



Central Bank Digital Currencies in Africa: Implications for Financial Inclusion and Intra-African Trade

A Publication of the NESG Non-Residential Fellowship Programme





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Table of Contents

Introduction	6
Literature Review	9
» <i>Barriers to Intra-African Trade</i>	
» <i>CBDCs and Financial Inclusion</i>	
» <i>CBDCs and Intra-African Trade</i>	
» <i>Summary of all the studies</i>	
Data and Methodology	18
Empirical Results	20
» <i>Preliminary Analysis</i>	
» <i>Normal Distribution test</i>	
» <i>Panel quantile regression results</i>	
Concluding Remarks and Policy Recommendations	23
Bibliography	
Appendix	

Introduction

The proliferation of studies examining the emergence and development of Central Bank Digital Currencies (CBDC) demonstrates the keen interest among researchers in understanding their likely macroeconomic implications, opportunities and challenges. Spurred by innovations in payment methods, the digital transformation of global economies, the rapid rise of digital payments in preference to cash, and the surge of digital currencies in the last decade, CBDCs are the next frontier in the global financial revolution. CBDCs refer to the virtual form of a country's fiat currency issued by the central bank. Its development is particularly considered exigent due to the increasing dominance of cryptocurrencies in the finance space (Ozili, 2022).

CBDCs possess some superiority over conventional cryptocurrencies and fiat currencies for several reasons. First, as a payment option, it reduces costs associated with cash, prevents counterfeiting, promotes financial inclusion, and strengthens the authority of legal tender. It also reduces reliance on payment services, banks and the private sector, thereby decreasing the burden and pressure of supervision on the central bank (Qian, 2019). Second, adopting CBDCs helps maintain the central bank's relevance in the monetary system, giving room for monetary supervision and regulation (Wang et al., 2022). Appraisal of monetary policy expectations and the detection of illegal activities such as money laundering, terrorist financing, and tax evasion are other benefits of CBDCs (Dupuis et al., 2021).

However, some observers have expressed caution, stating some potential risks associated with CBDC issuance, such as; risks to individual privacy, the potential occurrence of currency substitution/dollarisation, hampering monetary policy transmission, competing with bank deposits and undermining bank intermediation, exacerbating bank runs during periods of economic stress. CBDCs could also pose environmental issues due to the large amount of energy requirements for production, deposits and transactions (Laboure et al., 2021).

Nonetheless, most of the discussions on CBDC innovations and their macroeconomic impacts have concentrated on issues of potential opportunities and risks of CBDC introduction (see, e.g., Cunha et al., 2021; Kochergin, 2021), design theory, technology innovation, model optimisation of CBDC (see, e.g., Qian, 2019; Lee et al., 2021), privacy and security of CBDC usage (see, e.g., Borgonovo et al., 2021; Lee et al., 2021b), implications of its adoption on monetary policy and system (see, e.g., Davoodalhosseini, 2021; Meaning et al., 2021), CBDC and the banking sector (see, e.g., Fern'andez-Villaverde et al., 2021; Williamson, 2021). In contrast, only a few studies have investigated the implication of CBDC adoption on intra-Africa trade.

From a trade point of view, CBDCs could become a key driver of Africa's vision to significantly boost intra-Africa trade by facilitating access to trade finance and de-risking international trade. One of the well-

reported benefits of CBDCs in boosting trade is their ability to enable financial inclusion. Until recently, the understanding of the effects of CBDCs on financial inclusion remained unclear. However, a study conducted by Allen, Esser and Cooper (2019) found that CBDCs have the potential to foster greater interoperability, improve payment efficiency, facilitate cost-saving gains by minimising reconciliation complexity and notional costs and reduce the critical payment risks that are typically associated with mobile money.

In facilitating intra-African trade, CBDCs have also been found to enable domestic and cross-border P2P money transfers that are faster, more affordable and more convenient than the traditional formal channels or instruments (Raskin & Yermack, 2016). However, with the continuous advancements of digital payments and the proliferation of different payments solutions on the continent, including the potential issuance of CBDCs by other African countries in the near future, understanding the potential role of CBDCs in mitigating some of the existing fiscal challenges of intra-African trade is of critical importance. Hence, this study critically evaluates African CBDCs and their implications for intra-Africa trade.

As Africa continues her quest for development, the role of trade, especially intra-African trade, remains a strong focal point. The barriers to intra-Africa trade are well documented, as is the agenda to boost intra-African trade from the current 14% to 30% through AfCFTA over the next few years. African countries' burgeoning interests in launching their CBDCs could play a role in achieving this objective. Also, the literature has identified that a lack of common currency is among the significant intra-Africa trade barriers as well as a dysfunctional foreign exchange market. Digital currencies, especially

CBDCs, can help boost trade by removing or mitigating some of these critical barriers.

Therefore, this study aims to provide a critical evaluation of CBDCs and their implications for intra-African trade. More specifically, it focuses on CBDCs as a financial inclusion tool and their impact on intra-African trade. The objectives include:

- » A critical review of the literature on the barriers to intra-African trade
- » A critical evaluation of how CBDCs as financial inclusion tools can mitigate intra-African trade barriers

Considering that CBDCs are at the early stages of development and adoption, there is inadequate data on their adoption rate and usage statistics, thus limiting quantitative analyses of CBDC's effects on intra-Africa trade. Nonetheless, studies providing evidence-based insights would be significant in advancing the understanding of CBDCs on the continent; but more importantly, helping policymakers make better-informed decisions on policy interventions. In these early stages of adoption in Africa, evidence-based policymaking is critical.

Therefore, this study seeks to contribute to the existing knowledge by evaluating how CBDCs can realise their full potential on the continent, especially in the facilitation of intra-African trade, which is at the core of Africa's immediate developmental agenda. Following this background, we offer a detailed review of the literature on CBDC adoption as well as some of the barriers to intra-African trade in Section 2. In Section 3, we discuss the methodology adopted in the study. Section 4 evaluates the effect of CBDC adoption on Intra-Africa trade, while Section 5 concludes the paper.



Literature Review

Barriers to Intra-African Trade

The strategy for Africa's development and emergence into a global economic hub is often hinged on both trade and regional integration (Osuji, 2020). One of the key benefits of regional integration should be the facilitation of trade among country members, yet this remains a significant challenge among African nations.

In 2021, intra-African trade accounted for 14.4% of Africa's total export, only a 4% increase from ten years prior in 2010-2011. This suggests that intra-regional trade in Africa remains low relative to Europe (69 percent), Asia (59 percent), and North America (31 percent) (Songwe, 2019). However, as Mold and Chowdhury (2021) argue, comparing intra-regional trade in Africa with other continents can be misleading and does not compare like for like. Also, the systematic failure to capture the full extent of informal cross-border trade implies an incomplete narrative of the true extent of intra-African trade, which does have much greater economic significance than is often reported.

Regardless, what seems evident is the relatively slow progress the continent has made towards facilitating formal intra-regional trade at a viable rate to underpin the continent's development. The recent implementation of the Africa continental free trade agreement (AfCTA) further indicates more concerted efforts to significantly address well-known trade barriers on the continent. While key trade barriers are well documented, for instance, Longo and

Sekkat (2004) identified poor infrastructure, economic policy mismanagement, and internal political tensions as some of the major barriers to intra-African trade. Other barriers, such as tariffs, non-tariffs and quotas, have also been notably discussed in intraregional trade conversations (Ngepah & Udeagha, 2018).

However, this study's focus on CBDCs compels the identification and review of fiscal or monetary barriers to intra-African trade in practice. A review of the literature on some of the key monetary challenges of intra-African trade revealed that there are still significant challenges of instability and volatility of local African currencies. This implies that doing business in those local currencies may be very risky (Tierney, 2017). Another key issue is the perception held towards the currencies of other African countries. In simple words, Africans do not trust the currencies of other African countries.

Interestingly, some of Africa's largest economies, such as Nigeria, do not necessarily have the strongest currencies (see figures 1 and 2 below). A review of the strongest currencies in Africa in 2021 revealed that the Nigerian naira is the 24th on the list, with twenty- three other African currencies having stronger currencies relative to the US Dollar. Taking a simplistic view, this implies African currencies have good potential to become even stronger, and intra-African trade could facilitate this. Nevertheless, the inability of African countries to tap into this potential, combined with other barriers, causes a significant increase in transaction costs.

Figure 1: African Countries with the highest GDP

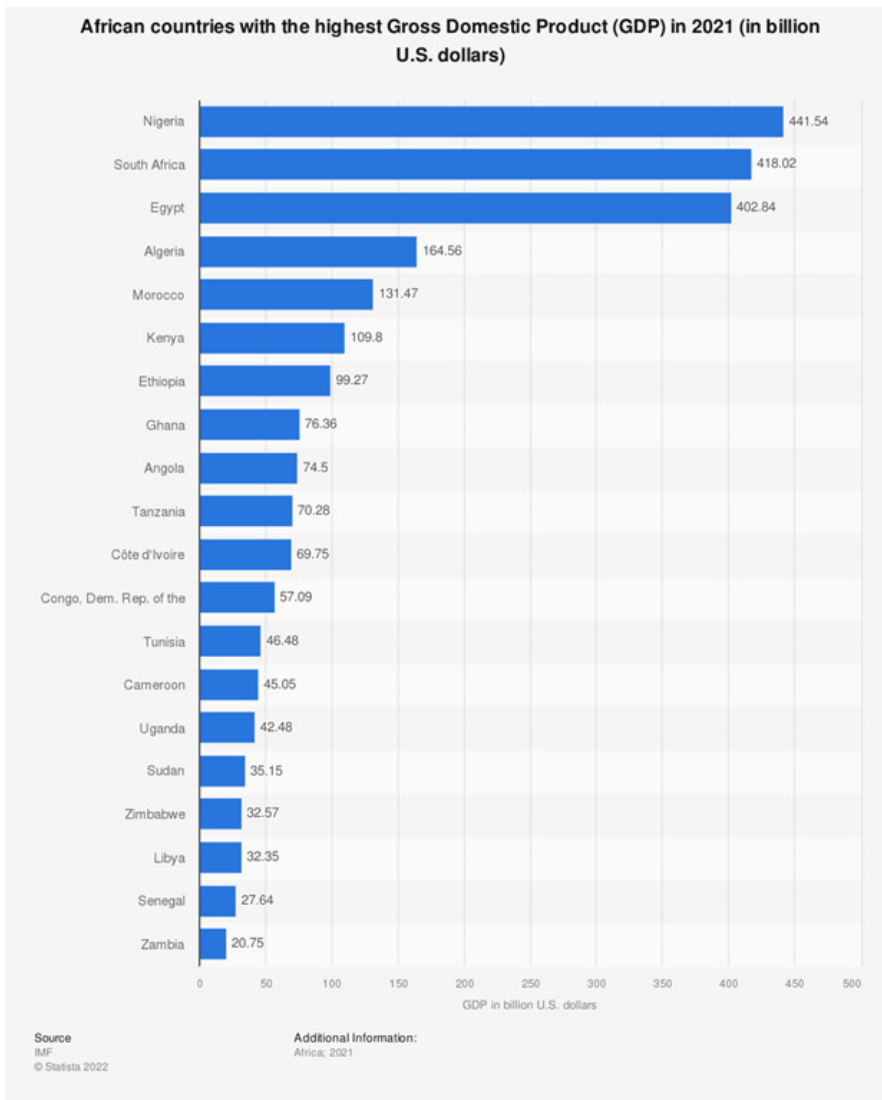


Figure 2: Exchange rate of African Currencies to US Dollar as of January 2022



Hence to mitigate perceived risks, transactions often have to be quoted and carried out in more stable international currency, such as the US Dollar, which itself is not exempt from market volatility, before conversion into the local currency of the final trade destination. The naira, for instance, has been ranked as one of the weakest currencies on the continent despite the size of the Nigerian economy, which is the largest in Africa (InfomediaNG, 2022).

According to the International Monetary Fund (IMF), CBDCs have the potential to offer safe government-backed forms of payment able to contribute to payment systems' stability

and can ultimately improve monetary policy transmission (IMF, 2020). With the recent establishment of the Pan African Payments and Settlement System (PAPSS), an intra-African trade and commerce payments, centralised payment and settlement system, as a part of AfCFTA, Africa may be heading in the right direction. PAPSS promises to save businesses across the continent US\$5 billion in transaction costs each year and is expected to facilitate a projected increase in trade on the continent, currently estimated at 22 percent by 2040 and potentially generating an additional US\$70 billion in value.

CBDCs and Financial Inclusion

Speaking at an event geared towards ideating innovative solutions for the newly launched digital currency, Nigeria's Central Bank Governor stated, "... The underlying goal of the eNaira (the CBDC issued by the CBN) is to ... develop solutions in the areas of international remittance, trans-border payment, blockchain, financial inclusion, and trade (AfCTFA)" (Emejo, 2022). The role of CBDCs in fostering financial inclusion and enhancing trade has also been cited as one of the primary reasons for its creation. In particular, some central banks, such as those of the Bahamas, Eastern Caribbean, Ghana and China, have clearly articulated the removal of stubborn obstacles to achieving financial inclusion as a significant motivation for a CBDC.

CBDCs are crucial in promoting financial inclusion by lowering financial access barriers and forging new pathways of upward mobility. In its biannual survey report on financial inclusion in Nigeria, EFINA has consistently identified poor access as one of the main impediments to financial inclusion in Nigeria. With Fintechs and other technological innovations disrupting existing paradigms, more and more excluded populations are being reached - even if the pace has been somewhat slow. CBDCs, which are essentially Fintech products, can/are positively impacting financial inclusion.

The mechanism through which CBDCs can improve financial inclusion is not necessarily

structural/technological. It is also argued that CBDCs increase financial inclusion by decreasing the power of banks, increasing deposits, and thus lowering interest rates. Additionally, other researchers, for instance, Murakami, Shchapov, and Ganesh Viswanath-Natraj (2022), have shown that "digital currencies address financial inclusion of the unbanked by providing a savings vehicle they allow households to smooth consumption" (pg. 1). Furthermore, evidence from South Africa's CBDCs have shown that CBDCs have the potential to "foster greater interoperability, improve payment efficiency, facilitate cost-saving gains by minimising reconciliation complexity and notional costs, and reduce the key payment risks that are typically associated with mobile money" (Allen, Esser & Cooper, 2019, pg. 10). These potentials mirror the main constraints to financial inclusion and, to a lesser extent, cross-border trade in Africa. To that end, CBDCs, if designed in a broad and open manner, can provide one of the most crucial keys to unlocking trade in Africa. As a recent IMF report notes, CBDCs would lead to "faster clearance of cross-border payments which will in turn help boost trade within the region and with the rest of the world."

Ultimately, financial inclusion is expected to mediate the relationship between CBDCs and intra-African trade. Greater financial inclusion should increase business formalisation, boost trade, and even reduce money-related illicit activities.



CBCDs and Intra-African Trade

Until recently, over four-fifths of African cross-border payment transactions had to be routed through foreign payment platforms such as SWIFT and the Real Time Gross Settlement System. These payment platforms rely on offshore entities and complicated international correspondent banking relationships, ultimately making it costly, inefficient, and an obstacle to seamless intra-African trade. Dependence on the existing multitiered payment system has led to a loss of more than \$5billion for households and businesses on the continent.

The economic and welfare losses associated with the prevailing payment system led to the creation of a new cross-border payment system by the AFREXIM BANK, dubbed

the Pan-African Payment and Settlement System (PAPSS). Africa currently has about 42 currencies which can make intra-African trade costly and cumbersome. PAPSS is a centralised payment and settlement system for intra-African trade in goods and services that allows traders in Africa to make payments for goods and services across Africa in their local currencies. It is expected to reduce transaction costs and enable quick and efficient settlement and payment of transactions.

Similarly, in the West African region, ECOWAS has, for a while, been advocating for a regional payment and settlement system in tandem with steps already taken by some of the other regional economic communities across the continent. The goal of the ECOWAS Payment

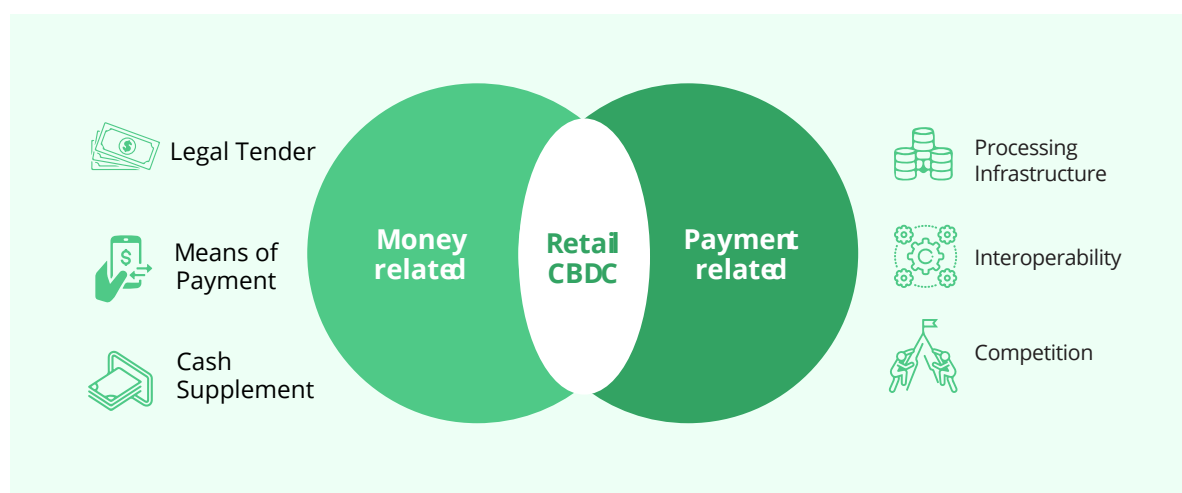
and Settlement System (EPSS) is to stimulate monetary and financial integration and enable intra-Community trade in goods and services in line with the community's objective of establishing an economic union in line with Article 2(e) of the ECOWAS Revised Treaty. Like the PAPSS, EPSS was also meant to facilitate the guarantee of prompt payments and building of trust among traders that would lead to an increase in intra-regional trade and a drastic reduction in the cost of intra-regional trade transactions and remittances.

Other anticipated benefits include allowing all commercial banks to deal directly with one another; enhancing the timing of payments and their predictability as well as reducing payment cycle time as compared to other international payment alternatives; lower cost and quick turnaround of EPSS payments translating into savings for the importer; and an easy process for making cross-border payments at retail and wholesale levels.

While this is a step in the right direction, it still does not resolve some of the inherent shortcomings of a centralised payment processing system. According to a report by the Financial Stability Board, these challenges are centred around the lack of technical integration of diverse payment platforms, delays in transaction settlement, high transaction fees, and the lack of transparency. Distributed Ledger Technology (DLT) is uniquely suited to eliminating/mitigating most of the challenges listed above (see Roeck, Sternberg & Hofmann (2019), SWIFT (2016)).

CBDC is a digital (DLT-based) currency designed to facilitate payments. It has five key attributes that make it a substitute for cash, with one key distinction- it is programmable. CBDCs are (i) issued by a Central Bank, (ii) legal tender, (iii) pegged by fiat, (iv) exchanged from peer to peer and (v) programmable. Other key features of a CBDC are illustrated in Figure 3.

Figure 3: Key features of a retail CBDC

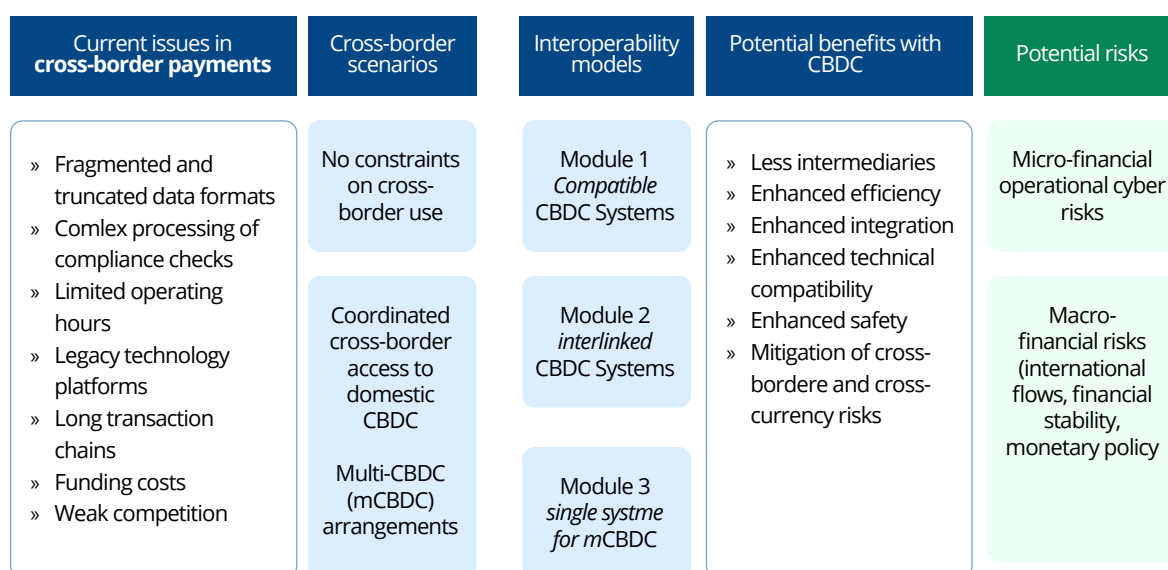


Adapted from: R. Morales -Resendiz, J. Ponce, P. Picardo et al. (2021)

As seen Figure 3, in addition to its cash-like attributes, CBDCs have payment-related attributes that can significantly alter how the transactions (that facilitate trade) are processed. CBDC can foster financial inclusion being more accessible and convenient for users; it can reduce transaction costs for electronic commerce; and crucially, it can increase the efficiency of cross-border payments, which boosts regional trade. In addition to retail CBDCs, there are Wholesale CBDCs which provide a new framework/platform for inter-bank settlements. “Wholesale CBDC can improve inter-bank payment settlement, reduce risks and costs of cross-border payment transactions” (see Zhang & Huang, 2021).

The existence of an affordable, accessible, and convenient payment system is crucial to AfCFTA’s aspiration to grow intra-African trade from 10 to 25% in the near future. The role of CBDCs in enhancing the efficiency of cross-border payments has significant implications for intra-African trade and the success of the AfCFTA. As the graph below, from a BIS study, shows, CBDCs can enhance cross-border payments/trade by: (i) enhancing compatibility of diverse platforms; (ii) lowering costs (eliminating intermediaries); (iii) eliminating interest rate, foreign exchange, counterparty and settlement risk by leveraging CBDCs near real-time settlement of transactions.

Figure 4: Summary of the potential to enhance cross-border payments with CBDCs



Source: CPMI; Innovation Hub; IMF; World Bank

A recent report by the World Bank argues further that CBDCs have the potential to address the four key challenges plaguing cross-border payments in Africa, namely-

high cost, low speed, poor access, and lack of transparency. Other challenges include the lack of convertibility and interoperability.

High Transaction Costs: High costs in cross-border payments are occasioned by high barriers to entry, reliance on correspondent banks, and regulatory requirements. Indeed, a WEF report shows that effective transaction fees on intra-African payments can range from as high as 3 to 10%. However, CBDCs can mitigate that by leveraging economies of scale, technical efficiency gains, and the direct participation of users (see Bank of England (2016).

Low Settlement Speed: Cross-border payments for intra-African trade are characterised by relatively significant delays ranging from 3 days to two weeks. Disjointed processing standards and technical incompatibility in current payment processing platforms are mostly responsible for the delay. However, with close to instantaneous settlement on the DLT infrastructure that provides the backbone for CBDCs, settlement speeds can witness remarkable improvement over current speeds.

Convertibility: With some forty-one different currencies on the continent, intra-African trade has to rely on a common currency (often the US Dollar) to resolve convertibility challenges. The lack of a unified currency poses a challenge that universal CBDC models can partly mitigate.

Despite the paucity of empirical studies examining the implications of CBDC on trade, some jurisdictions ran pilot projects to integrate CBDCs across borders to facilitate trade. Some relevant examples are discussed below.

- » Project Inthanon-Lionrock is a joint attempt by the central bank of Thailand and the Hong Kong Monetary Authority to enable peer-to-peer foreign exchange transactions

between the two countries. This project has improved settlement efficiency and enhanced liquidity efficiency.

- » Project Aber is a joint project to “create a CBDC instrument that can be used for settlement of cross-border payment obligations between commercial banks in the two countries as well as domestically.” A recent review of the pilot found significant efficiency gains in cross-border payment from the project without sacrificing security or privacy concerns.
- » Project Jasper-Ubin: The “project sets out to determine whether, with recent technological innovations, it is possible to make safe cross-border payments and realise other benefits in a future world of heterogeneous distributed ledger platforms.” While a comprehensive review of the project is underway, early evidence shows cost and time savings from the project. Credit and settlement risks are also substantially reduced due to removing intermediaries and the instantaneous nature of CBDC transactions.

While CBDCs hold immense potential to facilitate cross-border payments and trade, they are not without challenges. In particular, there are concerns with CBDCs related to privacy and financial integrity, compliance with anti-money laundering (AML), combating the financing of terrorism (CFT), financial stability and banking intermediation, and the risk of facilitating systemic runs on banks in crises.

Summary of all the studies

So far, the above background and literature review have shown that an increasing number of studies are being carried out on intra-African trade barriers, implications of CBDC development and adoption on the macroeconomy, among others. However, there are still notable discrepancies and gaps that require thorough empirical assessment. Available studies have paid more attention to CBDC design frameworks, the implications

of CBDC adoption on monetary policy regulations, reliability of CBDCs as a secure electronic payment option, among other issues. However, based on the premise that CBDCs would improve financial inclusion among African economies and thereby foster intra-African trade, it would be interesting to investigate the contribution of financial inclusion (measured in terms of access, depth and efficiency) to cross-border trade in Africa. This is the contribution of this study.



Data and Methodology

To understand the influence of financial inclusion on cross-border trade in Africa, a panel of twenty-three (23) sub-Saharan African countries was selected (namely; Benin, Burkina Faso, Burundi, Central African Republic, Chad, Congo, Rep., Gabon, Gambia, Ghana, Guinea-Bissau, Kenya, Madagascar, Mali, Mauritania, Mauritius, Niger, Nigeria, Rwanda, Senegal, Sudan, Tanzania, Togo, and Uganda) using annual data from 1992 to 2019, considering the consistency and availability of data. Notably, the dependent variable is trade balance (TBAL) (as a proxy for Intra-African trade), and the decisive

variable is financial inclusion (FI) (with financial institution depth, financial institution access, and financial institution efficiency as sub-components)¹. Other control variables include Gross Domestic Product per capita (GDPPC), real effective exchange rates (REER), gross capital formation (GCF), labour force participation rate (LAB), and consumer price index (CPI). All data are sourced from the International Monetary Fund (IMF) database. In line with the objective of this study, the baseline relationships between Intra-African trade and financial inclusion are expressed as follows:

$$TBAL_{it} = \alpha_0 + \alpha_1 FI_{it} + \alpha_2 Z'_{it} + \varepsilon_{it} \quad (1)$$

$$TBAL_{it} = \alpha_0 + \alpha_1 FIA_{it} + \alpha_2 Z'_{it} + \varepsilon_{it} \quad (2)$$

$$TBAL_{it} = \alpha_0 + \alpha_1 FID_{it} + \alpha_2 Z'_{it} + \varepsilon_{it} \quad (3)$$

$$TBAL_{it} = \alpha_0 + \alpha_1 FIE_{it} + \alpha_2 Z'_{it} + \varepsilon_{it} \quad (4)$$

where the intra-African trade balance, financial institution depth, financial institution access, financial institution efficiency, Gross Domestic Products per capita, real effective exchange rates, gross capital formation, labour force participation rate, and Consumer Price Index are represented by TBAL, FID, FIA, FIE, GDPPC, REER, GCF, LAB, and CPI, respectively. FI represents financial inclusion. The control variables included in the models are captured by Z' . ε is the error term.

We apply the panel quantile regression model with a non-additive fixed effect for the proper model estimation. The original version of the technique was proposed by Koenker and Bassett (1978) and later extended, particularly to include the fixed effect component that accounts for unobserved individual heterogeneity (Powell, 2016). Generally, the panel quantile regression model is superior to the traditional panel regression models built

on the assumption of normal distribution of the residual series and conditional mean. Since many economic indicators exhibit fat tails, there is a need for a model, such as the panel quantile regression model, that is not sensitive to the distribution patterns of the underlying series.

In addition, it provides varying results for the independent variables over the whole conditional distribution of the dependent variable, thereby making it a model that relies on a conditional median. As such, we can examine the impacts of financial inclusion on Intra-African trade across different quantiles. Other merits of the technique include its unbiasedness in the presence of outliers (Koenker & Hallock, 2001), a small sample (Powell, 2016), and heterogeneity.

Thus, the general form of the panel quantile regression is given as:

¹Access, depth and efficiency provide a comprehensive description of financial inclusion.

$$Y_i = X_i' \beta_\phi + \mu_{\phi i}; \quad 0 < \phi < 1 \quad (5)$$

$$Quant_\phi(Y_i|X_i) = X_i' \beta_\phi \quad (6)$$

where Y_i represents the dependent variable (Intra-African trade), and X_i represents a vector of all the independent variables (financial inclusion and the control variables). β_ϕ is the parameter of the regression at each quantile, ϕ . $\mu_{\phi i}$ is the regression error term, while $Quant_\phi(Y_i|X_i)$ is the error term in each quantile distribution where Y is located.

In order to account for the unobserved heterogeneity, the extension of the panel quantile regression by Powell (2016) to include non-additive fixed effects gives room for a variation in the regression parameter, β_ϕ , having relied on an unknown fixed effect function and a residual term that is unique to the observations.



Empirical Results

Preliminary Analysis

As a common practice in the empirical literature, we present preliminary analysis results first. Table 1 reports the statistical description of the data. Expectedly, we record negative average values for the trade balance as most African countries produce raw materials for export to developed economies rather than their African counterparts. It is also evident that financial inclusion variables (access, depth and efficiency) have negative average values.

Hence, sub-Saharan African economies are still sufficiently confronted with weak financial development. Regarding the distribution of the data, the departure of the skewness and the kurtosis values from their standard thresholds of zero and three (3) indicate that the variables are not normally distributed. This evidence first indicates the possibility of nonlinear dynamics in the variables, making the traditional mean regression models, built on the linearity assumption, inappropriate.

Table 1: Summary Statistics

Series	Mean	Median	Skewness	Kurtosis
TBAL	-1.09E-06	-1.01E-06	0.7410	14.7782
FI	-2.3379	-2.3360	0.1673	5.8296
FIA	-3.4682	-3.3480	-0.1887	3.0665
FID	-3.0615	-3.0127	-0.2396	5.2592
FIE	-0.7245	-0.6521	-1.8990	8.1280
GDPPC	6.8303	6.6085	1.1850	4.0272
LNREER	4.6378	4.6092	0.4371	6.3426
GCF	21.4780	20.75	1.4009	7.5544
LAB	69.1760	71.7	-0.1632	2.1694
LNCPI	4.2902	4.4213	-1.6045	9.5844

Source: Compiled by the authors

Normal Distribution test

Since the normality of the variables is one of the basic assumptions for a conditional mean regression model, it is expedient to determine their statistical distribution feature to validate the choice between adopting a model based on a conditional mean or otherwise.

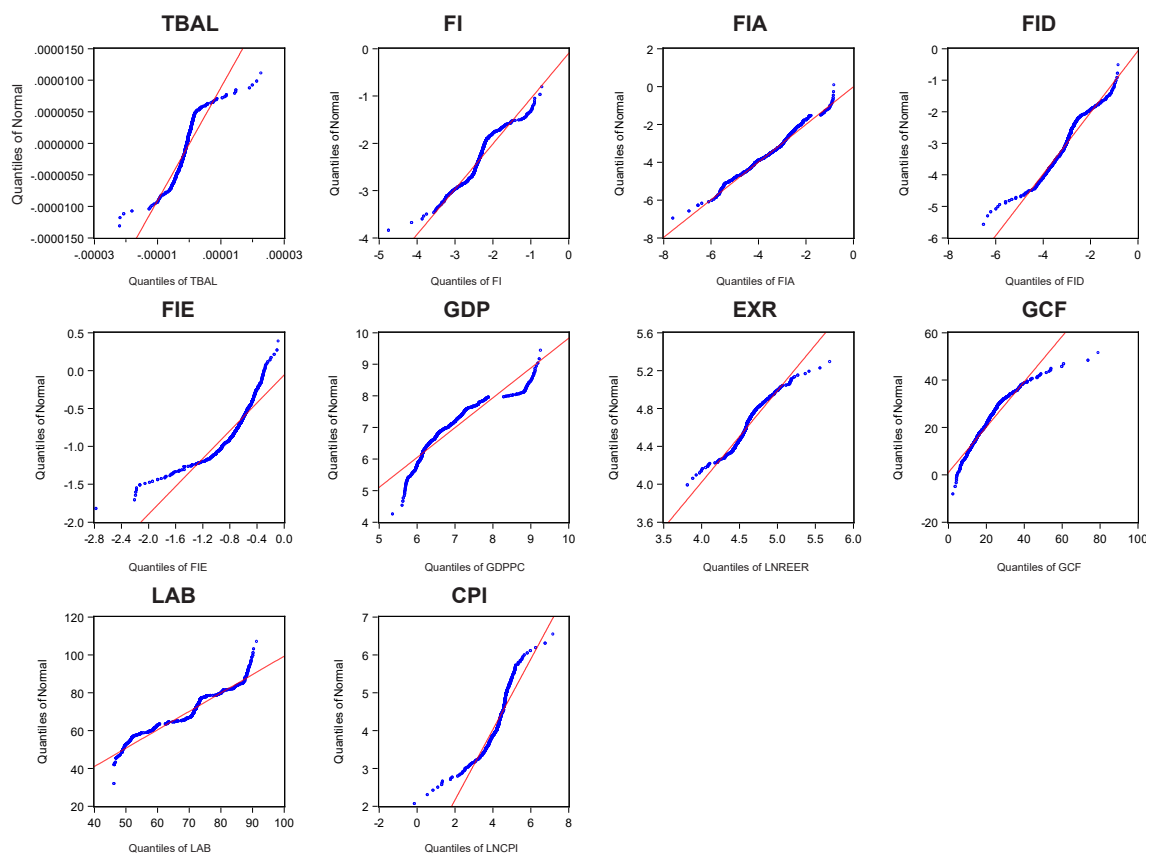
If the sample data is normally distributed, traditional mean regression models could be adopted; otherwise, traditional mean regression models would be unsuitable as they would lead to biased and non-robust estimation results. In this situation, the panel quantile regression model, which can deal

with heterogeneity in a distribution, would be a better option. Therefore, to confirm the suitability of the panel quantile regression model, we conduct the quantile-on-quantile (Q-Q) normality test to check the normality of the series.

For ease of visual perception, we adopt the Q-Q plot, as presented in Figure 5. The scatter diagram should markedly track the

straight diagonal line if a variable is normally distributed. The results demonstrate that all variables do not follow the normal distribution because the scatter diagrams in each Q-Q plot deviate from the diagonal lines. By implication, the traditional mean regression models would be unsuitable. Therefore, we adopt the panel quantile regression approach, which is more appropriate for handling series with such features.

Figure 5: Quantile-on-quantile normality plots of variables in Sub-Saharan African countries



Panel quantile regression results

Unlike the traditional mean regression method, the panel quantile regression method provides estimates across a range of quantiles representing different dependent variables' levels. We choose nine quantiles (i.e., 10th, 20th, 30th, 40th, 50th, 60th, 70th, 80th and 90th) during the regression process to provide a complete picture of different quantiles. Also, since financial inclusion is measured by access to financial services (FIA), depth of financial services (FID) and the efficiency of financial services (FIE), they are separately considered in the regression models for robustness. Thus, the models for FI, FIA, FID and FIE are represented by Model 1, Model 2, Model 3 and Model 4, respectively.

To begin, we consider the impact of financial inclusion (FI) on trade across sub-Saharan African countries (see Table I in the Appendix). Our results provide evidence of the following:

First, the impact of financial inclusion on intra-African trade is stable at the higher quantiles, unlike the heterogeneous impacts observed across the lower and middle quantiles. Second, the impact of financial inclusion at the higher quantiles is significantly positive, implying that the role of financial inclusion in facilitating intra-trade among the African countries is more viable as the countries increase in trade level. In other words, the impact is felt more favourably as countries open up to more intra-African trade. Furthermore, mixed impacts at the lower and middle quantiles are suggestive of the limited role of financial inclusion when the countries do not give room

for a higher level of trade among themselves. Although positive at the higher quantiles, the impact is still low. For instance, a 1% change in the financial inclusion index will lead to a 0.0000016% change in trade between African countries. Traditionally, African countries tend to concentrate on raw material trade and hence, find better value in commodity and service exchange with their developed western counterparts. Therefore, financial inclusion's contribution to the improvement of intra-African trade would be little until there is a change in trade culture, diversity in output, and a drive towards value addition among African countries. Conversely, large economies tend to spend large amounts on imports because they have large incomes. They also tend to attract large shares of other countries' spending because they produce a wide range of products. However, this is not so for African economies.

Other plausible reasons for the diminutive contribution of financial inclusion to Intra-African trade include the low level of financial development in virtually all the African countries and institutional barriers, among others. Thus, as there are increased attempts to facilitate more trade across the African borders, measures that increase financial institutions' development through improved access to financial services, improved quality of the financial services, and improved financial system efficiency should be enhanced while unnecessary bottlenecks are removed. If the e-currency agenda would serve this function, it promises many merits to increased trade among African countries.



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Concluding Remarks and Policy Recommendations

Our study examines CBDC adoption in Africa and its implications for financial inclusion and intra-African trade. First, we begin by capturing the barriers to intra-African trade. We further examined ECOWAS and the role of Pan African Payment System features in intra-African trade and critically evaluated how CBDC as a financial inclusion tool can mitigate intra-African trade barriers. We employed the panel quantile regression model, capturing a panel of twenty-three (23) Sub-Saharan African countries and using annual data from 1992-2019 due to data availability.

The results reveal the following: (i) the impact of financial inclusion on intra-African trade is stable at the higher quantiles, unlike the heterogeneous impacts observed across the lower and middle quantiles (ii) financial inclusion has a significantly positive impact at the higher quantiles, implying that the role of financial inclusion in facilitating intra-trade among the African countries is felt more favourably as countries open up to more intra-African trade (iii) mixed impacts at the lower and middle quantiles are suggestive of the limited role of financial inclusion when the countries do not give room for a higher level of trade among themselves.

Based on the above findings, we recommend the following:

- » Financial inclusion efforts (including through CBDCs) should be accelerated to deepen intra-African trade; African countries should mitigate all Conditional Cash Transfers (CCT) to CBDCs to increase adoption in marginalised households and then leverage on some critical attributes of CBDCs to deepen inclusion.
- » Central Banks should champion the digitalisation of proposed multinational currency (e.g., ECO) to eliminate convertibility concerns

inherent in intra-African trade, lower transaction costs of cross-border transactions within the region, and improve settlement speed for cross-border transactions.

- » Integration of CBDCs into cross-border payment infrastructure (e.g. PAPSS) to foster greater interoperability, reduce friction between different currencies (or CBDCs), improve payment efficiency (by lowering transaction costs), reduce payment risks – primarily credit and settlement risk and also minimise reconciliation complexity and notional costs.

Further Recommendations include:

incentivising citizens to buy into the CBDCs platform, creating an ecosystem of players that will provide training, enlightenment on benefits, capacity building, forming an interlinked payment system in Africa to enhance the development of capital market integration, public enlightenment on digital technologies and innovations, focusing on the people living with disabilities.

Some identified limitations of CBDC adoption in Africa include: (i) substantial informal trade components and an inability to capture data, (ii) volatility of local currencies posing a significant source of concern, (iii) the existence of a digital divide in most African countries will impair people's ability to transact. (iv) Finally, illiteracy is a big issue and can really affect CBDCs initiation in any country if citizens cannot transact or transfer payment using any digital instrument tools.

Overall, central banks are increasingly encouraged to expand their regulatory toolbox to address the outstanding payment needs of citizens by leveraging digital payment innovations while also addressing these potential risks.

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Appendix






Variables	Quantiles								
	10th	20th	30th	40th	50th	60th	70th	80th	90th
Model 1									
FI	1.22e-06***	2.09e-07	8.56e-07***	-3.97e-08	9.71e-08***	9.66E-08	2.14e-07**	9.65e-07**	1.64e-06***
GDPPC	1.58e-06***	5.22e-07***	1.31e-06***	6.52e-07***	6.12e-08***	4.36e-07***	3.31e-07***	7.60e-07***	-1.05e-06***
REER	-2.06e-07	-2.33e-06***	-2.73e-06***	-6.27e-07***	-2.86e-07***	-9.34e-07***	-1.30e-06***	-9.27e-07***	-1.33e-06***
GCF	-1.19e-07***	2.24e-09	-3.44e-08**	-1.47e-08**	1.73e-08***	-1.58e-08***	-2.45e-08***	-6.15E-09	-8.66e-08***
LAB	3.14e-08	-4.50e-08***	-2.01e-08*	-8.98E-09	-4.43e-08***	-4.83E-09	-1.42e-08***	4.88e-08***	-8.37e-08***
CPI	-1.21e-06***	-5.57E-08	5.88e-07***	-6.84E-08	-1.23e-07***	-1.77e-07*	-3.44e-07***	-2.30e-07	-6.15E-08
Model 2									
FIA	-1.01e-06***	-5.37e-07***	-5.87e-07***	-4.78e-07***	-2.37e-07***	-2.56e-08	3.04e-07***	6.64e-07***	9.34e-07***
GDPPC	9.36e-07***	1.71e-06***	8.17e-07***	1.15e-06***	1.07e-06**	2.51e-07***	4.61e-07***	4.83e-07***	-9.68e-07***
REER	-1.70e-06***	-1.50e-06***	-1.13e-06***	-6.80e-07***	-9.44E-07	-6.95e-07***	-1.16e-06***	-4.50e-07**	-1.78e-06***
GCF	-3.98e-08***	-5.60e-08***	-2.26e-08**	-3.02e-08***	-1.69E-08	-2.01e-08***	-1.44e-08**	7.00e-09	4.85e-08***
LAB	-8.31e-08***	-1.77e-08	-6.91e-08***	3.55e-08*	3.54e-08	-3.13e-08***	-6.36e-09*	7.34e-08***	-4.51e-08***
CPI	-3.12e-07***	9.73e-08***	1.36e-07***	-7.66e-07***	-2.04e-07***	-1.85e-07***	-1.51e-07***	3.24e-07**	-5.02e-09
Model 3									
FID	-5.02e-09	4.79e-07**	4.97e-07	4.32e-08	6.36e-07***	8.39e-07***	4.46e-07***	7.01e-07***	1.39e-06***
GDPPC	1.38e-06***	1.53e-06***	2.33e-07*	5.30e-07***	-1.29e-08	1.31e-07	3.43e-07***	-6.65e-08**	-2.01e-06***
REER	-2.21e-06***	-1.51e-06***	-1.85e-06***	-1.88e-06***	-6.32e-07***	-1.02e-06***	-1.31e-06***	-8.93e-07***	-1.21e-06***
GCF	-6.16e-08***	-9.94e-08***	-1.94e-08	-2.51e-08***	2.34e-09	-5.54E-09	-1.40e-08***	2.65e-08***	5.09e-08***
LAB	8.08e-08***	-2.61e-08***	-5.55e-08***	-1.41e-08**	-3.48e-08***	-2.88e-08***	-9.34e-09	-4.32e-08***	-1.95e-07***
CPI	-1.12e-06***	-3.24e-07***	-2.86e-08	-2.81e-07***	-3.25e-07***	1.54e-07	-8.01e-08**	1.86e-07***	1.07e-06***
Model 4									
FIE	1.07e-06***	-4.32e-07***	-1.04e-06***	-2.62e-07***	4.59E-08	-1.74e-07*	2.83e-07**	3.06e-07***	4.42e-07***

GDPPC	1.03e-06***	1.66e-06**	1.14e-06***	4.76e-07***	4.43e-07***	4.05e-07***	7.90e-07***	7.33e-07***	-2.95e-07***
REER	-1.82e-06***	-2.11e-06***	-1.58e-06***	-1.13e-06***	-1.83e-06***	-7.80e-07***	-1.29e-06***	-9.48e-07***	-1.94e-06***
GCF	-7.80e-08***	-8.43e-08*	-6.73e-08***	-2.45e-08***	-2.36e-08***	-2.34e-08**	-9.41e-09*	-1.02e-08	4.95e-08***
LAB	-2.28e-08***	-4.20e-08**	9.56e-08**	-2.96e-08***	-3.27e-08***	-1.80e-08	-5.61e-10	7.69e-11	-5.38e-08***
CPI	-4.53e-07***	-7.55e-07**	-1.35e-06***	-2.48e-07***	3.12e-07**	-1.29e-07*	1.81e-07**	-1.19e-07	5.50e-07***

***, **, and * indicate 1%, 5%, and 10% significance levels, respectively. Model 1, Model 2, Model 3 and Model 4, represent models with FI, FIA, FID and FIE, respectively. FIN is used as an indicator of financial inclusion, FIA is used as an indicator of access to financial services, FID is used as an indicator of depth of financial services and FIE is used as an indicator of efficiency of financial services.



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