



Research Article

The Effects of Bank Credit Risk and Liquidity on Bank Profitability in Sub-Saharan Africa: Evidence from a Dynamic Panel Model

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Abstract

In a highly competitive banking business environment of today, it is essential to maintain the bank's profitability to remain in the business and contribute towards a country's financial development. In this regard, this study tries to identify the role of banks' credit risk and liquidity status on their profitability. This study used a two-step GMM dynamic panel model to analyze the effects of bank credit risk and Liquidity on the profitability of banks using data obtained from 36 selected Sub-Sahara African countries from 2000 to 2020. The regression results prove the significant effect of risk and liquidity factors on banks' profitability. Specifically, bank credit risk adversely affects profitability, whereas liquidity affects the bank's profitability positively. The control variables included in the model show mixed results, with trade openness indicating a significant adverse effect on profitability. Others, such as inflation, and financial openness, negatively affected banks' profitability. The implication of this study is that it is crucial for policymakers and bank managers to design effective credit risk management strategies to maintain bank profitability, stay competitive, and thereby contribute to the overall development of the financial sector in the study area.

Keywords

Bank Profitability, SSA, System GMM, Credit Risk, Liquidity

1. Introduction

In today's world, banks play a significant role in a country's economy and are regarded as the main economic pillars in every country. They also significantly contribute to the expansion and development of the financial and economic sectors by influencing the investment climate through directing different types of savings toward successful ventures. They are therefore essential for accepting deposits, granting credit, and providing customers with other financial service [19]. The

commercial banking industry's development and success are influenced by a number of factors, particularly profitability growth and lending patterns [37, 90, 124].

One of the major purposes of banks is to be profitable. This is also a sign of effective management because it shows that the bank can bring in capital and invest in a variety of investment opportunities. With the increased use of information and

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communication technology, which has an effect on bank profitability, the banking industry is one that is very competitive [19]. Banking is a risk-taking industry. In most cases, banks play the intermediation role by receiving savers' deposits and lending the money to borrowers. They are exposed to numerous risks as a result, which may have an impact on their profitability directly or indirectly [99, 119].

The provision of credit is a bank's primary source of income. Credit risk is one of their big challenges in this industry. According to Boahene, Dasah, and Agyei (2012), credit quality is a crucial determinant of a bank's financial stability and health. Poor credit or loan quality has a significant effect on bank failures because it is the primary source of income for a bank [39].

Investors often use ongoing projects and increase customer confidence, which propels economic growth in a nation [86]. However, it is common for these banking organizations to lend money to investors without expecting repayment from the borrower (s). This may ultimately have a negative impact on financial profitability and cause the bank to fail. Therefore, since the financial crisis, credit risk is the primary focus of risk management in the majority of banks worldwide [48, 57, 80, 84, 95].

Studies have shown that credit risk and bank profitability are positively related [68], while others indicate a negative relationship [24, 52, 59, 69, 71, 100, 102, 112]. As a result, study results suggest that findings are incoherent regarding how credit risk influence bank profitability.

In the same manner, liquidity is regarded as one of the key factors influencing bank profitability in contemporary banking literature, and numerous studies have recently addressed this relationship. Empirical evidence, however, has provided a variety of findings. While some researches have revealed a positive relationship between liquidity and profitability [35], many others have shown the opposite relationship [46, 75, 76].

The banking literature reveals that bank profitability is determined by both bank-specific and external factors, according to a thorough analysis of the elements that determine bank profitability [33, 103].

Though several empirical researches have been conducted to investigate the effect of various bank specific and macro specific variables on bank profitability, financial openness, trade openness, and monetary policy parameters as explanatory variables weren't yet researched and examined to show their effect on profitability of SSA banks.

In nutshell, we identified inconsistent and contradictory findings in the empirical evidence regarding the impact of bank- and macro-specific factors and their interactions with commercial bank profitability. Additionally, the empirical data shows that a number of macroeconomic variables, such as financial openness, trade openness, and monetary policy parameters were understudied and their relationship with the banking industry was not thoroughly established. These variables were revealed to have an impact on the profitability of commercial banks.

However, these studies have a methodological and evidence gaps because the majority of them have relied on panel data employing OLS and regression analysis. In addition, the findings and the research methods of the prior studies were in contradictions. Furthermore, the studies' findings on the effect of macroeconomic variables on bank profitability are conflicting with some pointing to an insignificant impact and others claiming a significant effect. Numerous factors were not investigated, including trade openness, financial openness, GDP per capita, and monitoring policy parameters.

The main issue noted in earlier studies is the conflicting results about the relationship between bank profitability, liquidity, and credit risk impacts. The examined empirical studies produce results that are non-directional and inconclusive for various variables, including trade openness, financial openness, and monitoring policy parameters. This is because no single factor has been identified as having a positive or negative impact on ROA. Additionally, the majority of earlier studies were carried out in developed economies.

This paper represents the first attempt at investigating the effect of monetary policy parameters, trade openness and financial openness, Bank credit risk, liquidity, GDP, and inflation on commercial banks profitability in SSA using dynamic panel model. This study reexamines the factors that influence bank profitability, with a primary focus on bank credit risk, liquidity, monetary policy parameters, trade openness, inflation, financial openness, and GDP as a predictor variable.

Hence, the main purpose of the study is to investigate the effects of Bank credit risk, liquidity and macroeconomic factors on Profitability of Banks in Sub-Saharan Africa. Specifically the study was designed to: to investigate the effects of Bank Credit Risk on Profitability of Banks in Sub-Saharan Africa; to determine the effects of Liquidity on Profitability of Banks in Sub-Saharan Africa; to examine the effects of monetary policy parameters (broad money supply) on Profitability of Banks in Sub-Saharan Africa; to examine the effect of trade openness (import + export/GDP) on Profitability of Banks in Sub-Saharan Africa; to examine the effects of macroeconomic stability proxied by an inflation rate, on Profitability of Banks in Sub-Saharan Africa; to investigate the effects of GDP per capita, on Profitability of Banks in Sub-Saharan Africa, and to determine the effects of financial openness proxied by the Kopen index on Profitability of Banks in Sub-Saharan Africa.

In order to achieve the above objective, the study answers the following research questions. What are the effects of Bank credit risk, liquidity, monetary policy parameters, trade openness, financial openness, macroeconomic stability and GDP on profitability of banks in Sub Saharan Africa?

In several aspects, the empirical analysis of this study enriches and advances the body of literature. At first, no previous attempt has been made to analyze the combined effects of credit risk, liquidity, monetary policy parameter measured by broad money supply, financial openness, trade openness, macroeconomic stability proxied by inflation rate, and GDP per capita on the profitability of banks in Sub-Saharan Africa.

Secondly, this study offered a significant contribution by incorporating the interaction between bank profitability and the mentioned variables because several of the explanatory variables had not before been explored in relation to bank profitability. According to the literature, while there have been many studies on bank profitability, only a small number have used dynamic panel techniques models to look at the factors that affect banks' profitability. This could be a crucial point of departure for future researchers, so this paper uses dynamic panel techniques models (GMM) which contributes a lot to the current literature.

The remaining part of this study is organized as follows. Section two makes review of the theoretical and empirical literature on the effect of credit risk and liquidity. Section three describes the data and presents the empirical estimation strategies used. Section four reports the main findings and makes a discussion of the findings. Finally, a conclusion and policy implications are provided in the last section of the paper.

2. Review Literature

This section provides a thorough review of prior studies that have identified the factors that affect bank profitability. It discusses research outputs that have looked at different determinant factors affecting the profitability of banks focusing on all macroeconomic and bank specific variables. Despite the enormous number of studies investigating at how the determinants of bank profitability such as, bank credit risk, liquidity levels, and macroeconomic related factor affect banks' profitability, there are still differences of opinion regarding the nature of the relationship. As a result, this section emphasizes on the methodological and empirical gaps related to the topic and the variables of interest.

Many banks around the world experienced major challenges with profitability during the global financial crisis, and some of those banks are still struggling to recover. Since then, one of the main worries has been the stability of the banking system [38]. As a result, a number of previous researchers have been attempting to find the key determinants of bank profitability. Various studies have examined bank profitability, while some researchers concentrate on the banking systems of specific countries; other studies base their study on cross-country data [77]. Despite the enormous number of studies investigating at how the determinants of bank profitability such as, bank credit risk, liquidity levels, and macroeconomic related factor affect banks' profitability, there are still differences of opinion regarding the nature of the relationship.

The results of research on the relationship between credit risk and bank profitability are conflicting and mixed results. The body of knowledge on the subject is growing, particularly in the aftermath of the most recent global credit crisis in 2007, which had negative influences and threatened the stability of the financial system. However, while some empirical researches have supported the negative relationship, others have found a positive relationship [55, 69].

According to empirical studies, the impact of credit risk on banks' profitability varies significantly depending on the type of bank. Since credit risk has been identified as one of the primary elements known to affect banks' profitability, the impact of this factor on profitability has attracted the attention of numerous scholars.

Others who have conducted in-depth studies on the subject have come to differing conclusions with their findings. Some found a positive relationship between credit risk and bank profitability [2, 18, 115], while others found a negative one [10, 25, 50, 61, 87, 113]. To the contrary [72] documented no relationship between credit risk and profitability, as their findings revealed that profitability of the banks were not influenced by bank credit risk, suggesting that there were other variables at play to impact the bank profitability.

Therefore, the empirical evidence reveals that the findings of the previous studies were not directional and consistent to reveal the effect of credit risk on bank profitability. The research findings on the relationship between credit risk and bank profitability are contradictory and mixed results.

The relationship between liquidity and profitability in banking is investigated in different studies.

[114], examine the factors that affect the profitability of banks that were listed on the Amman Stock Exchange between 2010 and 2018. The study used GMM technique and reveals that capital levels, liquidity, and credit risks significantly increase bank profitability.

[7, 69], revealed that liquidity has a positive impact on bank profitability. The latter documented that liquidity, as measured by total loans to total deposit ratio, has a positive impact on profitability in case of net interest margin, but this relationship is insignificant.

Similarly for the years 2003 to 2006 [107], studied a sample of 25 Bangladeshi banks. The findings showed a relationship between liquidity risk and bank performance that was positive, indicating that banks must enhance their liquidity to be more profitable. A study by [137] also examined the effects of credit risk, liquidity, capital, and market structure on banks' profitability over an eleven-year period in Palestine, a developing country (2010 - 2020). A dynamic panel model was applied to the sample of 12 banks with three econometric models representing profitability indicators employed by the study.

In addition to the linear regression models was employed with GMM estimator (Generalized Method of Moments). According to the findings, market structure, liquidity, and capital as well as credit risk have an impact on the profitability of banks as evaluated by ROA, ROE, and NPM. The findings argued that there is still a debate or uncertainty over the nature of the relationship, despite the fact that empirical evidence indicates the negative relationship between liquidity and profitability.

In their studies, [125] present the argument that banks with higher liquidity levels have lower earnings. According to Tran et al. (2016)'s empirical analysis, managing liquidity is necessary to increase earnings. In their analysis [41], establish the

argument that banks with more liquid assets are more profitable. They contend that having more liquid assets reduces the banks' illiquidity and financing costs. In their analysis, [62], note that there is a poor correlation between bank performance and liquidity. The above arguments were at opposed with one another, and their conclusions were not firmly proven.

Moreover, using panel data from 12 developed economies between 1994 and 2006, [46], examined the factors driving liquidity risk and the relationship between liquidity risk and bank profitability. The study revealed that ROAA and ROAE are fundamentally and inversely related to liquidity risk, as anticipated by the financing gap. According to ROAA and ROAE estimates, banks are less profitable when the financing gap is bigger (i.e., when liquidity is higher).

Studies have shown that liquidity and bank profitability are positively related [11, 15, 44, 54, 136] while others indicate a negative relationship [29, 129, 131]. In the same manner Some studies [17] show no relationship between liquidity and profitability of banks. ONGORE & KUSA (2013) studied the impact of factors on the profitability of banks. The article uses OLS on panel data to estimate the parameters. The results show that bank-specific factors significantly affect the ROA, ROE, and NIM of commercial banks in Kenya, except for the variable liquidity [100]. Therefore, the previous Study results suggest that findings are incoherent regarding how liquidity impact bank profitability.

The profitability of banks is influenced by external factors, which are economic indicators beyond of a bank's control. Economic growth, commonly known as GDP growth and inflation rate, is one of the major macroeconomic variables that might have an impact on bank performance. Petria, Capraru and Ihhatov agrees that GDP growth and bank profitability are related positively [106]. A similar relationship between GDP growth and the performance of Latin American banks was found positive relationship [70] and [4], revealed a significant positive relationship from the findings on 14 Islamic banks in eight countries.

But Noman, Chowdhury, Chowdhury, Kabir, & Pervin are among the academics who find a significant negative correlation between GDP growth and profitability. According to theory, demand for banking services increases when there is a low risk of loan default. As a result, this raises bank profitability [9].

Numerous empirical studies found a significant and positive relationship between bank profitability and inflation [9, 27]. However, a study by Bila, Saeed, Gull, & Akram revealed that inflation had a detrimental effect on bank performance [5]. However, as a high inflation rate is related with strong bank performance, a positive impact of inflation on bank profitability is theoretically predictable.

Saeed examines the effect of bank-specific and macroeconomic variables on bank profitability in the United Kingdom before and after the global financial crisis in 2008 using panel regression analysis to data obtained from Bank scope for 73 commercial banks in the UK. The empirical finding shows

that inflation and the level of economic activity (GDP) indicate a negative effect on profitability [11].

In general, inconsistent findings from empirical studies examining the relationship between the factors makes them inconclusive. While some research identifies a positive relationship between the variables, others find a negative relationship, while still other studies identify no significant relation at all.

International organizations like the World Bank, International Monetary Fund (IMF), and World Trade Organization (WTO) promote liberalizing developing nations' economies to allow for the entry of new rivals (foreign industries), which lower transaction costs and strengthen the financial systems of those nations [104, 117].

Liu (2005) argues that, though not consistently and depending on national characteristics, the WTO's liberalization of trade in financial services encourages bank lending to developing economies. Financial sectors in developing nations, which are relatively capital-poor by global standards, are anticipated to be swamped by foreign capital under condition of full openness [8, 53, 105]. Trade openness entails trade liberalization and complete liberalization of the industrial sector, which implies unrestricted free flow of capital into and out of an economy. The degree of economic openness, the volume of trade between the country and other nations, the degree to which foreign traders (importers and exporters) rely on, or use, loan facilities from the commercial banks for trade finance, and the degree to which the commercial banks engage in merchant banking and trade finance, among other factors, determine how much trade openness affects the profitability of commercial banks [56].

Trade openness boosts competition by attracting more foreign businesses, which puts pressure on domestic businesses to increase infrastructure spending. In order to have simple access to loans, regulatory authorities are encouraged to bring about reform in the financial industry. By lowering the cost of a loan for businesses and raising the amount of credit in the economy, those financial reforms increase the banking sector's competitiveness. On the other side, more financial openness will allow local businesses access to external sources of finance from global money and capital markets, hence enhancing competitiveness in the credit market. The bank is probably going to lower the firm's borrowing cost to remain competitive [29].

The findings of the empirical analysis show that financial and trade openness had a positive effect on the profitability of commercial banks, but the effect of trade openness was statistically insignificant. Additionally, it shows that while trade openness had a negligible effect on profitability for commercial banks during the period of the global financial crisis (2007–2010), financial openness and inflation did. These results lead us to the conclusion that, if commercial banks are in a position to benefit from economic openness, profitability could increase [116].

The literature on the impact of trade openness and financial openness on commercial banks' profitability is still quite low

because there haven't been many studies done to look into this topic. This study is expected to significantly add to the body of literature already in existence. Asongu, using the fixed effect panel data analysis of 29 low- and middle-income countries in the continent, finds that openness to trade and finance results in less efficiency in low-income countries [31, 45]. The study sought to investigate the role of openness in bank efficiency with respect to income levels of selected African countries. The impact of financial openness is the same in middle-income countries; however, the impact of trade openness on banks profitability in such nations is statistically insignificant.

Bank profitability is influenced by monetary policy in two different ways. Firstly, lowering interest rates has a positive effect on macroeconomic conditions that will help the banks by lowering their funding costs and raising the creditworthiness of the borrowers. Second, monetary policy accommodation may result in a decline in net interest income [3]. The relationship between monetary policy and bank profitability has been the subject of some studies. Although there is still a lack of study in this area [42], it is unclear whether monetary policy affects bank performance in a positive, negative, or neutral way.

Udeh examines into how monetary policy tools affect the profitability of Nigerian commercial banks, with a focus on the experience of Zenith Bank. According to the study, Zenith Bank Plc's earnings before taxes and lowest rediscount rate have a strong significant relationship, which has a positive impact on the bank's profitability [126].

Rao investigated how monetary policy affects the profitability of Indian banks. In addition to using ROA & ROE as proxies for bank profitability, the researcher also uses the Bank Rate, Statutory liquidity requirement (SLR), and Cash Reserve Requirement (CRR) as proxies for monetary policy. According to the findings, lending rates and bank profits have a positive relationship; hence raising lending rates will boost banks' profitability. After taking into account CRR, SLR, and bank rate regression coefficient, it is not significant to explain the relationship between the profitability of the bank and monetary policy instruments in public sector bank [92, 98, 109].

Younus and Akhta investigated the effects of Bangladesh's Statutory Liquidity Requirement (SLR) as a tool for monetary policy. Researchers have shown that SLR has undergone irregular improvements using descriptive analysis techniques. Prior evidence has indicated that decreases in SLR have a positive impact on bank loans as well as investment, but only in the early 1990s. As essential tools for containing inflation, statutory liquidity requirements and cash reserve requirements have been highlighted [135]. Studies also noted that in order to conform to its market-adjusted approach, Bangladesh Bank frequently used open market operations rather than changing the Bank Rate and SLR as instruments of monetary policy.

The existing literature shows that there is a relationship between monetary policy and bank profitability; however, the results are inconclusive and vary across different countries. Given that, to our knowledge, there is no comprehensive study

that has explored this relationship in the SSA that investigates the relationship between broad money supply and bank profitability. Hence surprisingly, the link between monetary policy and bank profitability is an under-researched area. Therefore, this study explores the link between monetary policy and bank profitability in more depth, focusing precisely on the relationship between the broad money supply and bank performance so as to fill the literature gap.

In a nutshell, we found conflicting and inconsistent findings in empirical evidence on the influence of bank- and macro-specific factors and their interactions with commercial bank profitability. This study fills in this vacuum by identifying the variables that affect the profitability of commercial banks using a dynamic panel model with a GMM estimator that incorporates all SSA commercial banks.

3. Methodology

In general, this section describes the methodology of the study. In particular, it gives a brief explanation of the different types and sources of data, a description and measurements of the variables that were utilized in the analysis, and a specification of the econometric models that were used.

3.1. Data Sources and Description and Measurements of Variables

The primary purpose of this study is to examine how bank profitability is influenced by bank credit risk, liquidity, and key macroeconomic variables. In particular, it examines the effects of bank credit risk, liquidity, GDP, inflation, monetary policy parameters, trade openness, and financial openness on banks' profitability in Sub-Saharan African countries.

Accordingly, annual data on bank credit risk, liquidity, and other control variables are needed and obtained from various sources for sub-Saharan African countries in order to achieve the objective.

However, the study has selected 36 sub-Saharan African countries only for which we can get a complete dataset because a complete collection of data for all of them is not yet available.

The study used panel data since it allows for the tracking of changes in variable values and relationships over time. Panel data can be used to investigate the effects of lags, and the values and ordering of the data points both have meaning [14]. It also enables for controlling unobserved characteristics of individual banks.

The study relied on data from the years 2000 to 2020 because it is the time frame for which pertinent data was obtained. The study has used both institutional data at country level and macroeconomic level data which were obtained from World Bank and International monetary fund (IMF) official websites. Thus, the data for the used variables were obtained from the World Bank Open Data source [125, 128].

Based on the availability of data throughout the study period, the number of countries was identified. In summary, panel data that combines time-series and cross-sectional data were used in the study [81].

Unbalanced panel dataset of 36 SSA countries was used in this study. The remaining countries either lack bank data or do not submit data to the World Bank, despite that there are 48 countries in SSA according to the World Bank classification. Due to the fact that not all countries provide data for every year (or the data were incomplete) the study used 36 countries. From the 48 SSA countries because of the absence of complete data Central African Republic, Chad, Comoros, Congo, Rep., Equatorial Guinea, Eritrea, Guinea-Bissau, São Tomé and Príncipe, Seychelles, Somalia, South Sudan and Sudan were excluded from the study.

The dependent variable is bank profitability proxied by Return on Asset (ROA). The existing literature shows different alternative bank profitability measures were used such as Return on Assets, return on equity, and net profit margins. A widespread measure of bank profitability is ROA [20, 51, 97, 110, 113]. The ROA is considered an important profitability ratio, indicating the per-dollar profit a company earns on its assets. Since bank assets largely consist of money the bank loans, the per-dollar return is an important metric of bank management. The ratio, which shows the per-dollar profit a company makes on its assets, is thought to be a crucial profitability indicator. The per-dollar return is a crucial indicator of bank management because the majority of bank assets are made up of loans to customers. The ROA is a widely used indicator for measuring the profitability of banks since it reveals how leveraged or indebted a company is taken into consideration and includes the money it borrows to finance its activities in the overall assets.

In the same manner Sufian and Chong argue that because ROA is unaffected by high equity multipliers and gives a more precise picture of a company's ability to produce returns on its asset portfolio, it is the best indicator of bank profitability [119].

This is calculated by dividing a bank's net income by its total assets during the same period. The greater the Return on Asset (ROA), the greater the level of profit achieved by the bank and the better the company's performance [26].

According to the literature, there are numerous ways to analyze risk, including credit risk, market risk, liquidity risk, overall risk, etc. In this study credit risk is measured by the ratio of non-performing loan to total loans. According to the literature, credit risk is measured as the proportion of non-performing loans to total loans (NPLTL), and a higher ratio implies a greater chance of losses due to loan defaults [43, 137]. Changes in credit risk may be an indicator of how well a bank's loan portfolio is doing [49]. The previous study reveals that the relationship between profitability and credit risk is unclear. A number of studies, including those by [6, 22, 108, 118], show that loan provisions are significant and have a strong negative effect on profitability. Loan loss provision to

total loans is another indicator of credit risk because it shows how well banks can withstand losses from non-performing loans [137]. According to Syafri, the ratio of loan loss provisions to total loans improves profitability. A high ratio indicates a low degree of profitability and a low level of credit quality [122].

Kolapo, Ayeni, and Oke identified poor management, ineffective loan policies, interest rate volatility, low capital and liquidity rates, insufficient credit appraisal, improper lending procedures, poor lending underwriting, government intervention, and ineffective central bank regulation as the main causes of credit risk [60].

According to the Basel Committee on Banking Supervision, the persistent appearance of non-performing loans is one of the major factors contributing to banking sector collapse. The banking sector is very vulnerable because deposits from depositors make up more than 85% of banks' liabilities. Despite the fact that banks primarily rely on lending as a source of income, they are also vulnerable to a number of risks that, if not properly identified and addressed, could put the organization at risk. The majority of banks need competent risk management techniques to survive, yet some bank managers disregard this responsibility in favor of their own self-serving goals. Risk management can help you avoid these procedures that give banks the ability to reduce or get rid of the damage caused by credit risk. It's necessary for both the survival and improved bank performance and demands for a comprehensive and extended credit risk management framework [36, 63].

Another bank-specific variable that has had a significant impact on bank profit is the liquidity ratio, measured by the ratio of liquid assets to customer and short-term funding [76]. Higher liquidity is preferred, as it demonstrates the better ability of banks to manage their liquidity risks; however, holding more liquidity contributes to the higher opportunity cost of doing business [89].

Liquidity ratios measure the ability of a firm to pay its short-term debts with liquid assets. More liquidity decreases the risk of financial failure by providing access to cash when needed. This means that more liquid financial institutions are expected to be more profitable. Other studies [16, 23, 91, 120] also found a positive relationship between liquidity and profitability. However, [58, 65, 89, 103] argued that there was a tradeoff between profitability and liquidity. In this study we measure liquidity by the ratio of liquid assets to customer and short-term funding.

The central bank will announce monetary policy on a regular basis, and it is the mechanism through which the government of a country controls the flow of money into its economy. It works as a powerful weapon to maintain the stability of a currency's purchasing power by regulating the flow of money within an economy. Consequently, there is effective communication between the monetary policy and the success of the bank [34, 67, 134].

The existing evidence indicates a relationship between monetary policy and bank profitability, although the findings

are conflicting and country-specific [78].

The total worth of monetary assets present in an economy at a particular time is known as the money supply (also known as the money stock). The central bank's policy mostly determines the money supply, which has an impact on how banks behave and how profitable they are. In this study the monetary policy parameter was measured by broad money supply [86].

To control for the macroeconomic effect, one of the variables used in this study was the Inflation which measures the level of macroeconomic stability. The macroeconomic stability is proxied by the consumer prices indexes (annual percentage) which measures inflation rate [133].

The rate at which the average price of goods and services in an economy is rising over time is known as inflation. Consumers' purchasing power is reduced by inflation because we can buy fewer goods and services per unit of currency [83].

Based on yearly fluctuations in the consumer price index in percentage, we control inflation. The profitability of banks may be influenced by inflation since it affects the structure of interest rates. Greater loan interest rates will be the result of higher inflation, which will boost bank profits. The risk of loan repayment may increase with rising interest rates, though, as a higher inflation rate affects borrowers' budgets, risking their liquidity and reducing their ability to repay loans [82].

The GDP, which reflects the amount of economic activity, was one of the variables employed in this study to account for the macroeconomic influence. The yearly growth rate of GDP per capita serves as a proxy for GDP growth [133].

The Growth in gross domestic product (GDP) per capita, expressed as a yearly percentage change. It is stated as the annual fluctuation in GDP PIB per capita based on the current GDP per capita measured in US dollars [32, 73].

We utilize the trade to GDP ratio, which is measured as the sum of total import and export divided by GDP, to evaluate trade openness (TO). This variable is frequently utilized in studies on financial development and economic growth [28, 138].

To measure the financial openness (FO), we employ the dejure Chinn-Ito index (which is known as the KAOPAN index). This index is constructed based on the information available in the IMF annual report on exchange arrangement and exchange restriction. More specifically, it considers a binary dummy variable, which codifies a cross-border financial transaction limitation. A high number indicates a lower level of restriction [47].

3.2. Econometric Model Specification

This study uses dynamic panel model specifications to investigate the effects of bank credit risk and liquidity on profitability of banks which is based on the Arellano and Bover's (1995) Generalized Method of Moments (GMM). Previous studies in the literature mostly used the conventional ordinary least square regression, which has a lot of drawbacks, espe-

cially when working with a big data set and contrarily the systems GMM method of estimation is helpful to account for potential endogeneity problems [28, 64, 101, 132].

GMM takes into account endogeneity, heterogeneity, unobserved panel, autocorrelation, omitted variable bias, and measurement errors [13]. According to Bond (2002), the system GMM estimator provides more accurate results than the difference GMM estimator due to the unit root characteristic [40]. The differenced GMM approach differences all regressors before eliminating fixed effects to correct endogeneity. However, the first difference transformation is flawed since it subtracts the previous observation from the present one, magnifying data loss gaps [13]. As a result, it somewhat influences the anticipated outcome. The System GMM approach introduces extra instruments for the lagged dependent variable and any other endogenous variables, which greatly enhances efficiency and deals with endogeneity. It also redefines the instruments to be exogenous, with fixed effects, and uncorrelated with the lagged dependent variable (exogenous). Moreover, unlike Differenced GMM, System GMM does not subtract the current observation from the average of all future accessible variable data, but vice versa of Differenced GMM [111]. The link between the explanatory and dependent variables under research was therefore examined in this study using System GMM.

This strategy is also employed since the other conventional panel data estimators, like pooled OLS, fixed and random effects, are biased as a result of the lagged dependent variable put into the model.

To examine the effects of bank credit risk, liquidity and macroeconomic related factors interaction with profitability of commercial banks of SSA proxied by ROA, a two-step system dynamic GMM estimator was applied. The two-step system GMM was adopted because it could provide consistent estimates and mitigate endogeneity bias in the model [93].

Despite having predictor variables that are not primarily exogenous and even though autocorrelation and heteroscedasticity exist within the predictor variables, the two-step system GMM provides a consistent and effective co-efficient value [127]. The technique of the two-system GMM steadiness relies on two diagnostic tests: an autocorrelation test of the error terms and the Sargan test for instrument validity. The Sargan test, which tests for over-identifying restriction, will first identify the model specification or evaluate the instrument's reality related to the error term [129].

The main independent variables are bank credit risk that is proxied by Non-performing Loan ratio and Liquidity was measured by the ratio of liquid assets to customer and short-term funding. In addition, the control variables (macroeconomic variables) included in the model were Monetary policy parameters measured by broad money supply, trade openness measured by export plus import divided by GDP, Financial openness is measured by the KAOPAN index, gross domestic product (GDP) by GDP per capita based on the current GDP per capita measured in US dollars, and the macroeconomic

stability is proxied by the consumer prices indexes (annual percentage) which measures inflation rate inflation.

ROA, which was used to measure profitability, was employed as a dependent variable. The study added the lagged value of profitability ($ROA_{i,t-1}$) in addition to the independent variables to address the issue of serial correlation. This method makes the assumption that the level of bank profitability in the past may have an effect on the level of profitability in the present. As a result, the following model is constructed:

$$y_{i,t} = \alpha + \beta_1 y_{i,t-1} + \beta_2 X_{i,t} + \beta_3 Z_{i,t} + \alpha_i + \varepsilon_{i,t} \quad (1)$$

$$ROA_{i,t} = \alpha + \beta_1 ROA_{i,t-1} + \beta_2 CreR_{i,t} + \beta_3 Liq_{i,t} + \beta_4 monp_{i,t} + \beta_5 FOp_{i,t} + \beta_6 Top_{i,t} + \beta_7 GDPpca_{i,t} + \beta_8 Infln_{i,t} + \alpha_i + \varepsilon_{i,t} \quad (2)$$

4. Results and Discussion

4.1. Descriptive Statistics

Table 1 provides descriptive statistics, including the mean, the standard deviation, minimum and maximum observations for outcome variables and predictors. The results indicate a variation between the mean values and standard deviation of ROA as profitability measure from 2000 till 2020 among banks of Sub-Saharan African countries.

Table 1 shows that the mean value of ROA is 2.13 (213%) with a minimum value of -23.26 and a maximum value of 12.66. This result indicates that sampled countries banks on average make Birr 2 and 13 cents from a birr invested in their asset. This ranges from a loss of -23 birr and 26 cents to a profit of 12 birr and 66 cents during the study period with a standard deviation of 2.03 (203%) from the mean.

The ratio of non-performing loans to total gross loans is

Where $y_{i,t}$ denotes the dependent variable (bank profitability proxied by ROA) i at time t . $y_{i,t-1}$ represents lagged variables of the dependent variable. $X_{i,t}$ represents the explanatory variables; credit risk, and liquidity, i , at time t . $Z_{i,t}$ represents the control variables; GDP, Inflation, financial openness, trade openness, and monetary policy parameters proxied by broad money supply. α is a constant; β_1 , β_2 and β_3 represent the coefficients, α_i is the unobservable country characteristics and $\varepsilon_{i,t}$ is the error term.

However, to bring the interaction effect of the explanatory variables and control variables on profitability, equation (1) is modified as given below in accordance with [114, 133].

used to quantify credit risk. Its average value is 10.6, with minimum and maximum values of 1 and 74.1, respectively. The standard deviation, which is 9.23, shows that there is diversity in the credit risk level of the banks in the selected nations. This implies that the mean value of credit risk which was measured by non-performing loan to gross loan as an indicator of bank credit risk was 10.6, which indicates the banks operating in sub-Saharan African countries are exposed to average level of credit risk as compared to other explanatory variables.

The ratio of liquid assets to customers and short-term funding, which measures liquidity, has an average value of 39.14, with minimum and maximum values of 6.87 and 102.76, respectively. The standard deviation, which is 18.69, shows that there is variance in the liquidity position of the banks in the tested nations. From the macro-economic variables, financial openness has the lowest average value of -0.497 (-49.7%) and the lowest standard deviation of 1.24 with minimum and maximum values of -2 and 2, respectively.

Table 1. Descriptive statistics for the dependent and explanatory variables.

Variable	obs.	Mean	Std.Dev.	Min	Max
ROA	731	2.134103	2.02939	-23.25714	12.65756
L1	720	2.157011	2.055109	-23.25714	12.65756
CreR	720	10.601	9.233782	1	74.1
Liqy	731	39.13537	18.68709	6.871921	102.7618
GDPpca	752	1720.547	2122.077	110.4609	11645.98
Top	710	67.48603	29.52875	16.35219	175.798
Infln	752	10.05641	34.9141	-9.616154	557.2018
monp	752	30.6471	20.56599	2.857408	156.8433
Fop	731	-0.4978479	1.240045	-2	2

4.2. The Two-step System GMM Estimation Result

The system GMM technique is used in the study to investigate the link between the chosen variables and bank profitability. It is imperative to discuss the findings of the diagnostic tests before providing the empirical data. The model's findings, which were used to determine the factors that affect commercial banks' profitability in Sub-Saharan African countries, are shown in Table 2. We discuss the Hansen and Sargan tests. The Hansen J test is used to evaluate the reliability of the instruments; it examines the null hypothesis of the overall reliability of the instruments; failure to reject these null hypotheses supports the selection of the instruments. The Sargan test makes the assumption that the residuals or error terms don't correlate with the instrument's variables. When the null hypothesis that the over-identifying instruments are valid is accepted, the test's validity is established [111].

Additionally, the autocorrelation/serial correlation test of the error term is demonstrated to test the null hypothesis that the differenced error term is first and second orders serially correlated; if the null hypothesis of no second-order serial correlation is not rejected, it is implied that the original error term is serially uncorrelated and the moment conditions are suitably specified (i.e., the value of AR (2) > 0.05).

According to Table 2, the F-test statistics (Prob > F = 0.000) indicated the model's goodness of fit, the Hansen statistics result (Prob > chi2 = 0.236) evidenced the validity of the instrumental variables, the Sargan test (Prob > chi2 = 0.960) confirmed the validity of the over identifying restrictions in the GMM estimation is accepted for all specifications, and the second-order autocorrelation is rejected by the test for AR (2) (Pr > z = 0.213) as it indicated the absence of second-order autocorrelation.

Our lagged dependent variable, which measures the degree of persistence of bank profitability measure ROA, is statistically significant in the model, indicating a high degree of persistence of bank profitability and justifying the use of a dynamic model. The lagged dependent variable's significant coefficient indicates that the current year's bank profitability is influenced by the profitability of the prior year's banks. The lagged value of bank profitability appears to be an appropriate tool for measuring bank profitability since it has a positive effect on the current year of bank profitability.

Bank credit risk has a negative and statistically significant effect on banks' profitability in sub-Saharan African countries. A two-step system GMM result reveals there is a negative relationship between ROA and credit risk after measuring credit risk using non-performing loans. According to the relationship between ROA and bank profitability, credit risk is linked to lower bank profitability. The increase in the amount of the banks' non-performing loans will cause the profitability of the banks to decline, which is a plausible justification for the negative relationship between credit risk and bank profitability.

Non-performing loans create a credit risk that is negatively correlated with ROA, suggesting the usefulness of credit risk as a risk indicator. By adhering to the right procedures, managing credit risk is made easier, negating the need to create a system that will help to reduce expected costs [21]. The body of knowledge on the subject is growing, particularly in the aftermath of the most recent global credit crisis in 2007, which had negative influences and threatened the stability of the financial system. The findings of this study back up those of the previous study, which indicated a negative relationship between bank profitability and credit risk [10, 25, 50, 61, 87, 113].

The model's findings demonstrated that the profitability of banks in sub-Saharan African nations is positively and statistically significantly impacted by liquidity, which gages the capacity to meet current obligations with current assets. The result shows that an increase in liquidity leads to increased profitability. The result is in line with the prior literature and consistent with the findings of [11, 15, 44, 54, 136], argued that the greater the amount of the resources that are tied up to meet the liquidity position, the higher is the profitability but in contrast with the findings of [30, 130] who has concluded that liquidity is negatively related to profitability.

Although prior study suggested that trade openness considerably enhances banks' performance and a nation's economic development [1, 66, 74, 85, 94, 96].

Increased trade openness through access to foreign financial markets and intense competition in the credit markets could increase bank profitability [12]. The ability of domestic banks to obtain inexpensive loans from overseas lenders and lend them to domestic borrowers is facilitated by trade openness [123].

Trade openness has a negative and statistically significant effect on banks' profitability in sub-Saharan African countries. A two-step system GMM result reveals there is a negative relationship between ROA and trade openness, the coefficient of Trade openness (TRO) measured by export plus import to GDP ratio is -0.0038647 and its P-value is 0.012. Assuming all explanatory variables constant at their average values, the profitability (ROA) of sub-Saharan African countries will decrease by 0.39% when trade openness (TRO) increases by 1%, which is statistically significant at the 5% level of significance and it is in line with Sultonbek Uralov studies [121]. This result is not unexpected given that openness encourages international banks to compete in the sub-Saharan African countries bank. The finding is different from the few previous researchers because weaker economies or nations are compelled to compete in the same market as stronger ones, trade openness can be dangerous for developing countries or economies. It's possible that this obstacle will cause freshly founded or localized industries to fail.

Financial openness which was measured by KAOPAN index has a positive and statistically significant effect on banks' profitability in sub-Saharan African countries and statistically

significant at 1% level of significance. The findings of the empirical analysis show that financial openness had a positive effect on the profitability of commercial banks. These results lead us to the conclusion that, if commercial banks are in a position to benefit from economic openness, banks profitability could increase [116].

Monitory policy parameter which was measured by the broad money supply has a negative and statistically significant effect on banks' profitability in sub-Saharan African countries and it was statistically significant at 10% level of significance. This finding was consistent with [79, 88] who were concluded in their study that unconventional monetary policy tools reduce the profitability of banks. The prior evidence suggests that monetary policy influences bank profitability.

Lower interest rates help banks by lowering their financing costs and improving the creditworthiness of their borrowers. Second, loosening monetary policy could result in a drop in net interest income [3].

Inflation has a positive and statistically significant effect on banks' profitability in sub-Saharan African countries and it was statistically significant at 1% level of significance.

This finding was consistent with numerous empirical studies found a significant and positive relationship between bank profitability and Inflation [9, 27]. This implies that, as a high inflation rate is related with strong bank performance, a positive impact of inflation on bank profitability is theoretically predictable.

Table 2. Dynamic panel-data estimation, two-step system GMM.

ROA	Coef.	St.Err.	z	Sig
L.ROA	.58883	.098116	8.43	***
CreR	-.0392233	.013159	-2.98	***
Liqy	.0057044	.0023945	2.38	**
GDPpca	-.0000107	.0000193	-0.55	
Top	-.0038647	.0015303	-2.53	**
Infln	.0048652	.0064568	0.75	
monp	-.0044738	.0024081	-1.86	*
FOp	.1962007	.0717841	2.73	***
Constant	1.281458	.2761343	4.64	***
Number of obs		387	Prob > chi2	0.000
Number of Instruments		18	Number of Groups	20
Hansen Test		0.236	Sargan test	0.960

Arellano-Bond test for AR (1) in first differences: $z = -1.30$ $Pr > z = 0.192$

Arellano-Bond test for AR (2) in first differences: $z = 1.24$ $Pr > z = 0.213$

5. Conclusions

The actual data shows that the expansion of the banking industry is necessary for an economy to grow. One of the factors causing economic backwardness in the majority of sub-Saharan African nations is low levels of banking sector development in compared to other nations around the world. In order to investigate the variables influencing the profitability of banks in Sub-Saharan African nations, this study utilized the system GMM estimator created for dynamic panel model estimate. The paper examines the effect of bank credit risk and liquidity on bank profitability in SSA countries over the period 2000–2020. Unlike other empirical studies, this paper

considers bank credit risk and bank liquidity to assess how they affect bank profitability while controlling for some macro-economic variables which includes GDP per capita, inflation, monitory policy, trade openness and financial openness.

The result of the model indicated that there is a significant and negative relationship between bank credit risk and the profitability of SSA countries banks. The increase in the amount of the banks' non-performing loans will cause the profitability of the banks to decline, which is a plausible justification for the negative relationship between credit risk and bank profitability.

Trade openness has a negative and statistically significant effect on banks' profitability in sub-Saharan African countries. The results differ from those of the few prior academics

because weaker economies or nations are forced to compete in the same market as stronger ones, and trade openness can create challenges to developing economies or economies. This challenge may result in the failure of recently established or localized industries.

Bank profitability in sub-Saharan African countries is negatively affected by a monitoring policy parameter that was measured by the broad money supply, and this effect is statistically significant at the 10% level of significance. The study found that both liquidity and financial openness have a significant and positive relationship with the profitability of SSA countries banks. This implies that an increase in liquidity leads to increased profitability of banks, and the results lead us to the conclusion that, if commercial banks are in a position to benefit from economic openness, banks profitability could increase.

6. Research Implications and Future Research Suggestions

The findings and conclusions of this study have important policy implications for decision-makers and bank managers. Given the fierce competition in the banking industry brought on by both macro- and bank-specific variables, it is crucial for bank managers to ensure the wise use of bank resources in order to stay competitive.

There is currently a dearth of empirical research on the effects of financial openness, trade openness, and monitoring policy parameters on the banking industry, opening up considerable opportunities for future study. Thus, the study offers suggestions for future investigations. For instance, additional study may incorporate macroeconomic variables like foreign direct investment and public policy parameters to investigate their effect on bank profitability.

Abbreviations

GMM	Generalized Method of Moments
GDP	Gross Domestic Product
NPM	Net Profit Margin
ROA	Return on Asset
ROAA	Return on Average Asset
ROE	Return on Equity
ROAE	Return on Average Equity
SSA	Sub Saharan Africa

Author Contributions

Tesfaye Eresso Gofe: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Software, Validation, Visualization, Writing – original draft, Writing – review & editing

Amsalu Bedemo Beyene: Supervision

Data Availability Statement

Availability of data and materials all the data generated or analyzed during this study are included within the submitted manuscript.

Conflicts of Interest

The authors declare no conflicts of interest.

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