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The Effect of Export Commodities Price Fluctuation on the Banking Sectors' Financial Performance of the Sub-Saharan African States

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Abstract:

This study examines the impact of export commodity price fluctuation on the financial sector performance in some selected sub-Saharan African (SSA) countries. The objective is to determine how instability in export commodity prices transmit to banking sector performance indicators in the region. Essentially a longitudinal study is conducted by combing annual time series data (1996 – 2018) for 18 sub-Saharan Africa countries that are resource exporter sourced from United Nations Conference on Trade and Development (UNCTAD) and World Bank database. The study adopts inferential, descriptive ex-post facto research design, using panel data covering the period 1996 to 2018 sourced from eighteen major primary commodity exporting countries in the sub-Saharan African states. Z-score to evaluate the probability of banking default. Oil price volatility is estimated using a GARCH data analysis framework in terms of mild volatility and intense volatility was applied to estimate the export commodity volatility while Z-score was used to profile the banking performance. It is found that intense commodity price fluctuations exert more debilitating effects on all banking sector performance indicators among the SSA countries with strongest effect of commodity price volatility on the banking sector performance being driven due to vulnerability of the banking sector. It is therefore recommended that banks evolve more efficient resilience mechanisms and that monetary and fiscal policy authorities should seek to enhance domestic capacity of the financial system to withstand domestic export commodity shock over time.

Keywords: Export commodities, volatility, financial performance, banking sector, Sub-Sahara Africa

1. Introduction

1.1. Background of the Study

African continent as a whole, particularly the Sub-Saharan states are tremendously naturally endowed in primary and mineral products. Historical insight into trends in primary commodity trades indicates that over 50% of the primary products traded in the global market between 17th and early 20th centuries could trace their sources to African regions. However, the regions' global share of merchandise trade has reduced over decades due to partly concentration on few primary and mineral products with volatile prices in the global markets, (Nahanga Verter 2016). Trends in primary commodity prices have been remarkable in terms of speed and dimensions of changes. This is because commodity price changes have not only deepened in the past few decades, the frequency of such changes has also become more rapid (Obadan & Adegboye, 2016; Hernaiz, 2018). For instance, the dramatic nature of commodity prices was reflected in the rapid rise between 2002 and mid-2008 which surpassed movements over several decades in terms of –magnitude, duration and breadth|| of price changes. Interestingly, the sharp and sustained improvement in the prices summersaulted into one of the hardest collapses in the history of oil following the advent of the global financial crisis in mid-2008. The global crisis was predominant and eventful given the virulence of the price movement the share number of commodities affected in the price drop. As is characteristic of the commodities market, global commodity prices recovered rapidly and strongly just a year after the disastrous fall. Indeed, many mineral and commodity prices reached an all-time high in early 2011, though oil prices were sluggish during the same period. Sizeable corrections occurred in May and August 2011, but since then prices have recovered. Moreover, Also, the burst in commodity prices that started in late 2014 has been quite prolonged and highly unpredictable. In macroeconomic terms, such wide large swings and fluctuations in prices can deliver strong adverse effects on economies – whether as net exporters or importers (Eberhardt & Presbitero, 2018). Basic

understanding of the market suggests that the fundamental factors that drove commodity price developments during the boom period included sharp rise in demand from newly industrializing economies coupled with a relatively sluggish supply response from producing economies. However, a new and recent development in relation to financial assets have begun to play important roles in this direction.

There is a rising level of correlation between commodity price movements and developments in the commodity derivatives markets for which financial investors are increasingly attracted to as an asset (UNCTAD, 2012). This development is being referred to as financialization of commodity markets and it has continued to dominate the world market. Thus, there appears to be a significant linkage between developments in the commodity markets and the financial markets which are strongly represented by the banking sector in developing countries, including the sub-Saharan African region. Commodity price movements have historically provided strong headwinds to both fiscal and financial activities especially in commodity-exporting countries of the sub-Saharan African region (Chuku, et al, 2018). It is expected that such scenarios could have consequences for the markets in the financial sectors, with the banks experiencing larger shares of the effects in terms of the quality of assets (Agarwal et al., 2017; Eberhardt & Presbitero, 2018). The effects can range from bank profitability to non-performing loans, as well as wider and longer-term effects like the probability of systemic banking crises which all tend to increase in the wake of negative commodity price shocks (Kinda et al, 2016; Abdulazeez et al, 2020). Indeed, such effects could be much stronger in commodity exporting countries in sub-Saharan African where there is high dependence on commodity revenues in relation to external participation. Another aspect to the scenario of deep fluctuations in commodity prices is the associated exchange rate crises which are quite rampant for many African economies. In a few economies where dollar demand is often high with attendant declining supply in periods of commodity price declines, exchange rate depreciations that often follow fluctuations could also increase banking sector vulnerabilities. Exchange rate depreciation tends to increase the values of dollar-denominated liabilities of the banks measured in local currency, thereby exposing banks to losses through rising debt service burden for unhedged borrowers. This is in addition to general currency mismatches that banks have to face (Kinda et al, 2016; Eberhardt & Presbitero, 2018). This indicates that there are more than one channels through which commodity price fluctuations may negatively affect banking sector performance in a country, especially where buffers are weak as in the cases of most sub-Saharan African countries

1.2. Statement of Problems

Given that fluctuations in commodity prices are not easily predictable, the banking sector is often exposed to sharp effects which also have unpleasant implications. Hence, for the commodity exporting countries, their business risks are sometimes associated with instability in the price of commodities in the international markets. Thus, the needs for more empirical settings in order to provide essential considerations for resilience building and long-term stability of the banking sectors on sub-Saharan African countries in the presence of persistent global commodities price volatility becomes inevitable.

In the same vein, both theoretical and empirical studies demonstrate that shocks emanating from commodity prices can effectively contribute to financial instability and fragility through a number of channels first place, the connection between commodity prices drop and export revenues for commodity-dependent countries and governments posed huge budget underperformance in the region which tend to adversely impact all economic agents by weakening their ability to meet debt obligations with the resultant weakening banks' balance sheet (Papyrakis and Gerlagh, 2004; Tiago et al, 2012; Kinda et al, 2016).

Secondly, volatility of export commodity prices has the tendency for exporters to increase demand for cash balances, destabilize decrease importing and exporting government cash reserve flows as well as trigger a surge in bank withdrawals by firms and governments, which could degenerate to liquidity constraints for the financial sector.

In the same vein, as is the case for Nigeria and other sub-Saharan African countries, commodity price shocks develop into currency crises due to mounting pressure on the domestic currency which could also lead to bank losses due to the foreign exchange translation and economic risks from net open foreign exchange positions in their balance sheets and unhedged banks' investment portfolios.

The frequency in deep fluctuations in commodity prices in the international market has generated a large spectrum of research in terms of the dynamic roles of unstable commodity prices on overall economic performance (Deaton & Miller 1995; 5 Dehn 2000; Kode, 2002; Medina & Soto, 2016; McGregor, 2017; Chuku, 2018) as well as domestic financial conditions (Arezki & Brückner, 2012). However, the literature lacks a systematic empirical analysis of the impact of particular commodity price shocks on the financial sector of commodity exporters from the sub-Saharan region. Hence, the need to evaluate the linkage between the financial sector driven performance and the export commodities price fluctuation is aptly demonstrated by this study.

1.3. Objectives of the Study

The study broadly investigates the effects of export commodity price fluctuations on the performance of the banking sectors in the sub-Saharan African countries with specific focus on the link between banking sector fragility, profitability as well as liquidity and export commodity price volatility within the selected sub-Saharan African.

1.4. Research Hypotheses

In order to actualize the afore stated objectives of this study, the following hypotheses are empirically tested as follows:

- Commodity price fluctuations have no significant effect on the credit supply of banks among sub-Saharan African countries.
- Commodity price fluctuations do not significantly affect bank profitability among sub-Saharan African countries.
- There is no significant impact of commodity price fluctuations on banks' non-performing loans in sub-Saharan African countries.
- Commodity price fluctuations have no significant impact on the probability of bank default among sub-Saharan African countries?

1.5. Scope of the Study

This study adopts a panel data study of some selected Sub-Saharan African countries that are primary resource exporters for the period between 1996 and 2018. This scope encompasses the period of export commodity price instability, global export commodity boom, as well as global financial sectors crisis.

1.6. Structure of the Study

The study is structured into four sections. Background of the study, introduction and problem statement are covered in section one, the literature, empirical and theoretical reviews are covered in section two. Section three captures all the methodology and modeling procedure while Data analysis, discussion of findings recommendations and conclusion are covered in section four.

2. Literature Review

2.1. Conceptual Framework

2.1.1. Banking Performance and Stability

The definitions of measurement of banking sector performance and stability are numerous in literature UNCTAD, (2012) demonstrate that banking sector stability indicates absence of system-wide episodes in which the banking system fails to function and this further defines how resilient the banking system is to imposed stress. In particular, banking sector performance and stability indicators 'show the extent to which a financial system can be self-sustaining over time and may continue to operate even in the midst of direct and indirect influences from different kinds of shocks' (Kinda et al, 2012). Apparently, the absence of the capabilities stated above would indicate banking sector fragility. In general, banking sector fragility is better defined by considering its measurements. According to the World Bank (2013) a stable banking system is one that efficiently allocates financial resources from the surplus to the deficit units and is capable of effectively identifying or handling financial risks. The system is also able to have the capacity to dissipates any imbalances in the financial books such as its balance sheets.

The common measures of stable and efficient banking sector indicators are presented and how stability problems can be easily identified based on these measures. Given that the banking sector contains several indices in terms of monetary aggregates, rate structures, risk components, and internal adequacy compass, there is need to apply certain amount of caution in the definitions. All the proxies used in the Table highlight the problems within the banking sector and can also estimate the cost of any form of banking crises in the economy, (Gadanecz & Jayaram 2010)

More broadly, the soundness indicators of the sub-Saharan African (SSA) banks appear to be healthier when exported commodity prices are in boom (Amidu and Wilson, 2012). For instance, for a total of 20 (including Nigeria, Kenya, Namibia and Ghana) that published the indicators in 2013, profitability measures were high, while the risk components were sufficiently low. This was not the case for many of the banks during the 2008 financial sector shocks that most African countries experienced. There is therefore no strong indication that such financial soundness indicators are also up during periods of terms of trade weaknesses.

Exported Commodity Price Fluctuations: Fluctuations or volatility of commodity prices can be defined as the rate or speed at which the price of a commodity changes along a given trajectory over a given period (Obadan & Adegboye, 2016). It is expressed as a percentage and either calculated as a periodic standard deviation bounds or estimated using specific statistical procedures. The strength of volatility can be determined by observing the magnitude of the change (or the size of the amplitude) as well as the frequency of the changes over time (UNCTAD, 2012). According to Mabro (2000) any form of trading is processed by considering volatility. This implies that volatility of prices is significant for expressing hedging activities and making any form of profit on price trading. However, the essence and implications of volatility does relate to trading processes or hedging activities alone. For instance, Mabro (2000) notes that when commodity prices are volatile, revenues from oil exports are affected and fiscal planning of the commodity exporting countries are distorted. Moreover, it should be noted that price fluctuations can generate instability on a wide front in the economy, including domestic price 16 indicators, investment activities (both private and public) and overall development process of the economy (UNCTAD, 2005). The Organization for Economic Co-operation and Development (OECD) in their 2004 outlook listed some drivers of commodity price fluctuations and volatility which include: 1) Strong Demand for commodities: 'Pressures from commodity demand tends to push commodity equilibria in the commodity markets, thereby leading to short term fractions that may drive prices up or down'. The demand for commodities is often either underestimated or overestimated by the users thereby leading to 'rigorous investment cycles' that unsettle commodity markets. 2) Inability of primary commodity producers to respond to supply shocks. For instance, the supply of crude oil in the global market is largely influenced by a cartel which is OPEC and not the productive capacity of the economy. 3) Low commodity industry inventories: This relates to the forward cover provided in the markets for commodities. With lower industry margins from

suppliers, the market is exposed to potential disruptions and adjustment bottlenecks over time. 4) Transportation bottlenecks: Transportation bottlenecks seem to put upward pressure on commodity transportation rates with likely consequences for its prices. 5) Geopolitical tensions: Geopolitical tensions and uncertainty increases the 'risk premium' to commodity prices. The fluctuations in commodity-based asset prices have been a growing area of research. In terms of its measurements, time series processes are employed such as variance, range, and standard deviation. However, modern development in statistical analysis has evolved the analysis of volatility using more complex framework like the autoregressive conditional heteroskedasticity (ARCH) models and other time series autoregressive processes.

Banking/Financial Sector Dynamics and Commodity Price Movements: Apparently, international financial occurrences arising from shocks in asset prices have its own special requirement for optimizing its benefits in domestic financial markets. In a useful approach to this problem, Kose et al. (2009) highlight four segments of the economic structure in modern analysis which may influence the level of protection a domestic financial market can reap during commodity price fluctuations. These are (i) the extent of development and regulation of the financial sector, (ii) the quality of institutions in a country, (iii) the pattern of macroeconomic policy-making and direction, and (iv) the degree of international trade openness. Obsfeld also highlighted two basic aspects in which the marginal international price vagaries can raise potential new problems: • Regulatory processes that may result in end-runs that may lead to evasion of international transactions. • Currency mismatch which exacerbates the risk of imbalance in currency positions, which can create more systemic risk in the entire financial market or the economy. The implications of currency mismatch can be related to depreciation in domestic currency arising from sharp fall in commodity prices. For the banking sector, these effects can be considered through situations of domestic banks. Any sharp or massive depreciation of the naira against the dollar can affect banks whose loans are highly denominated in dollars. In such a case, as Kose et al. (2009) noted, the currency risk taken on by the companies in th

Mesters (2008), noted that –the traditional application of efficiency analysis to banking does not allow bank production decisions to affect bank risk, which rules out the possibility that scale- and scope-related improvements in diversification could lower the cost of borrowed funds and induce banks to alter their risk exposure. Also, much of the traditional literature does not account for the bank's role in producing information about its borrowers in its underwriting decisions when specifying the bank's outputs and inputs. On the other hand, Mesters (1992), showed that banks' monitoring and screening role can be accounted for by –measuring bank output treating loans purchased and loans originated as separate outputs entailing different types of screening, and treating loans held on balance sheet and loans sold as separate outputs entailing different types of monitoring.

2.2. Theoretical Literature Review

2.2.1. Structure-Based Theory of Bank Performance

This theory presented two main approaches or perspectives for measuring performance of financial intermediating companies. The first is a non-structural approach and the second is the structural approach (Hughes and Mester, 2013). The non-structural considers performance in relation to the investment patterns of the banks as well as the capacity for corporate governance. This approach therefore indicates that it is the non-structural factors of the banks in terms of its governance and control systems which in turn influence investment strategies, that are important. This case is also related to the role of external shocks on performance since investment is highly susceptible to macroeconomic conditions (Obadan and Adegboye, 2016). On the other hand, structural approach is more of a 'choice-theoretic' perspective that considers the optimizing conditions of the banks (Hughes and Mester, 2013). Here, all factors, both internal and external are critical for influencing bank performance at any given time.

Thus, the structure-based theory of bank performance looks at both the cost and output aspects of the banking system as explaining bank performance. In this direction, Hughes, Mester, and Moon (2001) observed that if risks on returns which are inherent in bank risks are ignored, there may be more motivation for non-financial firms, but for financial institutions, return risk plays an essential role in maximizing the discounted flow of expected profits. In this case, the theory postulates that banks will consider both the return and the risk conditions to choose the optimal path for sustaining performance. Indeed, the bank with high-valued investment opportunities would more likely focus on less cost-minimizing activities such as engaging in foreign exchange activities.

2.2.2. Banking Crisis Theoretical Review

The theoretical formulations on bank crises in terms of weak performs generally indicate that bank crisis or failure may arise from a number of reasons. In the literature, the theoretical formulations involve the roles of institutional factors (including firm-level and macro), management activities, risk, or environmental factors that serve as risks to the banks. Hooks (1994) developed a theoretical base to observe that deteriorating local economic condition (e.g., inflation, interest rates, and exchange rates) have led to bank failure in advanced economies. In the theory, macroeconomic factors may appear in the form of 'sudden adverse movements in a country's terms of trade and sharp fluctuations in world interest rates, real exchange rates and inflation rates'. These raise the cost of providing financial services, especially in less developed economies. 'When regulations are weak, such shocks tend to aggravate within the financial sector and impose strong constraints on lender-investor relationship. Thus, such constraints arising from shocks decreases banking sector activities and expose the banks to systemic failure over a period of time'.

How does macroeconomic instability arise? Hempel and Simonson (1999) emphasized in their theory that such destabilized macroeconomic environment arise from external shocks that are independent of domestic economic activities. The aggravated macroeconomic environment then produce factors that exert frictions on the financial markets,

thereby creating short term risks for banks. In this process, the main activity of bank management is not deposit mobilization and giving credit. However, when credit administration is more effective and efficient, the risk of customer default in times of shocks can be reduced significantly (Hooks, 1994, p.21) Thus, the model concludes that 'competitive advantage of a bank is dependent on its capability to handle credit risk valuably since bad loans cause bank failure'. Thus, the model highlights the central role of macroeconomic shocks to bank performance and overall failure in an economy.

Other theoretical bases for bank performance weakness and failure include the presentation by Kindleberger (1989) who stated that over-investment is directly related to high risk-taking and this causes bank failure. This is because some 'employees disregard laid down procedures and rather work according to instructions from certain areas. In some cases, a worker of a Credit Department of a bank obtains signatures from every member of the loan committee in irregular ways sanctioning a loan'. The model by Hempel and Simonson (1999) mentions that loans to the 'energy producers and commercial real estate developers are strong risky investments, especially when the economy is good and the lending decision is based on improper projection'. White (1993, p.12) adds that 'the failure of banks is mainly due to risky credits they give'. In the theory, there are always some forms of default by borrowers in the banking sector due to the state of economies. However, efficient management of credit in the banking system will help resolve any form of bank risk arising from default.

2.2.2.1. The Supply Shock-Lending Channel Theory of Bank Performance

This theory was developed by Kashyap and Stein (2000) and expanded and demonstrates that swings in global price of exported commodities can impact bank output as well as real domestic activities directly by changing the margins of exporters. This means that when commodity export price drops, the profits of exporters will be negatively affected with string implications for domestic investment activities. Such decline in domestic investment would in turn, have negative impacts on the banking sector by reducing their own performance. The theory is based on the assumption of a strong financial intermediation processes in the economy. Thus, the shock from external sector will initially lead to a lower demand for credit. The theory refers to this as the direct effect of shocks resulting from decline in the price of export commodities.

The bank lending channel also has indirect effects. 'When there are price shocks, governments fall back on payments, leading to rising arrears. The private sector also tends to default as a result of weak revenue growth of commodity dependent firms thereby rendering these firms unable to service their loans'. This worsens the quality of bank asset (as loans) and also eventually erodes capital. Thus, bank assets would tend to and the capacity of the banks to lend would also be negatively impacted (Gambacorta and Shin, 2016). The bank-lending channel of commodity price effect is demonstrated in the following Chart in Figure 1. The channel is through fall in revenues and profits of both private and government sectors, leading to decline in aggregate demand as well as capacity of banks to render loan services.

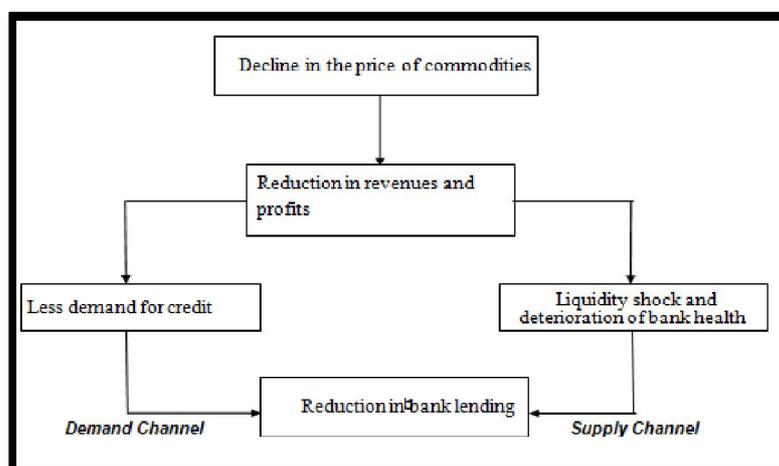


Figure 1: Commodity Prices and Bank Lending, Transmission Channels
Source: Authors Creation

Hempel and Simonson (1999) emphasized in their own theory that such destabilized macroeconomic environment arise from external shocks that are independent of domestic economic activities. The aggravated macroeconomic environment then produce factors that exert frictions on the financial markets, thereby creating short term risks for banks. In this process, the main activity of bank management is not deposit mobilization and giving credit. However, when credit administration is more effective and efficient, the risk of customer default in times of shocks can be reduced.

Thus, the model concludes that competitive advantage of a bank is dependent on its capability to handle credit risk valuably since bad loans cause bank failure.

Kindleberger (1989) in his investigation of drivers of banks' crisis stated that over-investment is directly related to high risk-taking and this causes bank failure. and this is because some employees disregard laid down procedures and instructions their findings corroborated Hempel and Simonson (1999) models which identified loans to the energy

producers and commercial real estate developers are strong risky investments, especially when the economy is good and the lending decision is based on improper projections.

2.3. Empirical Framework

Most studies on commodity price shocks effects have focused on how commodity price movement relates to the economy at large or its real aggregates. In this study, we consider this literature from which inferences can be drawn on the possible effects of oil price fluctuations on the financial system and the banking sector for the economies.

Loungani (1986) evaluated the effect of USA export commodity prices changes on their economy using quarterly data between 1947 and 1982 and found that fluctuation in commodity prices volatility tend to lead to reduction in domestic investment in the United States. In another research for the US economy, Davis et al (2003) found that shocks to oil prices explain long terms shifts in labour market and real sector investment by firms. In line with the findings of the 'dispersion hypothesis', Long and Plosser (1987) in a study for the US economy also had evidence of commodity price instability delivery strong impacts on industrial growth and development.

In relation to the entire economy, Deaton and Miller (1995) have found that for advanced economies, sharp declines in commodity prices appear to significantly undermine the overall performance of the economy in the short run. In the same vein, Deaton (1999) found results those sharp declines in commodity prices in the global market negatively affected economic growth among 35 Sub-Saharan African countries that are large commodity exporters. The study demonstrated that ex-ante price uncertainty in the commodity market does not affect economic growth, rather actual realization of negative shocks is responsible for economic performance changes.

In their own study, Bruckner and Ciccone (2010) also found that shocks in commodity prices lead to declines in GDP growth and were responsible for political instability in many Sub-Saharan African countries for up to three decades. From another perspective, Villafuertes and Lopez-Murphy (2010) found that the pattern of fiscal responses to the 2009 commodity prices crisis was not in a counter-cyclical form because the adjustments that followed the decline in prices were more of reduction in expenditures. This also had implications on the financial markets in the countries, with declines in current expenditures taking a stronger hit in terms of fiscal adjustments.

Omojolaibi and Egwaikhide (2013) used quarterly data over the 1990 to 2010 period to investigate dynamics in oil price movements and the fiscal macroeconomic implications for a group of African economies. The study employed the panel vector autoregressive technique in the analysis of five major oil exporters. Within the PVAR structure, oil price volatility, real GDP, fiscal deficit, total investment, and money supply were accounted for. They study found that oil price instability negatively affected domestic investment as well as the financial liquidity among the focused economies.

The role of commodity price movements in fiscal management and overall output cycles has also been found to be a major channel through which commodity price fluctuations relate to other aspects of the economy is through government fiscal positions in terms of government fiscal resilience against fiscal shocks as well as resilience of the banking sector to such shocks.

Kashyap & Stein, 2000), investigated the fiscal implications of commodity price fluctuations by linking the pro-cyclicality of fiscal policy to the weakness in expenditure controls that prevent governments from saving revenue windfalls in good times. They stated that weak expenditure control is rooted in ineffective budget procedures and execution, agency problems involving pressures from players to dissipate all forms of windfalls, and common pool problems (Tornell & Lane, 1999, Adegboye, 2015).

Similarly, Sturm, Gurtner and Alegre (2009) provided empirical analysis on the pro-cyclicality of fiscal policy for a panel of nineteen oil-exporting countries between 1965 and 2005 using the Generalized Methods of Moments techniques. Their results showed that pro-cyclical behavior of fiscal policy over the whole period 1965-20 05 seemed to have been more pronounced in later years. It has long been believed that commodity price variability causes problems for primary producing developing countries, but there is less agreement about which particular manifestations of commodity price movements matter to exporting countries. But Calderón et al. (2017), however found that in recent years, resource rich economies in Sub Saharan Africa have not been correlated with pro-cyclicality of government consumption. This outcome was attributed to the improved governance procedures for fiscal policy making in those countries.

Medina (2010) estimated the dynamic effects of commodity price shocks in a group of Latin American commodity-exporting countries using quarterly datasets. The results indicate that Latin American countries' fiscal positions react strongly to shocks to commodity prices with marked differences across countries in terms of income level and that institutional arrangements improves efficiency of fiscal policies in these countries.

Obadan and Adegboye (2013) examined the linkages between unstable oil prices, fiscal operations and the pursuit of macroeconomic stabilization in Nigeria within a dynamic framework and using the Structural vector autoregressive models (SVAR) for the period 1981 to 2012. They found that oil price fluctuation exerted long-run effects on revenues which rendered fiscal policy less efficient in delivering stabilization impact in the economy.

Lopez-Martin et al. (2019) examined the role of commodity price instability on fiscal policy by considering the interactive effect of risk management within a dynamic stochastic framework for a small open-economies with sovereign default. They found that commodity revenues increase government expenditures and tends to lessen tax rates. Thus, unless price risks are well managed, commodity prices will effectively stimulate inefficient fiscal operation for the resource-rich economy. These strands of research have shown that if strong institutions are available, the effects of commodity price fluctuations on fiscal management can be mitigated over time.

2.4. Commodity Price Fluctuation and Banks' Performance

The literature on the relationship between shocks or fluctuations in export commodity prices on the banking sector performance is rather limited, especially for sub-Saharan African countries.

Srinivan and Dillon (2015) examined the impact of commodity lower prices on domestic banks and found that many areas of a bank's business might feel the effects, either directly or indirectly, although a greatly through their lending market. Managing concentration lending challenges resulted because banks highly concentrated in direct loans to the oil industry (especially to upstream companies) which are obviously highly exposed to risks.

In a study by the European Central Bank (2015), it was found that the upheaval in the oil market in mid-2014 had a net impact on the global economy, including banks operations. Such linkages were found to comprise the exposure investment and ownership channels, including petrodollar flows in the form of debt and equity funding.

Fanizza (2009) examined the relationship between oil price shocks and bank profitability for 145 banks in 11 oil-exporting countries in the Middle East/North Africa (MENA) over the period 1994 to 2008, by testing whether the effects were direct or through a channels. The direct impact of oil price fluctuations on bank profitability were found as evidence while indirect impacts were also found to be macroeconomic and institutional based variables as investment banks appeared to be the most affected ones compared with the Islamic and commercial banks. For the same region. Hesse and Poghosyan (2009) explored how oil price instability influenced banks performance by considering most of the banks in the MENA region over a period of time. The study found that the impact of commodity price shocks on the banking system were only indirect way (through the macroeconomic channels), rather than direct.

In another study to analyse the relationship between oil prices and banks' profits, Poghosyan and Heiko (2009) used the data of 145 banks in eleven oil-exporting countries in the middle East during the period (1994-2008) to test the hypotheses about the direct and indirect impacts of oil price fluctuation on banks' profits. The study concluded that oil prices fluctuation affected banks' profits and financial performance for the countries and investors in banks were mostly affected. Similarly, IMF (2015) examined the pattern of effects of oil prices on the real and financial sectors in the Gulf Countries (GCC). It also investigated the risks to financial stability that may arise from swings in oil prices, although sizable financial sector buffers provide a significant cushion. It was found that the dependence on oil by the Gulf countries created structural risks from high concentration and interconnectedness within the GCC financial system.

In the same vein, International Bank for Settlement (2015) conducted a study on the ramifications of declining oil prices for banking sector performance through the channels of government fiscal positions and expenditures as well as domestic spending capacities in the Kuwait economy. The banking sector variables considered included the quality of banks' lending behaviour, the direction of deposit changes, and overall performance of the banking system. The study found that for Kuwait longer periods of oil price declines tended to reduce government spending capacity, with negative outcome for loans and deposits in the banking sector.

Said (2015) also examined how oil price instability affected bank efficiency for a sample of 32 Islamic banks in countries of the Middle east/north Africa region. Their result shows that the two variables had no direct relationship and that the underdeveloped nature of the banking system in Middle east/north Africa countries affected the positive results through inefficiencies.

Kinda, Mlachila, and Ouedraogo (2016) examined the impact of shocks to commodity prices on the banking and financial systems of a group of commodity exporters among emerging and developing economies. They found that 'negative shocks to commodity prices tend to weaken the financial sector, with larger shocks having more pronounced impacts by stimulating the rate of non-performing loans and extending overheads for the banks'. It was also found that banks in these economies became prone to crises as a result of sharp declines in commodity prices.

Moreover, Agarwal, Duttagupta and Presbitero (2017) investigated the how bank lending channel develops when there are strong fluctuations in commodity prices, especially regarding credit aggregates for the banking systems of 78 developing countries. The study found that relative declines in commodity prices led to sharp reduction in bank lending both in terms of capacity and willingness. It was also shown that banks with relatively lower deposits and poor asset quality are more prone to rapidly transmit variations in commodity prices to their lending systems, which corroborates the hypothesis of credit supply channel for commodity price shock effects in the banking system for developing countries

Most importantly, the study found no evidence of a strong or significant variation in the response of domestic or foreign banks which is attributed to the adaptation of foreign banks into the banking and financial systems of developing countries

Presbitero, Agarwal and Duttagupta (2020) examined the sensitivity of commodity price movement to banks performance using data for a group of developing countries to demonstrate that 'banks that are more sensitive to commodity prices experience a larger fall in retail deposits and a larger increase in non-performing loans when commodity prices fall'. In line with this, their study showed that smaller of banks with lower capacity experienced more severe contraction in lending when there were shocks to commodity prices. Like the previous studies, Presbitero et al., (2020) also found that it does not matter the type of banks considered (foreign or domestic banks), the response to commodity price shocks is primarily similar. They also explained this finding by noting that 'regional' foreign banks are prevalent in developing countries which tend to be locally incorporated with heavy reliance on retail funding as with banks with domestic origins.

Osuagwu (2014) investigated the determinants of bank performance in Nigeria, using bank-specific and macroeconomic indicators for a large sample bank in Nigeria. The study found that internally generated factors that relate to operational capacity and governance as well as credit risks are the most important drivers of performance. There was also evidence that market concentration affected profitability of the banks while the naira exchange rate was found to

affect both return on equity and non-interest margin. Thus, shocks that influence exchange rate, such as commodity price falls can also indirectly affect bank performance in Nigeria.

Similarly, Amidu and Wilson (2014) investigated the place of globalization and quality institutions in the promotion of efficient bank competition using a sample of 330 banks in 29 sub-Saharan African countries. The results suggested that better institutional framework improved bank competition, while globalized financial markets tended to significantly limit performance of the banks. The study therefore showed that a globalized financial market will only promote bank competition among sub-Saharan African economies.

3. Methodology

3.1. Research Design, Population, Sampling Techniques and Scope of the Study

The study adopts a longitudinal and inferential research approach using secondary panel data from a population of 46 countries that are commodity exporters. Stratified and purposive sampling technique are applied in selecting a sample of 18 major commodity exporters from the target population of 33 out of 46 commodity exporting sub-Saharan Africa countries. This technique involved initially stratifying the sub-Saharan Africa countries into commodity exporting or non-exporting, then a purposive sampling procedure where countries with available data is selected and was later applied. This technique essentially tends to minimize bias and provide ample opportunity for effective representation. According to Kothari's (2004), a sample of 10% to 30% is often sufficient to represent the population when macro-level data is being employed as in the case of this study.

The co-movements of financial sector activity indicators with commodity prices over a period of 22 years is considered for a group of selected sub-Saharan African countries. These countries are the major commodity exporters in sub-Saharan African (UNCTAD, 2019) and hence, they are the ones that should experience the greatest supply-based effects arising from shocks in the international commodity markets.

3.2. Nature and Sources of Data for the Study

Data used in this study comprises of cross-sectional and time series annual data for each of the sampled commodity exporting countries in sub-Saharan African which included the following countries: Angola, Botswana, Burundi, Cameroun, Chad, Gabon, Gambia, Ghana, Kenya, Madagascar, Mauritius, Mozambique, Nigeria, Senegal, South Africa, Tanzania, Uganda and Zambia. Essentially, these are the countries that constitute the main commodity exporters in the sub-Saharan African region according to the UNCTAD 2019 Report for the period from 1996 to 2018. Data on commodity prices are obtained from the IMF World Financial Statistics (IFS) database. Data on country series for the banking sector performance are obtained from the IMF Financial Structure Database which contains a wide range of financial data collected for several countries. Other data used as controls in the study will be obtained from world bank development indicators

3.3. Model Specification

The modeling in this study is based on the objectives of the study. Apparently, modeling commodity price effects on banking sector performance will have to take different experimental procedures which we focus on in this section. In general, the objectives of the study relate to risks from international commodity price shocks and banking sector variable movements. On this basis, the methodology of Hughes and Mester (2011) will be adopted in the study to measure mean scale economies on the value maximizing expansion path for banks in selected countries. The general form of model to be estimated involves bank performance function general form below: $PB_t = \gamma_0 + \gamma_1 RISK_t + \gamma RISK_t^2 + \beta X_t + \varepsilon_t \dots \dots \dots$ (3.1) Here, we argue that the risk is emanating from commodity price fluctuation in the international market. The square of the risk variable indicates a sharp shock to commodity prices.

3.3.1. Objective One

Investigate the cost of declining commodity prices on the banking sectors fragility among sub-Saharan African countries.

Banking fragility is measured by the share of banking sector credit to private sector in total output in the economy. Hence, the model specified for this objective shows relationship based on the structure in Equation (3.1) as:

$$BCP_{it} = \alpha + \beta_1 CPF_{it} + \beta_2 CPF_{it}^2 + \sum_{m=1}^m \gamma_m X_{m,it-1} + e_{it} \dots \dots \dots (3.2)$$

Where BPC is the banking sector credit ratio and CPF represents commodity price fluctuation. Also, $X_{m,t-1}$ denotes a vector of control variables of interest at time, t-1. The reason for using t-1 is based on the fact that previous activities are expected to affect current performance indicators of the banking system. Moreover, e_t stands for the error term, i represents the individual countries and t represents time. It is expected that commodity price fluctuation negatively affects banks' ability to supply loans. Hence, the parameter, β is expected to have a negative sign. The measures of financial soundness indicator included in the model is ratio of bank credit to total private sector credit. The vector of control variables includes interest rate (the monetary policy rate), exchange rate, inflation, m2/reserve ratio, real GDP per capital growth, fiscal deficit to GDP ratio, and institutional quality to capture the effect of fiscal stance of government. In its expanded form, six equations are specified for estimation in the relationships as:

$$BCP_{it} = \beta_0 + \beta_1 CPF_{it} + \beta_2 CPF_{it}^2 + \beta_3 MPR_{it} + \beta_4 EXRT_{it} + \beta_5 INFL_{it} + \beta_6 GRGDPPC_{it} + \beta_7 FDR_{it} + \beta_8 FDEP_{it} + \beta_9 INST_{it} \dots \dots \dots (3.3)$$

Apriori expectations: $\beta_1, \beta_2, \beta_4, \beta_5, \beta_7 < 0$; $\beta_3, \beta_6, \beta_7, \beta_8, \beta_9 > 0$

Where

MPR = interest rate (the monetary policy rate);

EXRT = exchange rate;

INFL = inflation rate,

FDEP = broad money/reserve ratio,

GGDPPC = real GDP per capital growth; and

FDR = fiscal deficit to GDP

INST = institutional quality

3.3.2. Objective Two

To assess the effect of commodity price fluctuation on bank profitability among sub-Saharan African countries.

For this objective, the measures of bank profitability (PROF) are return on asset (ROA) and return on equity (ROE). The model is specified in compact form as:

$$PROF_{it} = \alpha + \beta_1 CPF_{it} + \beta_2 CPF_{it}^2 + \sum_{m=1}^m \gamma_m X_{m,it-1} + e_{it} \quad (3.4)$$

All the variables are as defined earlier. Thus, the expanded form of the model is:

$$PROF = \beta_0 + \beta_1 CPF_{it} + \beta_2 CPF_{it}^2 + \beta_3 MPR_{it} + \beta_4 EXRT_{it} + \beta_5 INFL_{it} + \beta_6 GRGDPPC_{it} + \beta_7 FDR_{it} + \beta_8 FDEP_{it} + \beta_9 INST_{it} \quad (3.5)$$

Apriori expectations: $\beta_1, \beta_2, \beta_4, \beta_5, \beta_7 < 0$; $\beta_3, \beta_6, \beta_7, \beta_8, \beta_9 > 0$.

3.3.3. Objective Three

To examine how commodity price fluctuations affect banks' non-performing loans in sub-Saharan African countries.

The measure of non-performing loans is the ratio of non-performing loans to total loans disbursement (NPL).

The model is compactly specified as:

$$NPL_{it} = \alpha + \beta_1 CPF_{it} + \beta_2 CPF_{it}^2 + \sum_{m=1}^m \gamma_m X_{m,it-1} + e_{it} \quad (3.6)$$

All the variables are as defined earlier. Thus, the expanded form of the model is specified as:

$$NPL_{it} = \beta_0 + \beta_1 CPF_{it} + \beta_2 CPF_{it}^2 + \beta_3 MPR_{it} + \beta_4 EXRT_{it} + \beta_5 INFL_{it} + \beta_6 GRGDPPC_{it} + \beta_7 FDR_{it} + \beta_8 FDEP_{it} + \beta_9 INST_{it} \quad (3.7)$$

Apriori expectations: $\beta_1, \beta_2, \beta_4, \beta_5, \beta_7 < 0$; $\beta_3, \beta_6, \beta_7, \beta_8, \beta_9 > 0$.

3.3.4. Objective Four

To assess the role of commodity price fluctuations on the probability of bank default among sub-Saharan African countries.

The measure of bank default is the Z-score which shows the soundness of a bank at a given period. More specifically, we estimate the following equation for risk of banking default model:

$$Z_score_{it} = \alpha + \beta_1 CPF_{it} + \beta_2 CPF_{it}^2 + \sum_{m=1}^m \gamma_m X_{m,it-1} + e_t \quad \dots \dots \dots (3.8)$$

Where Z-score is the banking sector default measure and CPF represents commodity price fluctuation. Thus, the expanded form of the model is specified as:

$$NPL_{it} = \beta_0 + \beta_1 CPF_{it} + \beta_2 CPF_{it}^2 + \beta_3 MPR_{it} + \beta_4 EXRT_{it} + \beta_5 INFL_{it} + \beta_6 GRGDPPC_{it} + \beta_7 FDR_{it} + \beta_8 FDEP_{it} + \beta_9 INST_{it} \quad \dots \dots \dots (3.9)$$

Apriori expectations: $\beta_1, \beta_2, \beta_4, \beta_5, \beta_7 > 0$; $\beta_3, \beta_6, \beta_7, \beta_8, \beta_9 < 0$.

3.4. Model Estimation Techniques

The relationships specified in the equations of the models are direct and a uni-directional in terms of the main variables of the study (commodity prices and banking performance). Hence, the problem of endogeneity does not arise in the models since commodity price (the main independent variable) is exogenously determined in the model (i.e., the price fluctuations are not caused by any internal financial factors in the exporting countries). There is therefore no risk of mis-estimation of the models when an ordinary Least Squares (OLS) estimation procedure is applied in the analysis (Greene, 2011).

Hence for the equations in this study, the Panel Data Regression Framework will be adopted in the estimation. In this analysis, the mean relationship is estimated using the fixed-effects technique (that assumes country-specific time-varying influences in the relationship) or the random-effects technique (that integrates the country-specific factors within the common intercept). The choice of the technique to adopt is based on the empirical test provided by Hausman which has a null hypothesis that the random-effects procedure does not represent the proposed relationship. If the Chi-Square coefficient from the Hausman test is significant, then the fixed-effects estimation is adopted for the relationship.

3.5. Preliminary Tests (Tests of Time Series and Cross-Sectional Properties of Data)

3.5.1. Panel Unit Root Tests

The panel unit root test is conducted for all the variables employed in the empirical analysis. A series is said to be integrated of a particular order if it has to be differenced according to that order for it to be stationary. This implies that variables that do not require differencing in order to attain stationarity are said to be stationary in level. Essentially, the order of integration of the panel variables (panel unit root testing) is ascertained as a prerequisite. To provide robustness and exploit the additional information in the cross-sectional dimension of the data, the study employs several panel data unit root tests. The general form for testing unit root for panel data analysis may be given as:

$$\Delta y_{it} = k_i + \alpha y_{it-1} + \sum_{j=1}^x \varphi_{ij} \Delta y_{it-j} + \epsilon_{it} \quad (3.10)$$

$$\Delta y_{it} = k_i + \alpha y_{it-1} + \beta t + \sum_{j=1}^x \varphi_{ij} \Delta y_{it-j} + \epsilon_{it} \quad (3.11)$$

Where the subscript $i = 1, 2, 3, \dots, N$ indexes the countries, y is the series of interest, α is the indicator of serial correlation, ϵ is a white noise term.

For this study, the panel unit root tests proposed by Levin, Lin & Chu [LLC], (2002) and Im, Pearn & Shin [IMP] (2003) are used in the testing for unit rousing the. panel versions of the Augmented Dickey-Fuller (ADF) test.

3.5.2. Panel Cointegration Test

Once the stationarity test is established, we will next test the long run relationships among the variables. There is a number of equations to be estimated in the study, hence the tests were being conducted on a model-by-model basis. This test was carried out to check for the presence of cointegration. The Panel Cointegration tests formulated by Pedroni (1999), and Kao (1999) were utilised.

3.5.3. Cross-section Dependence Test

Another important data property test that is conducted in this study is the test for the cross-sectional dependence of the datasets used. This will help to disentangle the crucial issue of cross-sectional dependence in the data or situation where individual country characteristics drive the overall direction of relationships using both the Pesaran (2007) dependency test and the Breusch and Pagan (1980).

3.5.4. Operational Variables

The dependent variables used in the model are defined and explained in this section, along with the measurements and direction of effects.

3.5.4.1. Dependent Variables

- **Bank Fragility:** this is a measure that shows the level of soundness or otherwise of the banking system and is measured by of total credit to the private sector (BPC) that comes from the banks, (World Bank 2013),
- **Ratio of non-performing loans (NPL):** proportion of bank loans that have become bad debt. The ratio is usually higher during bank crisis and is usually as a result of poor management decisions. High NPLs suggest weaker financial sector.
- **Bank Profitability:** This will be measured by both the return on equity (ROE) and return on Asset (ROA) of the banks. These measures capture firm-level characteristics of the bank profitability in terms of operational and financial efficiency.
- **Bank Default:** refers to the probability systems that the banking sector will experience some form of default. This is captured by the Z-score which is a common measure of stability at the level of individual institutions and it captures the statistical probability of default of a country's commercial banking system (Mlachila & Ouedraogo, 2017).

3.5.5. Explanatory Variables

- **Commodity price fluctuation (CPF):** In this study therefore, commodity price fluctuation employs a univariate exponential generalized autoregressive conditional heteroskedasticity (EGARCH) technique to generate fluctuations. This method is superior since it highlights and internalize the effects of information on past price movements in current fluctuations (Adegboye, 2013). The EGARCH specification for the generation of fluctuations is as follows:

$$cprice_t = \alpha_0 + \alpha_1 cprice_{t-1} + \epsilon_t \quad (3.12)$$

$$\sigma_t^2 = \omega + \beta \epsilon_{t-1}^2 + \delta \sigma_{t-1}^2 \quad (3.13)$$

Where $cprice$ is the price of the commodity, σ_t^2 is the variance of ϵ_t conditional upon information up to period t . The fitted values of σ_t^2 are the conditional variances and they will be used as measure for commodity price volatility.

- **Interest rate (MPR)** is proxied by the monetary policy rate, which is expected to show the pattern of financial system in the country.
- **Exchange rate (EXRT)** is the per dollar cost of the country's currency, which is critical measure of the pass-through of commodity price effects on the economy and the banking sector.
- **Inflation rate (INFL)** is the annual change in the aggregate price over the years, and it shows macroeconomic stability in the country of interest.

- M2/reserve ratio (FDEP): is the ratio of broad money to total bank reserves in the country, and it indicates the level of financial sector development in a country.
- Real GDP per capita growth (GRGDPPC): is the annual growth rate of real per capita GDP.
- Fiscal deficit to GDP ratio (FGDPR): is used to capture the effect of fiscal stance of government.
- Institutional Quality: This is a critical measure for gauge the institutional environment on which the banks operate in the different countries. The two measures are control of corruption (COR) and government effectiveness (GEFF).

4. Data Analysis, Presentation and Interpretation

4.1. Preliminary Analysis

The analyses of the estimated models as well as the preliminary tests of the data used in the model are presented in this section

In Table 1 below, we present the time series properties of monthly commodity prices for the sample period. In the Table, average monthly prices for crude oil were 56.8 dollars per barrel, while the variable with the lowest price was tea at 2.11 dollars per ton.

The standard deviation for each of the price series is less than the respective means, although they are relatively high except that of fuel which experienced very high volatility.

Quarter	T	\bar{c}	$\overline{SD}(c)$	$\hat{\rho}_1$	$\hat{\rho}_6$	$\hat{\rho}_{12}$	Q_{12}	p-value
Fish (per ton)	276	4.87	1.56	0.696	0.302	0.059	54.3	0.00
Natural gas (per cubic barrel)	276	88.95	37.28	0.939	0.402	0.066	79.3	0.00
Cocoa (per ton)	276	94.88	31.86	0.890	-0.403	-0.119	40.2	0.00
Tea (per ton)	276	2.11	0.54	0.905	0.311	0.092	131.5	0.00
Tobacco (per ton)	276	3770.32	821.05	0.827	0.437	0.022	98.7	0.00
Copper	276	4718.85	2523.37	0.868	0.245	0.03	101.7	0.00
Gold (per ounce)	276	808.19	477.25	0.849	0.394	0.031	91.9	0.00
Crude Oil (per barrel)	276	56.80	32.59	0.957	0.442	0.061	97.2	0.00
Nickel	276	89.79	75.73	0.838	-0.420	0.063	88.3	0.00

Table 1: Time Series Properties of World Commodity Prices

Note: T Denotes the Number of Observations While \bar{c} and $\overline{SD}(c)$ Are the Sample Mean and Standard Deviation; the $\hat{\rho}_{is}$ Are the Autocorrelation Coefficients

Source: Author's Computation

The disequilibrium persistence of commodity prices also observed using the autocorrelation tests on the data. The first-order autocorrelation is 0.696 (agricultural products) minimum and 0.957 (fuels) maximum among the commodities. These autocorrelation values are high, showing that commodity prices are highly serially correlated, and estimations based on the data need adequate consideration. With the high serial correlation, there is evidence that any disequilibrium in the commodity market will likely take a longer time to restore. Fuel prices appear to be the most serially correlated and suggests that any shock in the prices last for very long periods.

The trends in monthly commodity prices between 1996 and 2018 are also reported in Figure 4.12. There is a clear upward trend in the prices of the commodities over the years, especially those of agricultural produce. This means that the price of agricultural products (both food and non-food) has been steadily rising since the mid-1990s. The periods of negative shocks in 1998, 2002, 2008 and 2014 have been clearly marked in the charts for each of the commodities and their groupings. The sharp decline in the prices was felt more by oil and gas. Moreover, the highest general periodic height for the commodity prices started in 2003 and the general high trend has remained for all commodities apart from that of agricultural commodities which fell below the pre-2003 period in 2008 although, it rapidly recovered in 2010. In all, tea prices appear to have experienced the most rapid fluctuations without any discernible short-term trends observed the period. The series for tea prices actually appears to be mean reverting over time.

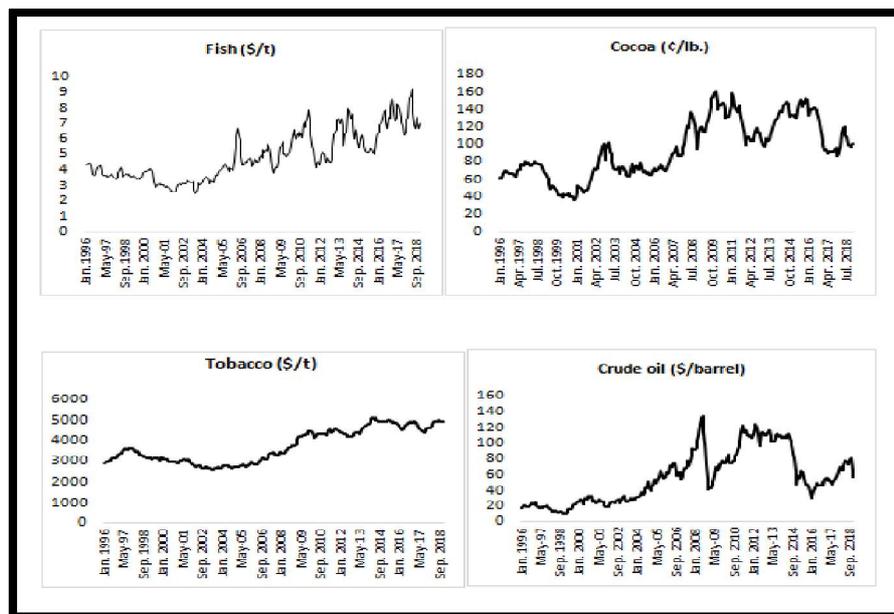


Figure 2: Trends in Commodity Prices

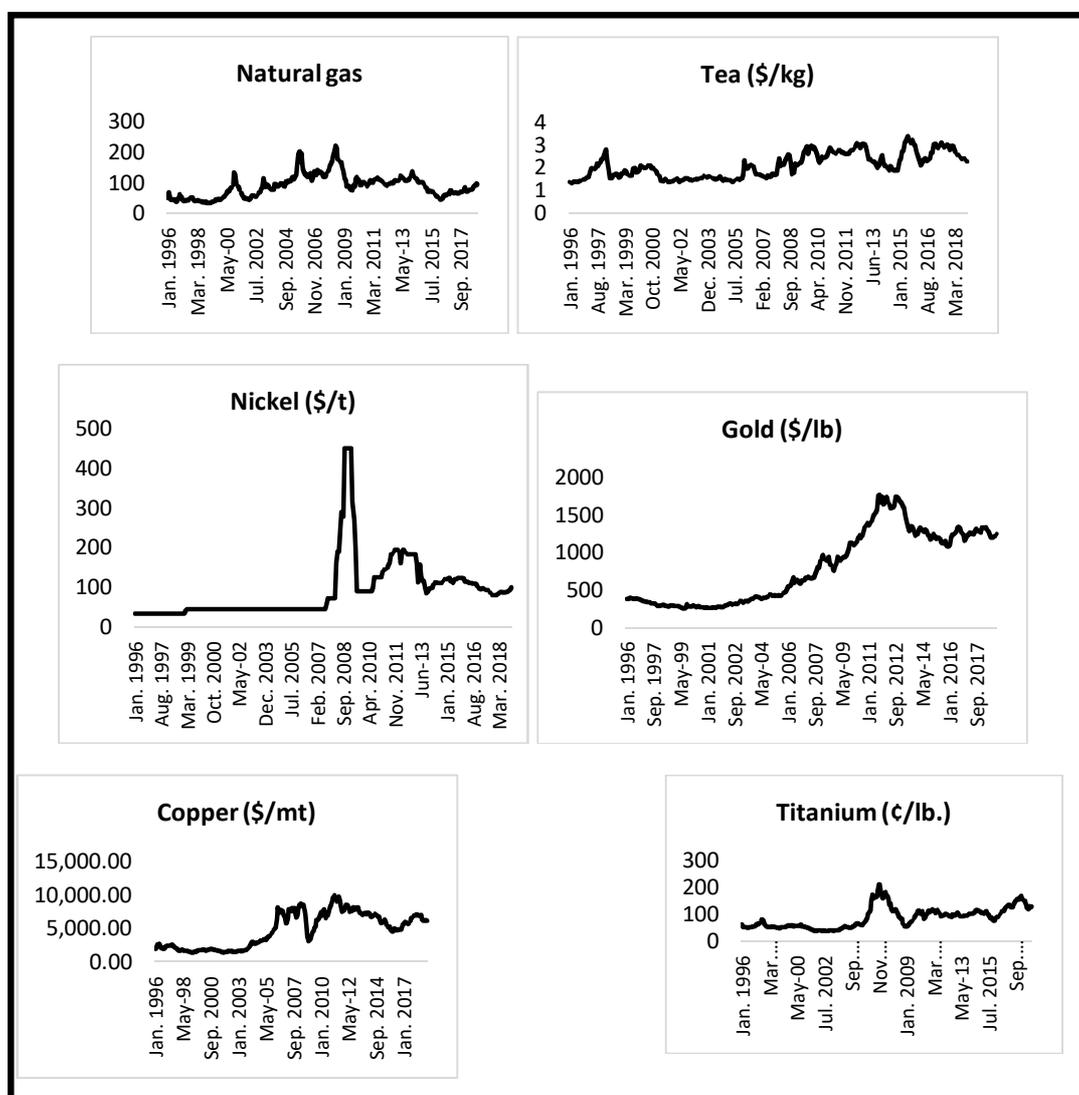


Figure 3: Trends in Commodity Prices

Source: Author's Computation

Series of charts showing patterns and trend of volatility exhibited by the commodities are used in the study. The aim is to show the nature or intensity of volatility and also to evaluate whether volatility patterns have changed (increased or decreased) over time within the period of the study.

In figure 4.2a, the volatilities in the price of fish in the international market is presented. It can be seen that volatility was moderate in the earlier periods (1996 to 2005), but it picked up after 2006. Essentially, it appears that the financial crisis in 2008 contributed significantly to volatility in the fish prices and such volatility appears to have persisted. Considering the trend line in the volatility trend, it is shown that there is an upward drift in the volatility over the years. This implies that volatility in the prices of fish in the international market has increased over time. In the trends shown in Figure 4.2b, the volatility in cocoa prices is shown. It is seen that volatility was more intense for cocoa prices than for fish prices. There is also a clear upward drift in the volatility trend over time for the commodity. Apparently, the degree of fluctuations and unpredicted movements in the prices of agricultural commodities in the international market has increased in recent periods compared to the 1990s.

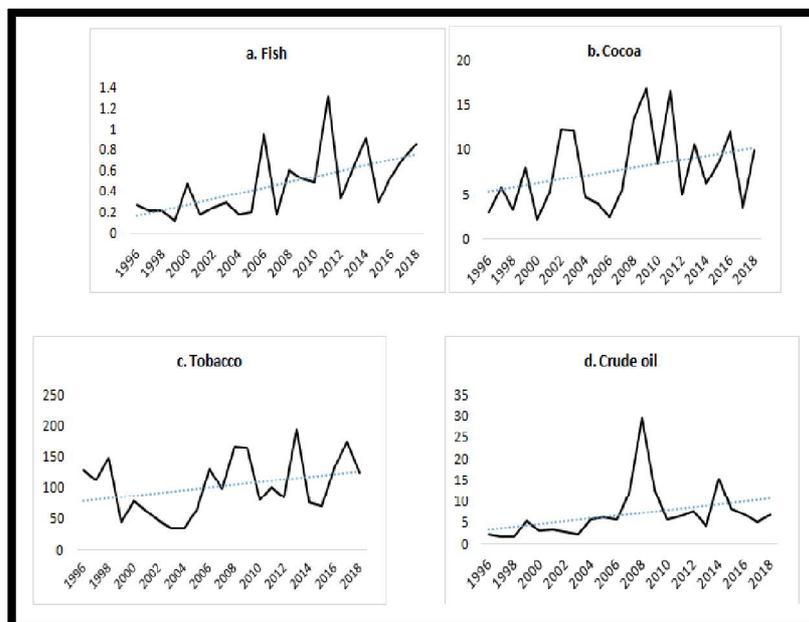


Figure 4: Volatility in Commodity Prices

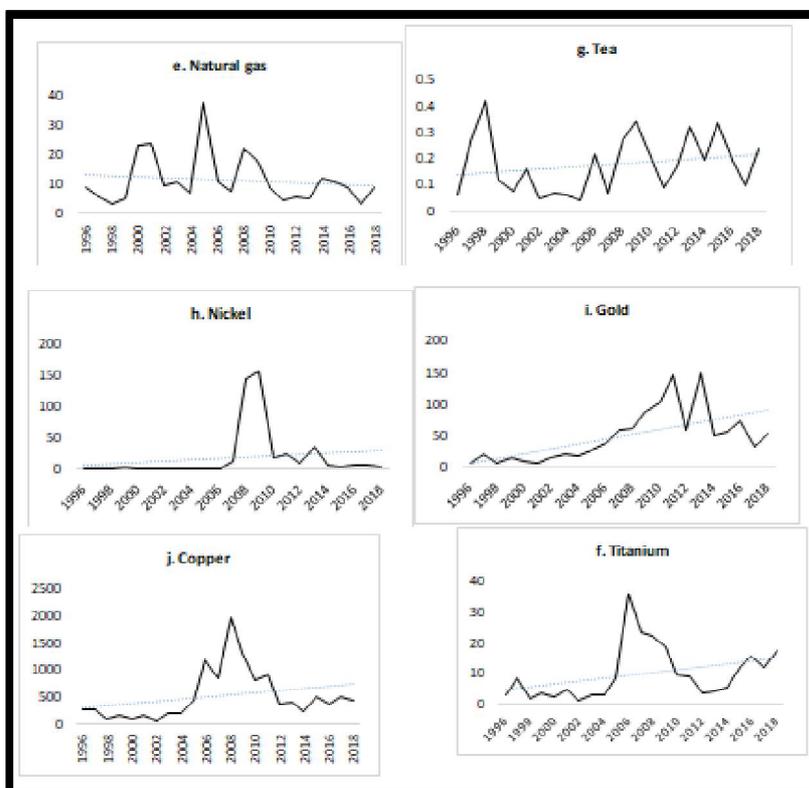


Figure 5: Volatility in Commodity Prices

Source: Author's Computation

The volatility in tobacco and tea are also similar to those of the other agricultural products in the international market. These volatilities are rapid and sharp across the periods. This shows that agricultural products have experienced the most frequent volatilities over the years and there is high instability in the international market prices of agricultural

products. Thus, countries that depend on export of agricultural products are more likely to feel the frequency of volatility in their domestic markets. Volatility in the prices of fuels (crude oil and gas) tend to exhibit longer wavelengths but bigger amplitudes. Crude oil prices have the sharpest fluctuation in 2008 and 2008, and the volatilities for those periods were very strong. Thus, fuel markets appear to have the most intense volatility with the most intense repercussions in the economies. In case of the metals, volatilities were only strongly experienced in the 2008-2010 period.

However, volatility in the gold market has persisted after the 2010 period. Another clear indication from the charts can be observed from the trends in the volatility of the prices. For all the commodities (except natural gas), the trend in volatility is rising over the period. This indicates that commodity price volatility is becoming stronger over the years and calls for stronger measures for commodity exporters in sub-Saharan African countries in withstanding the shocks arising from the increasing rate of volatility.

4.2. Descriptive Statistics

The descriptive statistics (in terms of averages) of the variables used in the empirical analysis for each of the countries is presented in Table 2.

COUNTRIES	BCP	NPI	ROA	ROE	ZSC	CPI	EXR	FDR	FDEP	GDP	MPR
ANGOLA	11.32	10.83	2.64	29.76	10.03	88.28	78.89	18.37	26.93	2.05	49.92
BOTSWA	23.15	3.10	3.74	48.82	8.14	83.86	6.71	40.36	21.39	2.57	12.89
BURUNDI	16.50	11.14	3.49	29.76	16.63	88.67	1118.01	23.71	19.91	-0.5	15.78
CAMERON	10.42	10.63	2.14	29.02	9.71	93.46	555.35	16.61	11.40	1.55	3.26
CHAD	4.92	11.59	2.53	24.73	10.53	93.23	555.35	12.23	6.20	2.71	8.55
GABON	10.74	7.58	2.83	22.02	15.20	94.78	555.35	18.62	13.63	-1.0	8.82
GAMBIA	7.51	11.24	5.89	58.55	9.41	90.17	27.27	27.60	9.29	0.18	27.77
GHANA	12.76	14.97	6.14	24.90	7.34	87.69	1.57	27.27	10.41	3.30	12.07
KENYA	28.23	15.91	3.45	40.20	16.26	86.43	79.46	28.20	15.09	1.57	18.11
MADAGAS	9.43	8.33	4.06	14.53	6.27	84.01	1934.64	20.28	15.53	0.26	40.66
MAURITIUS	76.11	5.04	2.24	14.53	17.21	86.54	29.21	93.67	14.15	3.70	15.15
MOZAMBIK	16.6	8.86	2.54	33.44	4.35	84.67	28.67	29.93	18.51	4.38	20.73
NIGERIA	10.92	14.84	1.75	19.48	14.63	90.34	140.96	18.24	4.94	2.63	18.40
S/ AFRI	67.47	3.46	1.61	20.48	21.14	90.90	8.47	66.83	19.52	1.19	12.91
SENEGAL	18.95	17.18	2.06	24.01	14.07	93.43	555.35	25.21	13.54	1.92	6.26
TAZANIA	8.81	13.47	3.76	37.28	12.57	93.99	1302.25	20.02	10.0	3.12	17.96
UGANDA	9.39	6.47	3.94	38.0	11.15	92.75	2142.3	17.76	11.55	2.86	21.21
ZAMBIA	9.22	10.42	2.44	20.66	8.20	81.28	4.94	19.09	12.39	2.69	26.51

Table 2: Countries Variables Averages

Source Author's Computations

The bank credit to capital variable is highest on average for Mauritius at 76.11 percent, followed by South Africa at 67.47 percent, indicating the level of financial development in the countries is high. It shows that banking sector credit is a significant aspect of financial activities in the economies. On the other hand, Chad has the least credit ratio at 4.92, suggesting that the financial system is essentially shallow in the economy. These outcomes can be corroborated by the financial depth (fdep) variable, which also shows that Mauritius has the highest financial depth among 68 the countries and Chad has the lowest financial depth.

Essentially, the level of banking sector credit in the economy is an important indicator of the level of financial development. Another aspect of the banking sector performance measurement is the non-performing loans ratio (npl) which indicates the level of operational efficiency in the banking system. Botswana (3.10 percent) and South Africa (3.46 percent) have the least average nonperforming loan ratio among the economies, while Senegal, with 17.8 percent has the highest non-performing loan ratio. There is a generally high non-performing loan ratio among the countries, with 11 out of the 18 countries having average non-performing loan ratios of over 10 percent over the study period.

The Z-scores which show the probability of default of a country's commercial banking system is highest for South Africa at 21.14 percent followed by Mauritius at 17.21 percent. Note that 'a higher z-score implies a lower probability of insolvency (or probability of default) in the banking system'. The outcome therefore shows that there is a 21 percent chance that the banking sector in South Africa will not fail. On the other hand, Mozambique (at 4.35 percent) has the least Z-score, suggesting that there is only a 4.35 percent probability that banks in the country will not experience default. Thus, there is evidence that banks in more developed economies, with larger financial sectors are more stable than banks in less developed financial systems.

VARIABLES	MEAN	MAX..	MIN	SD	SKEW	KURT	JB(PR)	N
BCP	19.5	106.26	1.97	20.36	2.24	7.46	687.33(0.00)	414
NPL	10.28	37.30	0.25	6.36	1.05	4.39	109.98(0.00)	414
ROA	3.18	12.44	-15.10	2.29	-1.67	21.08	5832(0.00)	414
ROE	31.9	168.87	-2.37	21.63	1.96	9.1	905.39(0.00)	414
Z-SCORE	11.82	96.68	2.73	6.48	6.04	74.46	90615(0.00)	414
CPF	72.76	1956.17	0.00	218.56	5.36	37.5	22542(0.00)	414
CPI	89.14	323.61	0.03	45.81	0.88	4.92	116.70(0.00)	414
EXR	506.93	3727.0	0.13	725.09	1.94	6.72	498.20(0.00)	414
FDEP	30.14	115.30	7.22	20.72	2.03	6.88	542.26(0.00)	414
FDR	13.66	30.07	0.91	5.15	0.24	3.22	4.70(0.00)	414
GDPPC	1.95	28.68	-15.04	3.65	0.46	11.89	1217.7(0.00)	414
MPR	18.72	217.88	2.45	17.07	5.37	51...35	42326(0.00)	414

Table 3: Descriptive Statistical Analysis

Source Authors Computations

The Jarque-Bera (J-B) statistics for all the variables (except fiscal deficit ratio - FDR) are all significant at the 1 percent level, which shows the absence of normality among the variables. This outcome is to be expected since a pool of different countries and different banks was adopted for the datasets. Hence, the result shows that country-level characteristics may be exerting strong heterogenous influences for the datasets. This is a strong basis for providing a panel-form analysis in the regression process for the study. In essence, the country-specific factors are likely to vary across the countries in the study, given the highly significant J-B test values for the variables.

The long run conditions of the variable interactions are established using the panel cointegration tests as presented in Table 4. The coefficients of the residual based (Kao) panel cointegration tests are all significant at the 5 percent level. Thus, the cointegration tests results show that there is strong long run relationships among the variables in the study. The panel estimation framework can therefore be employed in the empirical analysis.

Equation	Kao Statistic	Prob.
BCR	-3.37	0.00
NPL	-5.01	0.00
ROA	-1.72	0.04
ROE	-1.36	0.08
Z-score	-5.53	0.00

Table 4: Kao Panel Cointegration Test Results

Source: Author's Computation

To further examine the initial patterns of relationship and behaviour of the variables, the correlation characteristics of the dataset are also present in Table 4. The Table shows that bank credit to private sector has negative relationship with non-performing loans ratio, ROA and ROE. This implies that as loan disbursement increases, the efficiency performances of the banking sector tend to reduce, suggesting that loan applications by banks in the sub-Saharan African region tends to limit efficiency. On the other hand, higher non-performing loans are associated with lower overall loan disbursement. The correlation between loan disbursement and Z-score of banking sector stability is positive, indicating that more bank credit application tends to expose the banking sector to increased susceptibility to crises. Non-performing loans has significant negative correlation with ROA, while the two financial performance indicators (ROA and ROE) are positively correlated.

Variable	BCP	NPL	ROA	ROE
NPL	-0.328 (0.000)			
ROA	-0.223 (0.000)	-0.104 (0.035)		
ROE	-0.282 (0.000)	0.023 (0.640)	0.765 (0.000)	
Z_SCORE	0.388 (0.000)	-0.060 (0.219)	-0.079 (0.107)	-0.260 (0.000)

Table 5: Correlation Matrix for Bank Performance Variables

Source: Author's Computation. Note: T-Values in Parenthesis

The correlational matrix among the explanatory variables in the study are presented in Table 5 and the result shows the correlation between commodity price volatility and exchange rate is positive and significant, suggesting that higher volatility leads to more depreciated exchange rates among the economies confirming critical nature of exchange

rate to the countries' economy. The correlation between financial depth and GDP per capita growth is positive and significant, indicating that more financial development is associated with better growth rate of the economy.

Variable	CPI	EXRT	FDEP	FDR	GDPPC	MPF
EXRT	0.212 (0.000)					
FDEP	0.151 (0.002)	-0.321 (0.000)				
FDR	-0.057 (0.246)	-0.077 (0.118)	0.355 (0.000)			
GDPPC	0.102 (0.039)	-0.289 (0.000)	0.559 (0.000)	0.263 (0.000)		
MPR	-0.259 (0.000)	0.109 (0.027)	-0.106 (0.031)	0.132 (0.007)	-0.193 (0.000)	
CFP	0.052 (0.295)	0.205 (0.000)	0.019 (0.695)	0.091 (0.066)	0.094 (0.057)	-0.020 (0.689)

Table 6: Correlation Matrix for Explanatory Variables
Source: Author's Computation. Note: T-Values in Parenthesis

5. Panel Regression Result Analysis

The econometric analysis performed majorly focused on estimating the panel data-based relationship between commodity price fluctuations banking performance for the aggregate banking sectors 18 selected sub-Saharan. For the panel data analysis procedure there is need to select between the fixed effects or random effects models as the best representation of the relationships. The result of the effect of commodity price fluctuation, along with other factors, on the credit and loan systems of the banking sectors in the sampled economies is reported in Table 9.

The test for both results fails the significance test for each of the equations at the 5 percent level, implying that the null hypothesis holds. Thus, a random effect estimation does not effectively capture the relationship. Rather, the fixed-effect estimation procedure is the best fit for the regression analysis

Variable	Bank Credit Ratio			Non-Performing Loan Ratio		
	Coefficient	t-Statistic	Prob.	Coefficient	t-Statistic	Prob.
Constant	-5.949	-4.612	0.000	18.760	18.490	0.000
CPF	-0.006	-2.260	0.038	-0.015	-7.461	0.000
CPF ²	0.001	0.313	0.754	0.006	5.199	0.000
MPR	-0.163	-6.700	0.000	0.011	0.776	0.438
EXRT	0.002	4.463	0.000	0.001	3.194	0.002
CPI	-0.019	-2.430	0.016	-0.009	-0.852	0.395
GRGDPPC	0.067	0.750	0.454	-0.153	-2.778	0.006
FDR	0.063	0.908	0.365	-0.266	-6.337	0.000
FDEP	0.944	52.850	0.000	-0.089	-12.984	0.000
Adj. R-sq.	0.908			0.263		
F-statistic	489.358			18.577		
Hausman Test (Chi-Sq.)	9.72(0.29)			0.062 (0.926)		

Table 7: The Results for Bank Credit Loan Operations
Source: Author's Computation

The importance in terms of the effects of the explanatory variables on the dependent variable is determined by considering the estimated coefficients of each of the variables both in terms of sign and significance. From the result on the bank credit ratio estimates, the coefficient of the level commodity price fluctuation (CPF) is significant and negative, while that of the squared CPF variable fails the significance test at the 5 percent level. This result shows that commodity price volatility has a significant negative impact on the share of bank credit in the financial system. Thus, with volatility of commodity prices, banks are either unable or unwilling to provide more loans, rather the amount of loans tends to reduce following a shock arising from commodity price volatility.

For the other control variables, the result shows that the coefficients of MPR, EXRT and FDEP are significant at the 1% percent level, while the coefficient of CPI is significant at 5% percent level of significance respectively. The coefficient of MPR is negative, indicating that a rise in the monetary policy rate among the economies leads to a decline in bank loan provision. This therefore shows that central bank regulations in the economies effectively affects bank loans. A rise in MPR leads to a fall in loans, which is the correct direction of effect on a theoretical basis. This shows that the banking systems are heavily influenced by the activities of the respective central banks in the region. The coefficient exchange rate is positive and indicates that declining exchange rate is actually good for promoting loans among the sub-Saharan African banking sectors. The coefficient of FDEP is positive and demonstrates clearly that a well-developed financial system is one

where the share of loan disbursement by the money deposit banks is high. As expected, the coefficient of CPI is negative and shows that rising prices are not beneficial to the credit market among the countries. The coefficients of fiscal deficits and per capita GDP growth however fail the significance test even at the 5 percent level.

The results for the effects of the variables on the ratio of non-performing loans are reported in the second panel of Table 4.7. The coefficients of both CPF and CPF squared are significant at the 1 percent level, indicating that fluctuations and more intense volatility of commodity prices significantly influence the non-performing loans. In particular, the coefficient of level CPF is negative (not in line with a priori determination) and shows that shocks in commodity prices deliver negative immediate impacts on non-performing loans. On the other hand, the squared CPF coefficient is positive and indicates that intensive shocks and volatility of commodity prices lead to increases in the ratio of non-performing loans. Apparently, when commodity price shocks are intensive, loan failures increase and the proportion of non-performing loans rise within the banking sector. Thus, one of the main areas where intense and persistent volatility of commodity prices affects the banking system is through the rise in non-performing loan ratios.

Table 8, shows the results for banking sector profitability or financial efficiency (ROA and ROE) link with commodity volatility using the random effect panel regression model as suggested by Hausman's test result which rejected the fixed effect procedure at 5% level of significance

A cursory look at the coefficients of the important variables of CPF and squared CPF reveals that in levels, CPF has significant positive effect on both the ROA and ROE equations. This shows that, commodity price volatility has direct positive effects on the financial performance of the banking sectors of the sub-Saharan African countries. Thus, volatilities that are not too intense will improve the operational efficiency of the banking system (ROA) as well as the efficiency of shareholders' funds application. There is therefore evidence that banks are resilient to mild to moderate volatility of commodity prices among African economies. The effects of the squared volatility variable on both ROA and ROE are however negative and suggests that intense volatility of commodity prices is what actually leads to decline in financial performance among the banks in sub-Saharan African countries. For the ROA equation, the negative impact of intense commodity price volatility (-0.009) is greater than the positive impact on mild volatility (0.002). This shows that the negative impact of strong and intense volatility can wipe off any benefits that banks may obtain from initial mild volatilities.

Variable	ROA			ROE		
	Coefficient	t-Statistic	Prob.	Coefficient	t-Statistic	Prob.
Constant	3.110	5.183	0.000	39.383	5.615	0.000
CPF	0.002	3.167	0.002	0.026	3.805	0.000
CPF ²	-0.009	-2.027	0.043	-0.007	-2.088	0.046
MPR	0.010	1.377	0.169	-0.012	-0.131	0.896
EXRT	0.001	0.563	0.574	-0.001	-1.721	0.086
CPI	0.003	0.801	0.423	-0.056	-1.158	0.248
GRGDPPC	0.014	0.456	0.649	0.103	0.346	0.729
FDR	-0.021	-1.273	0.204	0.170	1.027	0.305
FDEP	-0.009	-3.159	0.002	0.180	5.480	0.000
Adj. R-sq.	0.105			0.127		
F-statistic	1.500			2.984		
Hausman Test (Chi-Sq.)	18.42(0.02)			20.11(0.01)		

Table 8: The Results for Banking Sector Efficiency
Source: Author's Computation

For the control variables, only the coefficient of financial depth passed the significance test for both equations, indicating that the level of financial development actually affects the financial performance of banks. This appears to be the main macroeconomic variable that can explain the behaviour of financial efficiency among the banks. Apparently more internal factors are responsible for determining financial performance of banks, apart from commodity price volatility.

The results of the effects of commodity price volatility on the risks of banking system default among the sub-Saharan African countries is estimated and reported in Table 11. In the result, the coefficient of CPF and squared CPF are both significant at the 1 percent level. The coefficients are both negative, suggesting that both mild and intense volatility of commodity prices lead to a reduction in the resilience of the banking sector to default. The results show that it is only on the z-score that both the level and squared CPF are negative and significant. This indicates that the impact of commodity price fluctuations on the banking sector is strongest through the risk of default among the banks.

Variable	Coefficient	t-Statistic	Prob.
Constant	11.580	18.067	0.000
CPF	-0.009	-6.589	0.000
CPF ²	-0.004	-4.467	0.000
MPR	-0.061	-3.734	0.000
EXRT	0.001	7.640	0.000
CPI	-0.009	-1.586	0.114
GRGDPPC	-0.125	-1.290	0.198
FDR	-0.061	-2.066	0.040
FDEP	0.103	5.720	0.000
Adj. R-sq.	0.105		
F-stat.	6.785		
Hausman Test (Chi-Sq.)	0.113(0.83)		

Table 9: Results for Banking Sector Default
Source: Author's Computation

In particular, the results show that a one percent increase in volatility of commodity prices leads to a 0.009 percent increase in the probability of banking sector default. In the same vein, a one percent further intensity of commodity price volatility leads to a further 0.004 percent rise in the risks of default in the banking sector. Thus, intense volatility is shown to be capable of increasing the risk of bank default among the sub-Saharan African countries by a combined effect of 0.014 percentage point.

For the other variables, the coefficient of MPR passes the significance test at the 1 percent level and is negative. This shows that consistently rising rates can intensify the susceptibility of the banking system to default. A similar outcome is demonstrated by the FDR coefficient which confirms that fiscal rising deficits can also destabilize the banking sector among the sub-Saharan African countries. Thus, there is evidence that the two policy tools (policy rates and fiscal spending) have the capacity of either destabilizing or stabilizing banking sectors in the economies. The coefficient of financial development is also significant at the 1 percent level and is positive. It shows that a rise in financial depth can improve the resilience of the banking sector to risks. Thus, both policy and institutional factors are capable of improving stability of the banking systems, even in the midst of external shocks.

6. Discussion of Findings

The results obtained from the empirical analysis are far-reaching and generally apt for policy. Firstly, it is established that more intense commodity price volatility is the most important factor that negatively impacts banking sector performance in sub-Saharan African countries. The effects of mild volatility are either inexistent or are positive, suggesting that the banking system may have developed coping mechanisms for adapting to mild shocks emanating from commodity price fluctuations. There is therefore evidence that banks are resilient to mild to moderate volatility of commodity prices among African economies. These may be because of hedging and risk protection capacity of the banks that may have risen through their investment policies. The results are similar to those of Rodrigues and Crooks (2015), Agarwal et al. (2017), and Saif-Alyousfia et al. (2020).

Similarly, the findings demonstrated a strong negative effect of intense commodity price fluctuations on credit provision as credit shrinks in the economy when commodity prices fluctuate more rapidly. The reason for the shrinkage can be explained through demand and supply sides. As Banerjee (2014), Presbitero et al. (2020) and Saif-Alyousfia et al., (2020) have noted, the demand for loans for different purposes may reduce when the effect of commodity price volatility hits other segments of the economy who are make up the demand for loans. On the supply side, banks' balance sheets have been known to shrink during periods of commodity price volatility, especially when banks' portfolio are linked with the commodity sector (ECB, 2015; Mlachila & Ouedraogo, 2016; Saif-Alyousfia et al., 2020).

However, the study has found that apart from commodity price volatility, other factors may have also contributed to low banking sector performance in among sub-Saharan African countries over the years. The study has found that consistently raising policy rates by the central banks can intensify the susceptibility of the banking system to default. as well as excessive fiscal deficits which can collectively destabilize the banking sector among the sub-Saharan African countries. The study therefore revealed that both monetary and fiscal policy tools (policy rates and fiscal spending) have the capacity of either destabilizing or stabilizing banking sectors in the economies. In the same vein, financial depth (which is an institutional factors) is seen to also contribute significantly to banking sector stability among the countries. Thus, both policy and institutional factors are shown to be capable of improving stability of the banking systems, even in the midst of external shocks.

These findings are similar to those of previous studies that demonstrate that fundamental domestic factors are also important for banking system stability. For instance, Obadan & Adegboye, Acemoglu et al (2004), and Kaminsky & Reinhart (1999) have considered the place of weak institutional setups, poor policy applications and unstable regulatory frameworks as major factors that lead to financial sector problems in the African region, including Nigeria. Indeed, poor financial structure planning and execution, as well as pure financial corruption may have bedeviled the financial landscape in Nigeria, leading to easy susceptibility to financial fragility and crises. Moreover, the increasing rate of financial development in the country calls for more considerations towards the use of monetary policy (even if combined with fiscal policy) as a tool for macroeconomic adjustment. This has constituted a great deal of academic and policy evaluation over

the years and provides a formidable alternative to an ever-increasing size of government in macroeconomic stabilization. These results clearly suggest that efficient policy use by the authorities is important for banking sector stability.

The overall results obtained from the study are generally in line with previous studies like Kinda et al. (2016), IMF (2015), Amidu & Wilson (2012) and Fanizza (2009) which showed that on a broad level commodity price instability or volatility either limits banking sector expansion, weakens the ability of the sector to withstand external shocks, increases the likelihood for banking sector crises or reduce the level of integration of the financial sector with the international markets.

7. Conclusion

The consequences of commodity price shocks on the economy are real since primary commodities remain the major foreign exchange earner of many sub-Saharan African countries. In a globalized world economy with highly interlinked market patterns, the need to devise appropriate policies to shield the economy as much as possible from the external shocks is becoming more and more relevant.

This study has placed in perspective on how the banking sector may become weakened by incessant commodity price movements over time and the roles that policy could play in ensuring domestic stabilization of the banking sector among sub-Saharan African economies. Although the outline of the study is not exhaustive, it has shown the extensive effect of instability commodity prices on the banking sector in sub-Saharan African countries. In this study, we attributed the poor performance of the banking sector (especially regarding loan and overall bank default) to the nature of linkages between the external and banking sectors as well as the amplified effects of supply shocks (arising from volatile commodity revenues) that persistently deride the stability of overall economic performance among sub-Saharan African countries.

8. Contributions of Study to Knowledge

The study has made significant contributions to learning in the following ways

- The study has contributed by presenting and re-designing a bank performance function that is linked to external risks that do not emanate from either the banking or the financial sector.
- The study also contributed to literature by demonstrating that it is intense volatility of commodity prices, not mild volatility, that influence banking sector performance among sub-Saharan African countries.
- The study has established how a combination of monetary and fiscal policy tools can be employed in helping the banking sector become more resilient to commodity price shocks among sub-Saharan African countries. This acts to provide strong background for evaluating the roles that monetary and fiscal authorities and the banking sector participants could play in mitigating commodity price volatility in the system.

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