

Inflation uncertainty, macroeconomic instability and the efficiency of financial institutions

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Abstract

Purpose – The study examines the effect of macroeconomic risk, inflation uncertainty and instability associated with key macroeconomic indicators on the efficiency of financial institutions among economies in sub-Saharan Africa (SSA).

Design/methodology/approach – Data for the empirical inquiry were compiled from 35 SSA economies from 1996 to 2019. The empirical estimates were carried out using pooled ordinary least squares (POLS) with Driscoll and Kraay's (1998) standard errors.

Findings – Reported empirical estimates show that macroeconomic risk and exchange rate volatility constrain the efficiency of financial institutions. Further results suggest that inflation uncertainty has a significant influence on the efficiency of financial institutions among economies in the subregion. Additionally, reviewed empirical estimates show that institutional quality positively moderates the nexus between inflation uncertainty and financial institution efficiency. At the same time, political instability is found to worsen the adverse effect of macroeconomic risk on the efficiency of financial institutions.

Practical implications – For policymakers and governments, improved institutional structures are recommended to ensure the operational efficiency of financial institutions, especially during an inflationary period. For decision-makers among financial institutions, the study recommends policies that have the potential to make their institutions less vulnerable to macroeconomic risk and exchange rate fluctuations.

Originality/value – The approach adopted in this study differs significantly from related studies in that the study examines and reviews interactions and relationships not readily found in the reviewed literature.

Keywords Financial institution efficiency, Inflation uncertainty, Macroeconomic risk, Pooled ordinary least squares (POLS), Driscoll and Kraay (1998) standard errors

Paper type Research paper

1. Introduction

In a macroeconomic environment characterized by recurrent fluctuations in key economic indicators, economic agents (investors, consumers and governments) adjust decision-making behaviors in line with prevailing macroeconomic conditions to make optimal choices according to the rational choice theory. In this process, economic agents reduce vulnerability to such macroeconomic fluctuations by incorporating all available and relevant information into the decision-making process that can improve chances of realizing optimal outcomes. For instance, consumers may minimize vulnerability to inflationary pressures by reducing



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exposure to shocks using all relevant pricing information in the decision-making process. However, among investors or corporate organizations such as financial institutions, reducing vulnerability to macroeconomic fluctuations or shocks often entails pursuing adaptive strategies in a competitive macroeconomic environment. Fundamental strategies often adopted to enhance resilience to macroeconomic shocks include ensuring operational efficiency and flexibility in an evolving macroeconomic environment. The literature on the dynamic interactions between events in the macroeconomic environment and the performance of economic agents such as firms and corporate institution is extensive (see [Issah and Antwi, 2017](#); [Pacini *et al.*, 2017](#); [Haider *et al.*, 2018](#); [Khan *et al.*, 2018](#); [Abaidoo, 2019](#)). In a related study, [Bayar and Ceylan \(2017\)](#) showed that macroeconomic uncertainty significantly affects firm profitability. Although existing studies differ considerably in approach and methodology, they mostly subscribe to the view that macroeconomic conditions greatly influence firms' and institutions' performance and operational activities in an economy. This study is designed to augment the discourse on the dynamic interactions between macroeconomic conditions and organizational performance by examining how specific adverse macroeconomic conditions, namely inflation uncertainty and macroeconomic risk, among others, influence the efficiency of financial institutions among economies in sub-Saharan Africa (SSA).

The subregion of SSA is often noted for significant adverse macroeconomic conditions, such as persistent fluctuations in key macroeconomic indicators or variables. According to [Melina and Portillo \(2018\)](#), the subregion is characterized by significant macroeconomic instability, cyclical investment and consumption trends, volatile consumption and investment growth and current and trade account imbalances. According to [Melina and Portillo \(2018\)](#), these pervasive features influence performance dynamics associated with various sectors of economies in the subregion. Exposure to these macroeconomic conditions makes institutions and firms operating in such an environment relatively susceptible to such risk with potential adverse impact on performance. [Sintim and Byekwaso \(2006\)](#) further note that the subregion of SSA is characterized by a myriad of economic downturns and poor macroeconomic performance due to economic mismanagement, political instability and natural disasters. To further provide insights into the evolving influence of these endemic macroeconomic conditions, this study is designed to assess the extent to which specific adverse macroeconomic conditions influence the efficiency of financial institutions among economies in the subregion. Existing literature alludes to significant interactions between performance or efficiency of financial institutions and prevailing macroeconomic conditions. For instance, according to [Sarpong-Kumankoma *et al.* \(2017\)](#), the efficiency of banking operations has implications for performance of an economy as a whole. However, the efficiency and effectiveness of these institutions and the extent to which these characteristics influence growth among economies in the subregion have come under significant scrutiny in recent years. For instance, [Segun and Anjugam \(2013\)](#) concluded that most financial institutions are inefficient in their intermediating role between borrowers and depositors among economies in the subregion. This conclusion by [Segun and Anjugam \(2013\)](#) drives the need to evaluate core determinants of efficiency among financial institutions operating in the subregion and hence the motivation for the current study.

The approach adopted in this study differs significantly from that in related studies. For instance, [Abaidoo and Agyapong \(2022a, b\)](#) verified conditions or factors influencing the efficiency of financial institutions, with a specific focus on institutional quality dynamics and macroeconomic uncertainty. However, the approach adopted in this study is significantly different from that of [Abaidoo and Agyapong \(2022a, b\)](#) in terms of the proxies for the key variables examined, model specification procedures and estimation methodology. Again, while [Abaidoo and Agyapong \(2022a, b\)](#) focused mainly on the effect of institutional quality, the current study predominantly examines the impact of macroeconomic instability (risk) on

the efficiency of financial institutions. Consequently, the present study reviews interactions and relationships not readily found in the reviewed literature. For instance, the macroeconomic risk variable examined in our inquiry is unique to this study; the variable, constructed using a principal components analysis (PCA) procedure, is significantly different given the underlying base variables employed in the construction process. While [Abaidoo and Agyapong \(2022a, b\)](#) used volatility associated with gross domestic product (GDP) growth to capture macroeconomic uncertainty, the current study uses specific base variables to construct a macroeconomic risk index using PCA methodology. In order words, the variables examined in this study differ significantly from that of [Abaidoo and Agyapong \(2022a, b\)](#) and are not readily available in any known database.

Additionally, this study adopts a disaggregated approach where the potential effects of inflation uncertainty and exchange rate uncertainty are examined, aside from the main impact of the composite macroeconomic risk index on the efficiency of financial institutions. Although these two variables (inflation and exchange rate) are critical to most economies around the world, it is of particular importance to economies of SSA since most of the economies are import oriented and, as such, relatively susceptible to such conditions. Again, while the continuous updating estimator (CUE) of the instrumental variable estimation technique was employed by [Abaidoo and Agyapong \(2022a, b\)](#), the current study is based on the pooled ordinary least squares (OLS) with Driscoll–Kraay standard errors and the panel-corrected standard errors (PCSEs) for robustness check. Furthermore, the financial institution efficiency variable examined is based on construction procedures different from the measures of efficiency such as cost efficiency and net interest margin, among others, that are often discussed in related studies (see [Worthington, 1998](#); [Phan *et al.*, 2018](#); [Banya and Biekpe, 2018](#); [Le *et al.*, 2019](#); [Liang *et al.*, 2020](#)). The financial institution efficiency variable employed in this study highlights a broader approach to assessing efficiency and represents the general operational effectiveness of financial institutions. The financial institution efficiency variable is constructed from three performance features. The first of these features is the efficiency associated with intermediating savings to investment, as measured by the net interest margin and lending-deposit spread. The second focuses on operational efficiency measures such as non-interest income to total income and overhead costs to total assets. The third feature captures profitability measures such as return on assets (ROA) and return on equity. Examining the potential influence of these unique variables could ultimately highlight hitherto unexamined interactions and present a new perspective on the macroeconomic conditions and firm/institutional performance discourse. Apart from the direct relationships examined, the study's approach further subscribes to the view that focusing only on surmised relationships, as noted, has the potential to bury other critical conditions that may play a significant role in how some of the noted macroeconomic conditions influencing variability in financial institution efficiency. Consequently, empirical analysis pursued in this study further examines the potential moderating influence of political instability and institutional quality on the primary relationships examined.

The methodology employed in the study is designed to allow for specific interactions and relationships that significantly enhance existing literature on the dynamics of financial institutional performance and efficiency among economies in the subregion. The choice of specific moderators in the study follows submission by empirical studies such as [Kilishi *et al.* \(2013\)](#), [Appiah *et al.* \(2022\)](#) and [Fosu \(1992\)](#), alluding to the significance of political stability/instability and the quality of institutions of governance on firm performance and growth among economies in the subregion. The rest of the study is structured as follows: Section 2 analyzes the theoretical basis for the interactions examined in the research and the empirical literature; this is followed by the study's methodology and data description, culminating in functional models employed in examining interactions in the study. Section 4 presents the empirical analysis and results of the investigation. The final section presents the study's

conclusions, highlighting potential policy implications, contributions and recommendations for future research.

2. Related literature

2.1 Theoretical review

Theoretically, empirical interactions examined in the study hinge on the rational choice theory, one of the central theories in economics, which explains the mechanics of choice behaviors associated with economic agents. The rational choice theory postulates that the ultimate choices made by economic agents such as investors, policymakers, consumers and other players in a business environment are guided or informed by all available and relevant information at any point in time. This submission is based on the presumption that economic agents are rational in their decision-making process, often fueled by the intent to satisfy personal interests ([Askari et al., 2019](#)). [Vriend \(1996\)](#), in his submission, notes that the principle of self-interest optimization is a key doctrine of the rational choice theory. The study, thus, notes that given the presumption of rationality, economic agents will make decisions that inure to the realization of personal interests, using all information at their disposal. These submissions suggest that the actions of economic agents and, for this study, decisions and policy directives of managers of institutions in the financial sector ultimately reflect prevailing macroeconomic dynamics or information. For instance, [Awounang and Foning's \(2014\)](#) submission notes that economic agents often prefer to defer investment decisions in a business environment characterized by significant market costs resulting from volatility in the macroeconomic environment. In other words, information on prevailing macroeconomic condition can influence economic agents' behaviors, all things being equal. [David and Ampah \(2018\)](#) further showed that uncertainty associated with prevailing policies affects investment decisions, alluding to the role of winning information in the choice behaviors of economic agents. Consistent with these research submissions and the rational choice theory, we hypothesize that the efficiency of financial institutions among economies in the subregion of SSA could be a function of specific adverse macroeconomic conditions, all other things being equal. Specifically, the study surmises that inflation uncertainty, volatility associated with key macroeconomic variables and other relevant economic conditions could significantly explain operational efficiency variability among financial institutions and economies in SSA.

2.2 Empirical review

Empirical studies that have reviewed conditions or factors influencing the efficiency of financial institutions mainly focus on internal or industry-specific determinants as well as conditions in the broader macroeconomic environment. Reviewed studies in this regard are categorized into three types: studies focusing solely on internal or industry-specific factors, those focusing only on external or macroeconomic factors and a final category comprising a combination of the two. [Goswami et al. \(2019\)](#) showed that liquidity risk, ROA, credit risk and market concentration significantly impact technical efficiency among financial institutions; interest rate, bank size and capitalization were found to be insignificant in the same inquiry. Examining the factors influencing the cost efficiency of the banking industry in Hong Kong from 2004 to 2014, [Phan et al. \(2018\)](#) showed that bank size and GDP growth exert a significant positive effect on efficiency. However, inflation, stock exchange listings and revenue diversification were found to have significant negative impacts on cost efficiency. [Mohd Noor et al. \(2020\)](#) studied similar interactions using data from 108 Islamic banks in 26 countries. Results from the study revealed that industry-wide measures such as supervision, private monitoring and activity restrictions significantly impact the efficiency of Islamic

banks; the results further showed that less stringent capital requirement enhances the efficiency of Islamic banks in the Middle East and North Africa (MENA) countries. Focusing on the Indian banking industry, with a panel of 54 banks, [Arora \(2014\)](#) showed that ownership, bank listing and financial reform significantly influence efficiency. The study, however, found no conclusive evidence of the relationship between bank size and efficiency. [Ab-Rahim et al. \(2012\)](#) focused on the Malaysian banking industry in similar research. Results from their empirical estimates suggest that government ownership, population density, market concentration and demand density positively affect efficiency; credit risk, asset quality, management quality, capitalization and macroeconomic conditions were found to have an adverse effect on efficiency measures used in the study.

Compared to most studies examining the efficiency of financial institutions, reviewed studies focusing on macroeconomic determinants of financial institution efficiency mainly examine the efficiency of the banking industry. For instance, in their evaluation of the determinants of bank efficiency from a sample of 94 banks from the Eurozone countries from 2011 to 2016, [Neves et al. \(2020\)](#) showed that the state of the macroeconomy significantly affects various determinants of banking industry efficiency parameters. Again, for the Thai banking sector, [Sufian and Habibullah \(2010\)](#) identified financial crises, among other macroeconomic factors, as significant in influencing the efficiency of banks. [Papanikolaou and Delis \(2009\)](#) also found the investment environment and industry concentration to be significant in bank efficiency. Similarly, [Sufian \(2009\)](#) submitted that bank efficiency is negatively related to prevailing economic conditions in the Malaysian economy. [Chen and Lu \(2021\)](#) also examined the impact of macroeconomic determinants on the efficiency of commercial city banks in China from 2005 to 2014. Results from the stochastic frontier analysis show that the efficiency of Chinese city commercial banks positively correlates with per capita GDP growth.

[Chan and Karim \(2010\)](#) further showed that the cost inefficiency of commercial banks in the Asian region is negatively related to real GDP per capita, credit to the private sector and market concentration but positively associated with trade openness. [Dietsch and Lozano-Vivas \(2000\)](#) investigated the influence environmental conditions (external macroeconomic conditions) have on the cost efficiency of French and Spanish banking industries; the results demonstrated that business environmental variables contribute significantly to the difference in efficiency scores for banks between the two countries. [Naceur et al. \(2009\)](#) evaluated the factors driving bank efficiency among MENA countries. The study found substantial differences in bank efficiency across the various markets due to differential macroeconomic conditions, despite similarities observed in reforms. Empirical conclusions reported by [Drake et al. \(2006\)](#) further highlight the influential role of macroeconomic conditions in bank efficiency or performance discourse.

Among African economies, available literature also features studies examining how industry-specific conditions/factors and external factors influence operational efficiency among financial institutions. For instance, focusing on determinants of economic efficiency of microfinance institutions in Ghana, [Oteng-Abayie et al. \(2011\)](#) showed that mainly internal specific factors influence economic efficiency among microfinance institutions. In a recent inquiry, [Abaidoo and Agyapong \(2022a, b\)](#) also concluded that macroeconomic uncertainty, denoted by GDP growth volatility, has a significant adverse impact on financial institution efficiency. In a similar study from selected frontier African economies, [Banya and Biekpe \(2018\)](#) submitted that risk profile and bank size influenced the banking industry efficiency. Similarly, focusing on the Egyptian economy, [Alber \(2015\)](#), who examined the subject matter from 1984 to 2013, showed that bank size and ownership status are the significant factors influencing efficiency in the banking industry. Additionally, for the Ethiopian economy, [Tesfay \(2016\)](#) found that liquidity and deposits tend to have an influential positive role on the efficiency of commercial banks in the Ethiopian economy.

The above-reviewed literature shows significant diversity in factors and conditions that explain efficiency variability among financial institutions (mostly banks). However, the approach adopted in this study goes beyond the focus on banks and reviews the efficiency of the entire financial institution among economies in SSA. This study focuses on how specific adverse macroeconomic conditions influence the efficiency of financial institutions among sub-Saharan African economies. It is worth noting that most reviewed works have concentrated on institution/industry-specific determinants, while the few focusing on macroeconomic conditions often examine the impact of GDP growth and interest rate, among other macroeconomic conditions, on the banking industry's efficiency. The current study adds to the existing literature by examining the effect of rarely reviewed macroeconomic conditions (due to the nature of based variables employed in constructing such variables) on financial institutions' efficiency for the SSA subregion.

3. Methodology and data

This section presents the methodology employed in analyzing underlying data for the study. The section also features discussions on data sources, descriptions and descriptive statistics of the data. We first present the data sources and description, including variable derivation procedures. The panel estimation technique's presentation and the models' functional forms per the study's objectives are discussed next, followed by the descriptive statistics of the various variables and analysis of the pairwise correlation and multicollinearity tests to verify whether key explanatory variables do not breach any underlying assumption per the models to be estimated.

3.1 Data sources and description

The study uses secondary annual data compiled from various sources for 35 [1] countries in SSA over the period that starts from 1996 to 2019. Financial sector variables, namely, financial institution efficiency and financial development index, were collected from the International Monetary Fund (IMF) database. Data for macroeconomic variables such as consumer price inflation, GDP growth, exchange rate, net inflow of foreign direct investment (FDI), trade, broad money growth, export price index and import price index were also compiled from the World Development Indicators (WDI) database of the World Bank. For institutional and governance structures, data for variables, including political stability, government effectiveness, regulatory quality, voice and accountability, the rule of law and control of corruption, were collected from the World Bank's World Governance Indicators (WGI) database.

The dependent variable for the study's empirical inquiry is financial institution efficiency; this variable denotes an index that the IMF computes to assess the operational efficiency of financial institutions among various economies in the subregion. According to the IMF, the index considers net interest margin by the banking sector, lending to deposit spread, non-interest income, overhead cost and performance ratios (ROA and return on equity). The construction process and the components involved make it a more comprehensive index defining the operational efficiency dynamics of financial institutions in an economy. Similarly, the IMF constructed the financial development index to represent the pace of growth of the financial sector as a whole in terms of access, depth and efficiency of the sector in an economy. Consumer price inflation, referred to as inflation in the study, measures the rate of change in the price of goods and services annually. Again, the exchange rate represents the US dollar rate to the local currencies, while FDI is measured as the value of the net inflow of foreign funds for investment as a percentage of GDP. Trade defines the total value of imports plus exports as a proportion of the value of GDP.

3.2 Volatility data

The study defines the uncertainty of a variable in terms of volatility associated with the variable. This approach follows the economic principle, suggesting that volatile macroeconomic variables or indicators of interest create uncertainty among economic agents such as investors. For instance, such volatile conditions make investors uncertain about potential future returns due to the impact such volatile conditions can have on forecasts and performance projections. In other words, volatile macroeconomic indicators highlight a significant amount of risk in a macroeconomic environment for most investors and other economic agents. Following this presumption, this study generates volatility data associated with key variables to measure uncertainty related to such indicators or variables. Generalized autoregressive conditional heteroscedasticity (GARCH) methodology generates such data. The GARCH procedure posits that the conditional variance of a variable is dependent on its lags; that is, a variable's volatility is a function of the stochastic or unpredictable portion of the variable. This approach to volatility data generation is not new; it is routinely employed in the economics and finance literature. The approach adopted in this study follows the approaches reviewed in studies such as [Abaidoo et al. \(2021\)](#), [Abaidoo and Anyigba \(2020\)](#), [Abaidoo and Agyapong \(2021\)](#), [Asamoah et al. \(2016\)](#), among others, who showed that the GARCH procedure presents significant advantages compared to other approaches such as the use of standard deviation. [Hansen and Lunde \(2003\)](#) and [Reschenhofer \(2013\)](#) further made a case for the sufficiency of GARCH (1,1) for generating volatility data. The functional form of GARCH (1,1) used in generating volatility data is represented as [equations \(1\) and \(2\)](#), respectively.

$$V_{q,t} = \alpha + \beta V_{q,t-1} + \mu_t \quad (1)$$

where $\mu_t \approx N(0, \sigma_t^2)$

$$\sigma_{q,t}^2 = \gamma + \lambda \varepsilon_{q,t-1}^2 + \gamma \sigma_{q,t-1}^2 \quad (2)$$

From the equations, the subscript t represents the year. In contrast, the subscript q represents the macroeconomic variable (q is inflation, exchange rate, FDI, broad money growth, trade, import price index or export price index). V is the macroeconomic factor, σ^2 denotes volatility associated with variable q, while α , β and μ are the intercept, coefficient of lag of variable q and the error term, respectively, for the mean equation. The intercept of the volatility function is given by γ , while the coefficients of the ARCH and GARCH terms are denoted by λ and γ .

3.3 Construction of composite indexes

The study constructs unique indexes from base variables as part of the focus variables per the study's objectives. These variables are macroeconomic risk and institutional quality indexes, respectively. Macroeconomic risk is constructed as a composite index using the volatility data associated with the following economic indicators: FDI, trade, exchange rate, inflation, import price index, export price index and broad money growth. Institutional quality is similarly constructed using the six governance variables by the World Bank, namely control of corruption, government effectiveness, voice and accountability, the rule of law, political stability and regulatory quality. The study uses the PCA procedure to generate weights for constructing these indexes. According to [Ahamed and Mallick \(2019\)](#), the weights generated by the PCA procedure are derived from the eigenvectors that denote a significant percentage of the variance of the variables for the construct. According to the PCA procedure, a substantial portion of the interconnected dependent variables' variance is retained, while the redundancies are discarded ([Abdi and Williams, 2010](#)). The PCA procedure used for determining weights is superior compared to other methodologies such as budget allocation process, conjoint analysis, analytical hierarchy process, correlation, assignment of equal

weights and use of expert opinions; these approaches are fraught with potential bias (see Sendhil *et al.*, 2018; Basel *et al.*, 2020).

The variables used in constructing the macroeconomic risk index are reported in different units and scales of measurement. The study, therefore, follows the works of Sendhil *et al.* (2018) and Kumar *et al.* (2016) to perform data normalization for the various variables. It is expected that volatility associated with macroeconomic indicators may adversely influence the efficiency of financial institutions; consequently, equation (3), which executes the normalization process, is formulated as follows:

$$N_{p,it} = (Y_{max_{p,i}} - Y_{p,it}) / (Y_{max_{p,i}} - Y_{min_{p,i}}) \quad (3)$$

According to equation (3), the subscripts p, i and t denote the volatility variable, country and year, respectively. N represents the normalized datapoint, Y denotes datapoint, Ymax is the maximum datapoint and Ymin refers to the minimum datapoint for the volatility variable of focus. The macroeconomic risk index is therefore constructed following equation (4).

$$MRI_{it} = \sum_p^n \left((N_{p,it} * W_{p,i}) \right) / \sum_p^n W_{p,i} \quad (4)$$

From equation (4), MRI refers to the macroeconomic risk index, while W denotes weight. The remaining letters and symbols denote the definitions given per equation (3).

We do not undertake a data normalization procedure for the institutional quality index because the World Bank presents the six governance variables used for the construction as indexes of equal scale. Equation (5), therefore, calculates the index.

$$InsQ_{it} = \sum_j^n \left((X_{j,it} * \omega_{j,i}) \right) / \sum_j^n \omega_{j,i} \quad (5)$$

Institutional quality is defined in equation (5) by InsQ, X_j represents datapoint for governance variable j and ω_j represents the weight for governance variable j. As a result of these processes, the constructed variables are ultimately examined to achieve the study's objectives.

3.4 Political instability

The study further examines the potential moderating impact of the unstable political and civil environment on the surmised relationships examined. However, data collected from the WGI measures political stability ranging between -2.5 and 2.5; a higher value denotes a stable political atmosphere and vice versa. We convert the political stability variable to political instability to achieve the study's objective. The process involves taking the additive inverse of the political stability variable. Equation (6) provides the function for political stability; this function is then converted through the additive inverse process in equation (7) to represent political instability.

$$f(PS_{it}) = f(Z1_{it}, \dots, Z24_{it}) \quad (6)$$

$$f(PINST_{it}) = f(-Z1_{it}, \dots, -Z24_{it}) \quad (7)$$

From both equations, the subscript i and t represent country and year, respectively. PS and PINST denote political stability and political instability, respectively, while Z1, ..., Z24 are the datapoints for political stability from 1996 to 2019, respectively. The derived variable, political instability, measures political and civil unrest, where a higher value indicates heightened political unrest and vice versa.

3.5 Estimation technique and model specifications

The study uses panel data from 35 countries from SSA from 1996 to 2019. Panel estimation technique is therefore employed in examining the key objectives of the study. Specifically, the study uses the POLS with standard errors of [Driscoll and Kraay \(1998\)](#). The technique is adopted due to empirically verified features that make it a robust model for the estimation in question. The estimation procedure has received a significant application in the empirical literature due to its robustness ([Abaidoo and Agyapong, 2022a, b](#); [Khan et al., 2021](#); [Isik et al., 2021](#); [Joshi et al., 2021](#)). For instance, the technique has been found to provide robust standard errors and controls for cross-sectional dependence, which is often prevalent in most panel data ([Hoechle, 2007](#)). According to [Hoechle \(2007\)](#), a severe problem exists when cross-sectional correlation is ignored while carrying out panel data analysis; such a problem, as [Hoechle \(2007\)](#) notes, could result in severely biased statistical results and interpretations; consequently, [Hoechle \(2007\)](#) recommends the use of Driscoll–Kraay standard errors in panel regression analysis. [Haseeb and Hye \(2020\)](#) further argue in favor of the superiority of the Driscoll–Kraay standard errors by showing that the technique controls for the presence of serial correlation and heteroscedasticity, which are common features of panel data. [Croutzet and Dabbous \(2021\)](#) also add to the discourse on the robustness of the Driscoll–Kraay estimation methodology; they find the technique to be heteroscedasticity and autocorrelation consistent as being robust to all forms of cross-sectional correlation. The technique is, thus, efficient in controlling for most of the empirical issues associated with panel data and hence its adoption. For further robustness checks, we also carry out similar estimations with PCSE estimation technique that has also been deemed efficient in panel analysis.

Following the theoretical basis for the study, the rational choice theory, we surmise that variability in operational efficiency associated with financial institutions among economies in SSA could be a function of adverse macroeconomic conditions. Consequently, we conceptualize the functional form of such interactions per [equation \(8\)](#).

$$FIE = f(InfUnc, MacInst, Ctrl) \quad (8)$$

From [equation \(8\)](#), FIE denotes financial institution efficiency, InfUnc represents inflation uncertainty, MacInst denotes a vector of macroeconomic instability variables and Ctrl is a set of control variables, including institutional quality. We proceed to specifically present [equation \(9\)](#) to verify the relationships this study seeks to examine.

$$FIE_{it} = \beta_0 + \beta_1 InfUnc_{it} + \beta_2 MRI_{it} + \beta_3 ExcUnc_{it} + \beta_4 Inf_{it} + \beta_5 FDev_{it} + \beta_6 FDI_{it} + \beta_7 GDPG_{it} + \beta_8 InsQ_{it} + \varepsilon_{it} \quad (9)$$

According to [equation \(9\)](#), FIE represents financial institution efficiency, and InfUnc, MRI and ExcUnc are the explanatory variables of focus, denoting inflation uncertainty, macroeconomic risk index and exchange rate uncertainty, respectively. The control variables are represented by Inf, FDev, FDI, GDPG and InsQ, representing inflation, financial development, FDI, GDP growth and institutional quality, respectively. β_0 is the intercept, while the coefficients of the explanatory variables are given by $\beta_1, \dots, \beta_8$ in the order of appearance per the equation. The composite error term is represented in the equation by ε_{it} . We also assess the potential moderating influence of institutional quality and political instability on the nexus between inflation uncertainty, macroeconomic risk and financial institution efficiency in relation to [equation \(10\)](#).

$$FIE_{it} = \beta_0 + \beta_1 InfUnc_{it} + \beta_2 MRI_{it} + \beta_3 ExcUnc_{it} + \beta_4 Inf_{it} + \beta_5 FDev_{it} + \beta_6 FDI_{it} + \beta_7 GDPG_{it} + \beta_8 InsQ_{it} + \beta_n (GovV_{k,it} * MIV_{m,it}) + \varepsilon_{it} \quad (10)$$

From [equation \(10\)](#), GovV_k is governance variable k , where k represents an institutional quality index or political instability, and MIV_m denotes macroeconomic instability variable m , where m represents either inflation uncertainty or macroeconomic risk index. β_n is the coefficient of the interaction variables examined, while the remaining variables and symbols follow the earlier definitions per [equation \(9\)](#).

3.6 Descriptive statistics and variable acceptability checks

[Table 1](#) presents the descriptive statistics for the various variables used for this study's empirical estimates. The mean (0.52) and standard deviation (0.14) for financial institution efficiency suggest that there exist insignificant differences in operational efficiency among financial institutions in the subregion. On the other hand, the same parameters of variables such as inflation uncertainty, macroeconomic risk index and exchange rate uncertainty show a significant disparity of the conditions among the various economies in the sub-region (that is, higher standard deviation scores than their respective mean scores). Again, over the study period, economies in the subregion grew by an average of 4.9%, with a standard deviation of 7.6% (again, signifying disparity in the pace of GDP growth for the various economies). An average of 4.4% of the total value of GDP was also recorded as an inflow of funds from foreign investors into the subregion over the study period. The average institutional quality index recorded over the study period was -0.41 ; political instability, however, recorded a positive average of 0.41 , indicating that weak governance and institutional structures exist among economies in the subregion. These summary statistics suggest that the subregion comprises emerging economies characterized by an anemic institutional framework.

[Table 2](#) presents the pairwise correlation matrix between pairs of the various variables designed to assess the acceptability profile of the explanatory variables, consistent with the underlying assumptions of regression analysis. Specifically, the goal is to ensure that the estimated model is not characterized by multicollinearity, which could churn out spurious results leading to misleading interpretations. According to [Suzuki et al. \(2008\)](#), for a variable to meet the acceptability threshold, the correlation coefficient between the variable and the other explanatory variables should not exceed 0.85 . Results from the table show that the correlation coefficient between pairs of the various explanatory variables are all less than the recommended 0.85 , highlighting that conclusions from the study will be free from spurious estimates. Following this conclusion, we further review the variance inflation factor (VIF) results in [Table 3](#). [Liao and Valliant \(2012\)](#) recommend that a variable's VIF should be

Variables	Obs	Mean	SD	Min	Max	p1	p99	Skew	Kurt
FIE	828	0.524	0.136	0.111	0.86	0.198	0.785	-0.447	2.975
InfUnc	828	-0.018	0.31	-6.101	0.322	-0.475	0.218	-14.744	247.521
MRI	828	0.712	1.12	-6.658	8.966	-3.193	5.366	0.345	22.774
Inf	767	0.069	0.072	-0.096	0.507	-0.035	0.347	2.206	10.864
ExcUnc	828	0.025	0.05	0	0.752	0.001	0.266	6.659	70.188
FDev	805	0.14	0.101	0.022	0.648	0.035	0.57	2.535	9.961
FDI	819	0.044	0.101	-0.087	1.618	-0.03	0.463	8.416	99.895
GDPG	823	0.049	0.076	-0.301	1.5	-0.088	0.207	9.753	177.638
InsQ	720	-0.405	1.365	-8.133	12.908	-3.105	5.453	4.163	39.436
PINST	720	0.405	0.827	-1.219	2.524	-1.089	2.211	0.291	2.438

Note(s): FIE = financial institution efficiency, InfUnc = inflation uncertainty, MRI = macroeconomic risk index, MacUnc = macroeconomic uncertainty, Inf = inflation, ExcUnc = exchange rate uncertainty, FDev = financial development, Flib = financial liberalization, FDI = foreign direct investment, GDPG = GDP growth, InsQ = institutional quality and PINST = political instability

Table 1.
Descriptive statistics

Table 2.
Pairwise correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) FIE	1.000								
(2) InfUnc	0.182	1.000							
(3) MRI	0.033	−0.018	1.000						
(4) Inf	−0.055	0.197	−0.050	1.000					
(5) ExcUnc	−0.081	0.046	−0.029	0.263	1.000				
(6) FDev	0.515	0.061	0.050	−0.067	−0.016	1.000			
(7) FDI	−0.039	0.031	−0.035	0.007	−0.033	−0.024	1.000		
(8) GDPG	0.117	0.014	−0.041	−0.002	0.021	−0.067	0.279	1.000	
(9) InsQ	0.013	−0.324	0.034	−0.049	−0.061	0.156	−0.039	−0.003	1.000

Note(s): FIE = financial institution efficiency, InfUnc = inflation uncertainty, MRI = macroeconomic risk index, Inf = inflation, ExcUnc = exchange rate uncertainty, FDev = financial development, FDI = foreign direct investment, GDPG = GDP growth and InsQ = institutional quality

Table 3.
Multicollinearity test

Variables	VIF	SQRT VIF	Tolerance	R-squared
InfUnc	1.40	1.18	0.7159	0.2841
MRI	1.01	1.00	0.9922	0.0078
Inf	1.17	1.08	0.8583	0.1417
ExcUnc	1.13	1.06	0.8868	0.1132
FDev	1.06	1.03	0.9445	0.0555
FDI	1.17	1.08	0.8524	0.1476
GDPG	1.12	1.06	0.8910	0.1090
InsQ	1.39	1.18	0.7169	0.2831

Note(s): InfUnc = inflation uncertainty, MRI = macroeconomic risk index, Inf = inflation, ExcUnc = exchange rate uncertainty, FDev = financial development, FDI = foreign direct investment, GDPG = GDP growth and InsQ = institutional quality

less than 10 in model specification and analysis. [Table 3](#) shows that none of the explanatory variables have VIF in excess of 10; these pre-estimation checks confirm that the underlying variables examined in this study do not breach any fundamental assumption of regression analysis.

4. Empirical analysis

This section presents the results of the various empirical estimates and the analysis. [Table 4](#) shows the results of estimations verifying the impact of inflation uncertainty and macroeconomic instability on the efficiency of financial institutions and the potential moderating effects of governance and institutional structures on the relationships examined. Results presented in Column (1) of the table indicate that inflation uncertainty exerts a significant positive impact on the efficiency of financial institutions among economies in the subregion. This outcome suggests that instability in general price levels somehow augments operational efficiency among financial institutions in the subregion contrary to expectation. Although counter-intuitive, this result is consistent with the submission of the rational choice theory, the theoretical framework defining interactions examined in this study. Since economic agents are deemed to harness and utilize all available information in their decision-making process per the rationality assumption of the theory, it is expected that instability or inflationary uncertainty, which has the potential to influence performance or profits negatively, will be of major concern to financial institutions. Consequently, to minimize the

	(1) FIE	(2) FIE	(3) FIE	(4) FIE	(5) FIE
InfUnc	0.215*** (3.52)	-0.288** (-2.70)	0.211*** (3.74)	0.181 (1.41)	0.176*** (2.76)
MRI	-0.0149*** (-6.97)	-0.0153*** (-7.54)	-0.0144*** (-4.46)	-0.0147*** (-6.73)	0.0100 (1.19)
ExcUnc	-0.409*** (-4.04)	-0.303*** (-3.77)	-0.410*** (-3.98)	-0.420*** (-5.21)	-0.342*** (-3.53)
Inf	0.0443 (0.49)	0.0861 (1.07)	0.0472 (0.52)	0.0420 (0.47)	0.00745 (0.08)
FDev	0.669*** (14.02)	0.575*** (9.13)	0.669*** (13.95)	0.668*** (14.00)	0.654*** (14.72)
FDI	-0.129*** (-3.02)	-0.125*** (-2.92)	-0.130*** (-3.03)	-0.129*** (-3.09)	-0.128*** (-2.67)
GDPG	0.490*** (4.74)	0.419*** (4.93)	0.491*** (4.75)	0.495*** (4.62)	0.463*** (4.25)
InsQ	-0.00119 (-0.31)	0.0167** (2.17)	-0.00203 (-0.43)	-0.000600 (-0.10)	-0.00459 (-0.82)
InfUnc*InsQ		0.142*** (6.15)			
MRI*InsQ			0.00179 (0.28)		
InfUnc*PINST				0.0867 (0.24)	
MRI*PINST					-0.0246*** (-3.28)
Constant	0.425*** (34.25)	0.452*** (26.69)	0.424*** (35.34)	0.425*** (35.10)	0.417*** (29.53)
Obs	655	655	655	655	655
No. of countries	35	35	35	35	35
R-squared	0.356	0.400	0.356	0.356	0.380
F-statistics	780.5	496.7	786.7	755.3	670.6
p-value	3.33e-36	2.19e-33	9.33e-37	1.86e-36	1.39e-35

Note(s): * $p < 0.1$, ** $p < 0.05$ and *** $p < 0.01$. t statistics in parentheses. FIE = financial institution efficiency, InfUnc = inflation uncertainty, MRI = macroeconomic risk index, Inf = inflation, ExcUnc = exchange rate uncertainty, FDev = financial development, FDI = foreign direct investment, GDPG = GDP growth, InsQ = institutional quality and PINST = political instability

Table 4.
Inflation uncertainty,
macroeconomic
instability and
financial institution
efficiency (POLS-
Driscoll and Kraay
standard errors
estimate)

potential adverse impact of such macroeconomic conditions, financial institutions (presumed by the theory to be rational) may preemptively pursue measures designed to ensure efficiency and minimize exposure to such persistent price fluctuations and hence the positive relationship.

From Table 4, macroeconomic risk, the PCA constructed index and exchange rate uncertainty are found to impact financial institution efficiency among economies in the subregion negatively. These results suggest that macroeconomic risk and exchange rate volatility constrain the efficiency of financial institutions, all things being equal. For instance, the macroeconomic risk or perception of such risk could foment investor apathy, influencing the extent of engagements or investments in financial products and services. This condition can severely affect the operations of such institutions. For most financial institutions, macroeconomic risk can also distort operational norms (any effective traditional means) as they adjust to minimize vulnerability to the prevailing risk. These reactions due to macroeconomic risk can negatively influence core efficiency measures such as cost efficiency, net income margins and other operational efficiency measures and hence the negative result.

Exchange rate volatility in this regard may also signal the potential vulnerability of the domestic currency against major external currencies with a similar perceived risk profile. Reacting to perceived domestic currency weakness can induce reactions similar to macroeconomic risk and hence the negative result. Reported results between macroeconomic risk and financial institution efficiency are consistent with [Abaidoo and Agyapong's \(2022a, b\)](#) conclusions, which found that adverse macroeconomic conditions such as macroeconomic uncertainty (GDP growth volatility) can negatively affect the efficiency of financial institutions. Results from the study also confirm the conclusions from a significant number of empirical inquiries, such as [Neves *et al.* \(2020\)](#), [Sufian \(2009\)](#), [Chen and Lu \(2021\)](#), [Chan and Karim \(2010\)](#) and [Drake *et al.* \(2006\)](#) who have shown that occurrences in the macroeconomic environment tend to have a significant influence on the efficiency of financial institutions and system.

Results presented in Columns (2) to (5) of [Table 4](#) are designed to evaluate the potential moderating role of institutional quality and political instability on the nexus between inflation uncertainty, macroeconomic risk and financial institution efficiency. In Column (2), we observe that institutional quality positively modifies the relationship between inflation uncertainty and financial institution efficiency. This suggests that improved structures or governance institutions could help improve financial institutions' operational efficiency during periods of significant price instability among economies in the subregion. In other words, the quality of domestic institutions of governance tasks with the responsibility of overseeing activities in the business environment is essential to the operational efficiency of financial institutions within the subregion. Again, in Column (5), it is evident that political instability has a significant negative moderating influence on the relationship between macroeconomic risk and financial institution efficiency among economies in the subregion. This suggests that political instability can potentially worsen the adverse effect of macroeconomic risk on the operational efficiency of financial institutions among economies in the subregion. In other words, the constraining impact of macroeconomic risk on the efficiency of financial institutions among economies in the subregion is further exacerbated by general insecurity or political unrest. This result further highlights the importance of policies that promote a stable political environment among economies in the subregion. However, results reported in Columns (3) and (4) indicate that institutional quality and political instability do not significantly influence the relationship between macroeconomic risk and financial institution efficiency and the nexus between inflation uncertainty and financial institution efficiency, respectively.

Among the control variables examined, the results show that financial development and GDP growth significantly affect financial institution efficiency among economies in SSA. These results suggest that the general performance or growth of the entire financial system in the subregion could have a significant positive cascading effect on the efficiency of financial institutions among economies in the subregion. Similarly, appreciable growth in productivity tends to promote confidence in the economy among economic agents such as investors. Such confidence ultimately bodes well for financial products and services, eventually improving the operational efficiency of financial institutions that are the main conduit for financial transactions. Results presented in [Table 5](#) further verify the abovementioned interactions but with a different panel data technique. The PCSE estimation technique is employed as a further robustness check for the main empirical model examined in the study. It is evident from the PCSE results that the direction and magnitude of influence from the PCSE estimates are similar and consistent with the conclusions from the POLS with [Driscoll and Kraay's \(1998\)](#) standard errors framework. Thus, the robustness of already examined results based on POLS with [Driscoll and Kraay's \(1998\)](#) standard errors is confirmed.

	(1) FIE	(2) FIE	(3) FIE	(4) FIE	(5) FIE
InfUnc	0.215*** (2.86)	−0.288** (−2.10)	0.211*** (2.68)	0.181 (1.58)	0.176*** (2.59)
MRI	−0.0149*** (−3.58)	−0.0153*** (−3.91)	−0.0144*** (−3.05)	−0.0147*** (−3.42)	0.0100 (1.46)
ExcUnc	−0.409*** (−5.05)	−0.303*** (−3.56)	−0.410*** (−5.03)	−0.420*** (−5.15)	−0.342*** (−4.33)
Inf	0.0443 (0.88)	0.0861* (1.85)	0.0472 (0.92)	0.0420 (0.87)	0.00745 (0.13)
FDev	0.669*** (24.37)	0.575*** (17.16)	0.669*** (24.33)	0.668*** (24.51)	0.654*** (25.68)
FDI	−0.129*** (−3.77)	−0.125*** (−3.80)	−0.130*** (−3.77)	−0.129*** (−3.77)	−0.128*** (−3.57)
GDPG	0.490*** (5.79)	0.419*** (5.30)	0.491*** (5.80)	0.495*** (5.65)	0.463*** (5.34)
InsQ	−0.00119 (−0.35)	0.0167*** (3.29)	−0.00203 (−0.46)	−0.000600 (−0.16)	−0.00459 (−1.40)
InfUnc*InsQ		0.142*** (4.65)			
MRI*InsQ			0.00179 (0.27)		
InfUnc*PINST				0.0867 (0.33)	
MRI*PINST					−0.0246*** (−3.50)
Constant	0.425*** (53.14)	0.452*** (44.42)	0.424*** (53.92)	0.425*** (55.16)	0.417*** (51.33)
Obs	655	655	655	655	655
No. of countries	35	35	35	35	35
R-squared	0.356	0.400	0.356	0.356	0.380
χ^2	1188.0	1152.0	1271.5	1198.1	1174.9
p-value	3.77e−251	2.77e−242	4.36e−268	3.16e−252	3.19e−247

Note(s): * $p < 0.1$, ** $p < 0.05$ and *** $p < 0.01$. t statistics in parentheses. FIE = financial institution efficiency, InfUnc = inflation uncertainty, MRI = macroeconomic risk index, Inf = inflation, ExcUnc = exchange rate uncertainty, FDev = financial development, FDI = foreign direct investment, GDPG = GDP growth, InsQ = institutional quality and PINST = political instability

Table 5.
Inflation uncertainty,
macroeconomic
instability and
financial institution
efficiency (panel
corrected standard
errors estimate)

5. Conclusion

Stability or fluctuations among macroeconomic indicators or variables have been found to play an influential role in the development of economies around the globe (refer to [Bleaney, 1996](#); [Sanchez-Robles, 1998](#); [Haghighi et al., 2012](#); [Ali and Rehman, 2015](#); [Liew et al., 2018](#)). The current study delves into the subject matter by assessing the impact of inflation uncertainty, macroeconomic risk and other key variables on financial institutions' efficiency among SSA economies. Relevant variables for the empirical inquiries were compiled from the IMF, WDI and WGI databases starting from 1996 to 2019 for 35 economies in the subregion. The empirical interactions defined by the study's objectives were performed using POLS with Driscoll–Kraay standard errors due to its unique control features that enhance the robustness of the model. Subsequent robustness checks were performed using the PCSE estimation technique.

The results show that macroeconomic risk and exchange rate uncertainty significantly negatively impact the efficiency of financial institutions among economies in the subregion. These findings suggest that significant instability among key macroeconomic indicators is

inimical to the operational efficiency of financial institutions in SSA. Further results from the empirical inquiry indicate that inflation uncertainty positively impacts the efficiency of financial institutions. This suggests that persistent fluctuations in the price of goods and services somehow foster efficiency among financial institutions among economies in the subregion contrary to expectations. The outcome, however, suggests that to minimize the potential impact of such conditions on operations, financial institutions, presumed to act rationally according to the rational choice theory, may implement measures designed to reduce vulnerability to such conditions; these measures could, in the process instead, promote efficiency and hence the observed result.

Further empirical inquiries show that institutional quality positively moderates the nexus between inflation uncertainty and financial institution efficiency. This outcome suggests that improved institutional structures among the economies could help improve the efficiency of financial institutions during periods of inflationary conditions in the subregion. Again, political instability is also found to exert a negative moderating impact on the relationship between macroeconomic risk and the efficiency of financial institutions, suggesting that political instability has the potential to worsen the adverse impact of macroeconomic risk on the efficiency of financial institutions among economies in the subregion.

The empirical findings reviewed above have valuable implications for various stakeholders, including policymakers of financial institutions, governments and the academic community. To policymakers and governments, the study's findings support and recommend measures that minimize macroeconomic risk and ensure stability in key macroeconomic factors. Improved institutional structures are further recommended to ensure the operational efficiency of financial institutions, especially during an inflationary period. Again, reviewed findings support measures that ensure political stability since political instability exacerbates the negative impact of macroeconomic risk on the efficiency of financial institutions among economies in the subregion. For decision-makers among financial institutions, the study recommends policies that have the potential to make their institutions less vulnerable to macroeconomic risk and exchange rate fluctuations. Finally, the present study examined dynamic interactions between adverse macroeconomic conditions and financial institutions' general efficiency. We propose further studies to review how similar macroeconomic conditions impact specific financial institutions, such as microfinance institutions (a dominant subsector of the financial system), among economies in the subregion.

Note

1. Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Chad, Comoros, Congo, Cote d'Ivoire, Equatorial Guinea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, MALI, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sierra Leone, South Africa, Tanzania, Togo, Uganda and Zambia.

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