo 2017, Bojanic 2012, Uddin et al. 2013, Appiah et al. 2023, Mustafa 2023, Paul 2017, Adam 2022, Bankola 2022). However, previous studies like (Maduka & Onwuka, 2013, Iheanacho 2016, Taofeek & Olumuyiwa, 2016) among others.

Table 9: Estimated Results of Financial Markets Depth

Variable	1	2	3
TOPEN (-1)	0.803*** (0.000)	0.056*** (0.000)	0.804*** (0.000)
MCAP	0.016*** (0.000)		
PRDS		0.030*** (0.000)	
PUDS			0.282*** (0.001)
M2/GDP	0.013*** (0.000)	0.051*** (0.000)	0.017*** (0.006)
EXR	0.368 (0.979)	0.022 (0.394)	-0.023 (0.429)
No of Obs.	766	766	766
AR1	-0.663 (0.665)	-3.755 (0.775)	0.032 (0.367)
AR2	-1.933 (0.853)	-1.815 (0.869)	0.728 (0.466)
Hansen	596.7 (0.058)	22.52 (0.071)	183.1 (0.110)
R-squared	0.782	0.602	0.901

Source: As Concieved by the Researcher. NB: ***, ** and * represents the 1%, 5% and 10% significance levels, while () is the probability value and the variables are expressed in natural logarithms

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Financial Market Access

The relationship that exists between financial market access and trade openness were estimated and analyzed in this section. From the results presented in Table 10 below, we found that trade openness's past values have significant effects on the current values. We also discovered that measures of financial market access – percentage of market capitalization outside 10 largest companies (MACOC), ratio of domestic to total debt securities (DTDS) and ratio of private to total debt securities (PTDS) respectively portrayed significant positive effects on trade openness in Sub-Saharan Africa.

Furthermore, we found that while financial deepening showed positive and significant relationship with trade openness, the exchange rate results of models 1&2 shows insignificant effects on trade openness, while it showed a significant effect on trade openness in model 3 in Sub-Saharan Africa. Moreover, findings further revealed that the specified models' instrument have no overidentification problem, and second order serial correlation issues. These findings are in corroboration with the previous findings made by scholars such as (Akinsola & Odhiambo 2017, Bojanic 2012, Uddin et al. 2013, Appiah et al. 2023, Mustafa 2023, Paul 2017, Adam 2022, Bankola 2022). However, previous studies like (Maduka & Onwuka, 2013, Iheanacho 2016, Taofeek & Olumuyiwa, 2016) among others.

Table 10: Estimated Results of Financial Markets Access

Variable	1	2	3
TOPEN (-1)	0.028*** (0.000)	0.272*** (0.000)	0.039*** (0.000)
MACOC	0.084*** (0.000)		
DTDS		0.024*** (0.000)	
PTDS			0.701*** (0.001)
M2/GDP	0.016*** (0.000)	0.019*** (0.001)	0.026*** (0.000)
EXR	0.085 (0.460)	0.012 (0.247)	0.016*** (0.000)
No of Obs.	755	766	766
AR1	-3.775 (0.681)	0.045 (0.294)	-0.016 (0.812)
AR2	-1.904 (0.856)	-0.988 (0.929)	0.028 (0.966)
Hansen	203.0 (0.125)	2297. (0.270)	8.083 (0.031)
R-squared	0.744	0.833	0.735

Source: As Concieved by the Researcher. NB: ***, ** and * represents the 1%, 5% and 10% significance levels, while () is the probability value and the variables are expressed in natural logarithms

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Financial Markets Efficiency

Furthermore, to study the synergy between financial market efficiency and trade openness, we employed indicators such as turnover ratio for stock market (TOR), liquidity cost (LC) and quoted id-risk spread for government bonds (QBS) to measure the financial market access as well as system GMM estimation technique. Findings shows that the past values of trade openness have significant positive effect on the current trade openness values in Sub-Saharan Africa. We also discovered that while turnover ratio for stock market (TOR) and quoted id-risk spread for government bonds (QBS) have significant negative effects on trade openness, the liquidity cost (LC) has significant positive effect on trade openness in Sub0Saharan Africa. Findings further entailed that financial development across the models portrayed significant positive effects on trade openness in Sub-Saharan Africa, which is similar to the results findings from exchange rate which has significant positive effects on trade openness except in model 1 with negative and significant effects on trade openness. In addition, the results of the Hansen test revealed that the instruments in the models were not overidentified and there is no trace of second-order serial correlations. These findings are in line with the previous empirical findings by (Akinsola & Odhiambo 2017, Bojanic 2012, Uddin et al. 2013, Appiah et al. 2023, Mustafa 2023, Paul 2017, Adam 2022, Bankola 2022). However, previous studies like (Maduka & Onwuka, 2013, Iheanacho 2016, Taofeek & Olumuyiwa, 2016) among others.

Table 11: Estimated Results of Financial Markets Efficiency

Variable	1	2	3
TOPEN (-1)	0.726*** (0.000)	0.903*** (0.000)	1.202*** (0.000)
TOR	-0.846** (0.019)		
LC		0.827*** (0.000)	
QBS			-0.596*** (0.000)
M2/GDP	7.938*** (0.000)	5.764*** (0.004)	3.239*** (0.000)
EXR	-7.737*** (0.000)	1.117** (0.023)	1.798*** (0.000)
No of Obs.	766	766	766
AR1	-1.479 (0.039)	-1.383 (0.016)	-1.573 (0.005)
AR2	-2.538 (0.851)	-2.709 (0.896)	-2.720 (0.876)
Hansen	7356 (0.003)	497.8 (0.052)	268.5 (0.0126)
R-squared	0.871	0.589	0.799

Source: As Concieved by the Researcher. NB: ***, ** and * represents the 1%, 5% and 10% significance levels, while () is the probability value and the variables are expressed in natural logarithms

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Financial Market Stability

The results obtained while exploring the relationship between financial market stability and trade openness in Sub-Saharan Africa were presented and analyzed in this section. We found that the previous values of trade openness (TOPEN(-1)) have significant positive effects on the current values across models 1-3 respectively. Relatedly, we found that financial market stability indicators – volatility of stock price index (VOSP) has significant positive effect on trade openness in Sub-Saharan Africa, sovereign bond index (SBI) has positive and significant effect on trade openness, while vulnerability to earnings manipulation (VEM) had negative and insignificant effect on trade openness in Sub-Saharan Africa. Further exploration also shows that financial deepening and exchange rates have significant effects on trade openness in Sub-Saharan Africa. Evidence from the results further revealed that there is no form of second-order serial correlations, and the instruments were not overidentified. These finding aligned with previous findings by (Akinsola & Odhiambo 2017, Bojanic 2012, Uddin et al. 2013, Appiah et al. 2023, Mustafa 2023, Paul 2017, Adam 2022, Bankola 2022). However, previous studies like (Maduka & Onwuka, 2013, Iheanacho 2016, Taofeek & Olumuyiwa, 2016) among others.

Table 12: Estimated Results of Financial Markets Stability

Variable	1	2	3
TOPEN (-1)	0.669*** (0.000)	0.838*** (0.000)	0.880*** (0.000)
VOSP	0.745*** (0.000)		
SBI		0.510*** (0.000)	
VEM			-0.123 (0.577)
M2/GDP	2.528*** (0.000)	0.258*** (0.000)	0.768*** (0.000)
EXR	-1.186*** (0.000)	1.847*** (0.002)	8.056*** (0.000)
No of Obs.	766	766	766
AR1	-1.480 (0.138)	-0.085 (0.045)	-1.397 (0.032)
AR2	-2.468 (0.563)	-0.027 (0.574)	-2.323 (0.560)
Hansen	20.48 (0.032)	124.5 (0.146)	127.6 (0.041)
R-squared	0.865	0.727	0.516

Source: As Concieved by the Researcher. NB: ***, ** and * represents the 1%, 5% and 10% significance levels, while () is the probability value and the variables are expressed in natural logarithms

4.6 Robustness Check – FMOLS and DOLS

We robustly checked the findings of the analysis of system GMM results on the effects of financial development on trade openness in Sub-Saharan Africa by re-estimating specified

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models using the panel fully modified ordinary least squares (FMOLS) and panel dynamic ordinary least squares (DOLS). The bases for conducting this robustness check stems from the fact that we discovered that system GMM estimator is not efficient in handling cross-sectional dependency issues in panel model, while FMOLS and DOLS can handle this problem using the leads and lags mechanisms. For clarity sake, we studied financial development by emphasizing on financial institutions which was measured with financial institution depths index (FINDI), financial institution access index (FINAI), financial institution efficiency index (FINEI) and financial institution stability index (FINSI) as well as financial markets indexes which include financial market depths index (FIMDI), financial market access index (FIMAI), financial market efficiency index (FIMEI) and financial market stability index (FIMSI) which encompasses the and the analysis were conducted in this manner in the preceding sections.

4.6.1 Analysis for Financial Institutions

We analyzed the relationship between financial institution and trade openness in this section and our very first step was to ensure that the model variables went through pre and post estimation tests like normality test, serial correlation test, Ramsey Reset model specification test, and White heteroscedasticity test and the results are presented in Table 13 below. However, we found that the errors of the models are normally distributed, serially uncorrelated and homoscedastic and the results also shows that the models are specified correctly. Evidence from the results of FMOLS shows that the past values of trade openness significantly affect the current values of trade openness in Sub-Saharan Africa. Findings shows that financial institution index had positive and significant effects on trade openness in Sub-Saharan Africa. Similarly, we found that financial institution access index (FINAI) has significant positive effects on trade openness. In the same manner, financial institution efficiency index (FINEI) and financial institution stability index (FINSI) were all discovered to portray significant positive effects on trade openness of Sub-Saharan Africa. The implication of these results is that increase in financial institution activities would lead to increase in trade openness in Sub-Saharan Africa. Furthermore, across the models, it was discovered that financial deepening had insignificant effect on trade openness in model 1, significant positive effects in models 2 & 3, but had significant negative effects on trade openness in Sub-Saharan Africa in model 4. Further, the result of exchange rate shows that exchange rate has significant positive effects on trade openness in models 1, 2 & 4, but insignificant effects on trade openness in Sub-Saharan Africa in model 3. In addition, the results of the R-squared for the models indicates that the explanatory variables greatly explain the total variations in the trade openness in Sub-Saharan Africa.

From the DOLS perspective, the results of the pre and post like normality test, serial correlation test, Ramsey Reset model specification test, and White heteroscedasticity test suggests that the errors of the models are normally distributed, serially uncorrelated and homoscedastic and the results also shows that the models are specified correctly. Furthermore, it was discovered that the past values of trade openness are contributive to the current values of trade openness in Sub-Saharan Africa. Findings from the results revealed that financial institution depths index (FINDI) had significant positive effect on trade openness and this is similar to the findings

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made from the financial institution access index (FINAI) which portrayed significant positive effect on trade openness in Sub-Saharan Africa. Related findings were made from financial institution efficiency index (FINEI) and financial institution stability index (FINSI) which have positive and significant effects on trade openness in Sub-Saharan Africa. The result findings revealed that the control variables – financial deepening (M2/GDP) exchange rate (EXR) have respectively significant effects on trade openness in Sub-Saharan Africa. Moreover, the results of the R-squared shows that the explanatory variables jointly explained trade openness to a great extent in Sub-Saharan Africa. These findings therefore corroborated with the previous findings made by scholars like (Akinsola & Odhiambo 2017, Bojanic 2012, Uddin et al. 2013, Appiah et al. 2023, Mustafa 2023, Paul 2017, Adam 2022, Bankola 2022). However, previous studies like (Maduka & Onwuka, 2013, Iheanacho 2016, Taofeek & Olumuyiwa, 2016) among others.

Table 13: Estimated FMOLS and DOLS Results of Financial Institutions

	FMOLS				DOLS			
Variable	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
TOPEN(-1)	0.651*** (0.000)	0.874*** (0.000)	0.840*** (0.000)	0.731*** (0.000)	0.386*** (0.000)	0.629*** (0.000)	0.543*** (0.000)	0.464*** (0.000)
FINDI	0.031*** (0.000)				0.049*** (0.000)			
FINAI		0.017*** (0.002)				0.029*** (0.000)		
FINEI			0.022*** (0.004)				0.046*** (0.000)	
FINSI				0.024*** (0.000)				0.404*** (0.000)
M2/GDP	0.039 (0.161)	0.188*** (0.007)	0.187*** (0.000)	-0.464*** (0.000)	-0.492*** (0.000)	0.023 (0.934)	-0.440*** (0.000)	0.599*** (0.000)
EXR	0.181*** (0.000)	3.157** (0.016)	0.065 (0.245)	0.087*** (0.000)	0.011*** (0.000)	-0.272** (0.039)	0.018*** (0.000)	-0.008*** (0.000)
No of Obs	581	581	581	573	708	708	708	703
Normality	110.4 (0.000)	943.8 (0.000)	978.1 (0.000)	101.2 (0.000)	110.4 (0.000)	943.8 (0.000)	978.1 (0.000)	101.2 (0.000)
Serial Corr.	8.139 (0.730)	1.362 (0.321)	1.419 (0.359)	1.283 (0.776)	8.139 (0.730)	1.362 (0.321)	1.419 (0.359)	1.283 (0.776)
Ramsey	-0.045 (0.000)	-0.068 (0.000)	-0.058 (0.000)	-0.526 (0.000)	-0.045 (0.000)	-0.068 (0.000)	-0.058 (0.000)	-0.052 (0.000)
Het.	1.405 (0.662)	11.77 (0.588)	0.130 (0.188)	1.087 (0.655)	1.405 (0.662)	11.77 (0.588)	0.130 (0.188)	1.087 (0.655)
R-squared	0.789	0.758	0.841	0.834	0.598	0.816	0.528	0.605

Source: As Concieved by the Researcher. NB: ***, ** and * represents the 1%, 5% and 10% significance levels, while () is the probability value and the variables are expressed in natural logarithms

4.6.2 Analysis for Financial Markets

We analyzed the results of the relationship between financial development (financial markets) and trade openness in this section which was estimated with the FMOLS and DOLS estimation technique. The financial markets indicators are – financial market depths index (FIMDI),

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financial market access index (FIMAI), financial market efficiency index (FIMEI) and financial market stability index (FIMSI) in this analysis and we ensure that each of them enter different models to avoid multicilliniarity issues. We first test the models with basic econometric tests – normality test, serial correlation test, Ramsey specification test and White heteroscedasticity test and we discovered that the errors of the models are normally distributed, serially uncorrelated, and homoscedastic and the models were correctly specified.

However, findings from the FMOLS results shows that the past values of trade openness have significant effects on current values of trade openness in Sub-Saharan Africa. Further exploration revealed that financial market depth index (FIMDI), financial market access index (FIMAI), financial market efficiency index (FIMEI) and financial market stability index (FIMSI) have positive and significant effects on trade openness in Sub-Saharan Africa.in addition, we discovered that the control variables financial deepening (M2/GDP) showed negative and significant effects on trade openness in Sub-Saharan Africa.

We also found that the exchange rate (EXR) has significant positive effects on trade openness in Sub-Saharan Africa except for model 3, where it portrayed negative and significant effects on trade openness in Sub-Saharan Africa. The results findings of R-squared further showed that the explanatory variables greatly explained the total variations in the trade openness in Sub-Saharan Africa.

In the context of DOLS results, we took our very first step by testing the models with basic econometric tests – normality test, serial correlation test, Ramsey specification test and White heteroscedasticity test. Hence from the results, we discovered that the errors of the models are normally distributed, serially uncorrelated, and homoscedastic and the models were correctly specified. Findings from the results revealed that the past values of trade openness significantly contributed to the current values of trade openness in Sub-Saharan Africa.

The results further shows that financial market indicators such as financial market depths index (FIMDI), financial market access index (FIMAI), financial market efficiency index (FIMEI) and financial market stability index (FIMSI) respectively portrayed positive and significant effects on trade openness in Sub-Saharan Africa. The implication of this result findings is that financial markets promotes international trade in divers' ways.

It broaden trading options, and improve investor confidence when properly executed. In addition, we discovered that the control variables – financial deepening (M2/GDP) and exchange rate (EXR) have significant effects on trade openness in Sub-Saharan Africa. We also discovered from the R-squared results that the explanatory variables greatly explained trade openness in Sub-Saharan Africa.

These findings are in line with previous findings made by scholars such as (Akinsola & Odhiambo 2017, Bojanic 2012, Uddin et al. 2013, Appiah et al. 2023, Mustafa 2023, Paul 2017, Adam 2022, Bankola 2022). However, previous studies like (Maduka & Onwuka, 2013, Iheanacho 2016, Taofeek & Olumuyiwa, 2016) among others.

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Table 14: Estimated FMOLS and DOLS Results of Financial Markets

	FMOLS				DOLS			
Variable	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
TOPEN(-1)	0.697*** (0.000)	0.840*** (0.000)	0.849*** (0.000)	-0.494*** (0.000)	0.419*** (0.000)	0.544*** (0.000)	0.610*** (0.000)	0.475412*** (0.000)
FIMDI	0.604*** (0.000)				0.102*** (0.000)			
FIMAI		0.012*** (0.004)				0.005*** (0.000)		
FIMEI			0.026*** (0.000)				0.034*** (0.000)	
FIMSI				0.022*** (0.000)				0.029*** (0.000)
M2/GDP	-0.487** (0.016)	-0.440** (0.025)	-0.580*** (0.000)	-0.496*** (0.004)	0.764*** (0.000)	0.703*** (0.000)	0.597*** (0.001)	-0.505*** (0.002)
EXR	0.186*** (0.001)	0.011*** (0.001)	-0.267*** (0.000)	0.010*** (0.000)	-0.035*** (0.000)	-0.015*** (0.000)	0.128*** (0.004)	-0.212*** (0.002)
No of Obs	581	581	571	1008	708	708	698	708
Normality	111.3 (0.000)	971.4 (0.000)	876.1 (0.000)	10.09 (0.000)	111.3 (0.000)	971.4 (0.000)	876.1 (0.000)	10.09 (0.000)
Serial Corr.	1.243 (0.887)	1.422 (0.876)	1.497 (0.098)	4.999 (0.876)	1.243 (0.887)	1.422 (0.876)	1.497 (0.098)	4.999 (0.876)
Ramsey	-0.084 (0.000)	-0.085 (0.000)	-0.910 (0.000)	-0.075 (0.000)	-0.084 (0.000)	-0.085 (0.000)	-0.910 (0.000)	-0.075 (0.000)
Het.	2.212 (0.098)	0.251 (0.258)	2.676 (0.458)	3.010 (0.667)	2.212 (0.098)	0.251 (0.258)	2.676 (0.458)	3.010 (0.667)
R-squared	0.857	0.541	0.735	0.622	0.788	0.728	0.7655	0.863

Source: As Concieved by the Researcher. NB: ***, ** and * represents the 1%, 5% and 10% significance levels, while () is the probability value and the variables are expressed in natural logarithms

4.9 Discussion of Findings

This study centred on examining the effects of financial development on trade openness from 2000 to 2022 owing to data availability and estimated the relationship with the pane a system generalized method of moment (GMM) as the baseline model and panel fully modified ordinary least squares (FMOLS) and panel dynamic ordinary least squares (DOLS) as the model for robustness check. We choose the models based on their peculiarity in solving some econometric estimation issues like endogeneity, cross-sectional dependence, country-specific effects, and heterogeneity and serial correlation estimation problems. However, after conducting a review of the literature, we considered the following variables literature trade openness (TOPEN) was measured with Trade (% of GDP), financial development was measured with financial institution and financial markets. For financial institutions, we further stratified it into financial institution depths which was measured with Private Sector Credit to GDP – (PSC), Financial Institutions' asset to GDP (FIA) and Deposits to GDP (DEP); financial institution access which was measured with Accounts per thousand adults (commercial banks), (NOA), Branches per 100,000 adults (commercial banks), (CBB), and % of firms with line of credit (all firms) (FCL); financial institution efficiency which was measured with Net interest margin, (NIM), Lending-deposits spread, (LDS), and non-interest income to total income. (NII); and financial institution stability which was measured with Capital adequacy ratios,

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(CAR), Asset quality ratios, (AQR), and Liquidity ratios (LR). In the realm of financial markets, we further subdivided it into financial market depths which were measured with indicators such as Stock market capitalization and outstanding domestic private debt securities to GDP, (MCAP), Private Debt securities to GDP, (PRDS) and Public Debt Securities to GDP (PUDS); financial market access – measured with Percent of market capitalization outside of top 10 largest companies, (MACOC), Ratio of domestic to total debt securities, (DTDS) and Ratio of private to total debt securities (domestic) (PTDS); financial market efficiency – measured with the Turnover ratio for the stock market, (TOR), Liquidity/transaction costs, (LC) and Quoted bid-ask spread for government bonds (QBS); and financial market stability – measured with Volatility (standard deviation/average) of stock price index, (VOSP), sovereign bond index, (SBI), and Vulnerability to earnings manipulation and Price/earnings ratio (VEM). However, the control variables are financial deepening (M2/GDP) and exchange rate (EXR). Findings from the results of some basic econometric tests were analyzed as follows. The descriptive statistics results revealed that the values of the mean, median, standard deviation, skewness and kurtosis did not drift so much from each other, and the probability values of the Jarque-Bera statistic for all the variables are less than 0.05 showing that the variables are normally distributed. We also found existence of correlations between financial development and trade openness in Sub-Saharan Africa from the results of the Spearman's correlation test. Relatedly, we discovered no trace of unit root and the variables were integrated of I(0) and I(1) and not I(2). The results of Pedroni (2004) and Kao (1999) suggest that cointegration exist between financial development and trade openness in Sub-Saharan Africa across financial institutions and financial markets.

However, in the results of the system GMM, it was discovered that financial development – financial institution and financial markets have significant positive effects on trade openness in Sub-Saharan Africa. More specifically, this study found that financial institution depths, financial institution access, financial institution efficiency, financial institution stability, financial market depths, financial market access, financial market efficiency and financial market stability have significant positive effects on trade openness in Sub-Saharan Africa. This is also similar to findings made from the results of the robustness check – FMOLS and DOLS. These findings are in line with some of the reviewed studies (Akinsola & Odhiambo 2017, Bojanic 2012, Uddin et al. 2013, Appiah et al. 2023, Mustafa 2023, Paul 2017, Adam 2022, Bankola 2022). However, previous studies like (Maduka & Onwuka, 2013, Iheanacho 2016, Taofeek & Olumuyiwa, 2016, Obinna 2015, Dandume, 2014, Balango 2014, Okpara 2010, Manasseh et al. 2021, Manasseh et al. 2023) among others.

Findings from the results revealed that research question one was fulfilled since there is a significant effects of financial institutions on trade openness in Sub-Saharan Africa. We also found that financial markets have significant influences on trade openness in Sub-Saharan Africa and this validates research question 2. In furtherance, the research question 3 were fulfilled since the results depicts that financial institutions depths plays vital role on trade openness in Sub-Saharan Africa. Findings further revealed that question 4 was fulfilled since financial institution access showed a significant positive effects on trade openness of Sub-Saharan Africa. In the like manner, we found that financial institution efficiency significantly

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affects trade openness in Sub-Saharan Africa from the results and this validates research question 5 in this study. Furthermore, we found that financial institution stability have significant influence on trade openness of Sub-Saharan Africa showing that research question 6 was validated. The research question 7 were also validated since financial market depths have significant positive effects on trade openness in Sub-Saharan Africa. Also, findings also revealed that financial market access had significant positive effects on trade openness in Sub-Saharan Africa which validates research question 8. We also found that research questions 9 and 10 were all validated since financial market efficiency and financial market stability have significant effects on trade openness in Sub-Saharan Africa.

Different from the existing studies, the peculiarity of this study are enumerated as follows. Firstly, we dissected financial sector development into financial markets and financial institutions unlike the prior studies and studied there effects on trade openness in Sub-Saharan Africa. Secondly, we thoroughly studied financial institutions by laying much emphasis on financial institution depths, financial institution access, financial institution efficiency and financial institution stability which gave us much room for policymaking in this study unlike previous study. Thirdly, we also studied the effects of financial markets on trade openness by focusing on financial market depths, financial market access, financial market efficiency and financial market stability. Fourth, we estimated the relationships with the aid of panel differenced and system generalized method of moment (GMM) model as the baseline model which is consistent in estimating efficiently estimating the long-run effects in the model as well as taking care of endogeneity, over identification of the instruments, sampling bias, and serial correlations. Fifth, we robustly checked the results of the GMM model by employing the panel fully modified ordinary least squares (FMOLS) and panel dynamic ordinary least squares (DOLS) as the robustness check model which takes care of cross-sectional dependency and country-specific effects which the above-stated studies ignored.

5. CONCLUSION AND POLICY RECOMMENDATIONS

This study investigated the effects of financial development on trade openness in Sub-Saharan Africa. From the findings, the estimated descriptive statistics results show that the series of the data are normally distributed since the probability values of the Jarque-Bera statistics for virtually all the variables are less than 0.05. In addition, we found that the mean, median, standard deviation, Kurtosis and Skewness values did not drift so much from each other. The results of Spearman's correlation matrix suggest that financial institutions measures and financial market measures have negative correlations with the trade openness in Sub-Saharan Africa. In the panel unit root tests, we carried out, the researcher did not find any trace of a unit root in the variables since the probability values of the LLC test, IPS test, Fisher-ADF test and Fisher-PP test are less than 0.05. Findings from the cointegration tests – The Pedroni Cointegration test shows that there is the existence of cointegration between financial institutions, financial markets and trade openness in Sub-Saharan Africa, while the results of the Kao (1999) Cointegration results confirmed it since the values of the ADF-Statistic is less than 0.05. Findings from the diagnostic tests show that the error terms of the specified model are normally distributed, serially uncorrelated and homoscedastic and thus, the models are

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correctly specified. The results from the system GM revealed that the results of the system GMM, it was discovered that financial development – financial institution and financial markets have significant positive effects on trade openness in Sub-Saharan Africa. More specifically, this study found that financial institution depths, financial institution access, financial institution efficiency, financial institution stability, financial market depths, financial market access, financial market efficiency and financial market stability have significant positive effects on trade openness in Sub-Saharan Africa. This is also similar to findings made from the results of the robustness check – FMOLS and DOLS. From the results findings, we conclude that financial institution depths, financial institution access, financial institution efficiency, financial institution stability, financial market depths, financial market access, financial market efficiency and financial market stability have significant positive effects on trade openness in Sub-Saharan Africa.

There is a need to improve trade openness in Sub-Saharan African countries. Thus, based on the study's findings, the following are the recommended policies. Firstly, financial institutions depths can significantly enhance trade openness by improving access to trade finance, strengthening financial infrastructure, encouraging financial innovation, expanding financial inclusion, enhancing risk management, facilitating cross-border investments, and ensuring a strong regulatory framework. By creating a more efficient and inclusive financial system, such policies enable businesses to engage more effectively in international trade, thereby boosting economic growth and integration into the global economy. Secondly, policies should be designed to improve access to financial institutions can have a profound impact on trade openness by addressing barriers, reducing costs, and increasing inclusivity. By expanding access to financial services, enhancing trade finance options, improving financial literacy, and supporting innovation, such a policy helps businesses better manage the financial aspects of international trade, ultimately leading to increased trade volumes and greater economic integration into the global market. Thirdly, authorities should make policies aiming at improving the efficiency of financial institutions which would significantly enhance trade openness by making financial services more accessible, cost-effective, and reliable. By streamlining operations, investing in technology, reducing transaction costs, and fostering innovation, such policies help create a financial environment that supports and facilitates international trade. Improved efficiency in financial institutions ultimately leads to smoother cross-border transactions, greater participation in global markets, and increased economic integration. Fourth, if authorities target policies that enhance financial institution stability, it can significantly improve trade openness by ensuring that financial institutions operate reliably and effectively. By strengthening regulatory oversight, ensuring system resilience, promoting transparency, supporting risk management, and facilitating cross-border cooperation, such policies create a stable financial environment that supports international trade. Stable financial institutions provide the necessary infrastructure and confidence for businesses to engage in global markets and ultimately foster greater trade openness. Fifth, the government should imbibe policies towards deepening financial markets to enhance trade openness by providing a more robust and supportive financial environment for international trade. By expanding financial market instruments, improving liquidity, strengthening regulation, increasing access,

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and promoting transparency, such policies create a dynamic and stable financial ecosystem. This environment supports businesses in managing trade-related risks, reduces transaction costs, and facilitates greater participation in global markets, ultimately fostering increased trade openness and economic growth. Sixth, improving financial market access through some policy which aims at integrating international trade and financial markets can significantly enhance trade openness by creating a more inclusive, efficient, and transparent financial environment, expanding access to financial services and products, enhancing market infrastructure, promoting financial literacy, and supporting innovation, businesses are better equipped to participate in international trade. This can lead to increased trade volumes, greater economic integration, and overall economic growth. Seventh, policies should also focus on improving financial market efficiency to enhance trade openness by reducing transaction costs, improving access to financial resources, and creating a more transparent and reliable financial environment. By streamlining operations, enhancing infrastructure, promoting innovation, and ensuring effective regulation, such policies support more efficient and cost-effective international trade, and leading to increased trade volumes. Lastly, authorities should aim at policies that enhance financial market stability since they contribute significantly to improving trade openness by creating a reliable and predictable environment for businesses to engage in international trade. Through robust regulation, resilience planning, transparency, liquidity support, and effective risk management, such policies foster a stable financial system that supports global trade activities. This stability reduces uncertainty, lowers transaction costs, and facilitates access to financial resources, ultimately leading to increased trade volumes.

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