

Antwi, Samuel; Tetteh, Anthony Buawolor; Armah, Patience; Dankwah, Eric Opoku

## Article

# Anti-money laundering measures and financial sector development: Empirical evidence from Africa

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\*Corresponding author: Samuel Antwi, Faculty of Accounting and Finance, University of Professional Studies, Accra LG 149, Ghana  
E-mail: [antwi.samuel@upsamail.edu.gh](mailto:antwi.samuel@upsamail.edu.gh)

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David McMillan, University of Stirling, UK

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## FINANCIAL ECONOMICS | RESEARCH ARTICLE

# Anti-money laundering measures and financial sector development: Empirical evidence from Africa

Samuel Antwi<sup>1\*</sup>, Anthony Buawolor Tetteh<sup>1</sup>, Patience Armah<sup>1</sup> and Eric Opoku Dankwah<sup>2</sup>

**Abstract:** The study's main objective was to evaluate the link between anti-money laundering (AML) regulations and financial sector development (FSD) in Africa and to test the nonlinearities in the AML regulations-FSD nexus. Panel data of 51 African countries from the World Bank's indicators, the IMF, and the Basel Institute on Governance over the period 2012 to 2019 were used. The study employs the two-step system GMM and the dynamic panel threshold regression in estimating the model. The Hansen test and Arellano—Bond test for AR (2) were conducted to check for the robustness of the model specification. The study employed STATA 15 in analysing the study. The analysis shows that anti-money laundering regulation positively influences African financial sector development. However, the study found a significant positive coefficient for AML below the threshold value at a 1% significant level and a significant negative coefficient for AML above the threshold. This indicates that AML laws favour financial sector development below the threshold, but this link disappears for regimes with high AML requirements in Africa. This suggests that excessive AML structures might discourage financial sector development in Africa due to the cost associated with AML. Financial institutions in Africa should invest in technology solutions to support financial crime compliance efforts in combating criminal crimes involving digital payments, cryptocurrency, third parties and trafficking of proceeds and other crime-related activities such as drug trafficking, corruption, terrorism, arms dealing, confiscation of their illegal funds and bribery.

**Subjects:** Economics; Finance; Business, Management and Accounting

**Keywords:** anti-money laundering regulations; financial sector development; threshold analysis

## 1. Introduction

Financial development gives better information about possible profitable investments and promotes optimum allocation of capital (Guru & Yadav, 2019). It is empirically proven that financial development affects positively every sector of an economy in developed countries (King & Levine, 1993; Levine, 1993) of which the banking sector has benefitted immensely. Other scholars have also proven that financial development has the tendency of impacting positively on all sectors of an economy in emerging countries, especially in Africa (Adu et al., 2013; Ibrahim & Alagidede,



2018a, 2018b; Levine, 2003; Yakubu et al., 2018). The above studies, therefore, confirm the assertions put forward by the “founding scholars” of financial development (Kuznets, 1955; Schumpeter, 1934) that financial development is a key determinant of an economy which intends to grow. Moreover, financial sector development creates economic potentials and opportunities in an economy (Biplob & Halder, 2018; Raghutla & Chittedi, 2021). However, it has been argued that even though the financial sector in Africa has achieved tremendous growth over the years, it is still considered to be underdeveloped compared with the global financial average (David et al., 2014). In spite of the proliferation of literature on the factors that drive financial development in a country, it appears empirical literature has not paid particular attention to how anti-money laundering (AML) regulations influence financial sector development as compared to developed economies. This current study therefore seeks to examine the non-linear relationship between AML regulations and financial sector development in Africa.

Money laundering (ML) schemes have become a global canker, mainly because of its devastating effects on nations’ global financial systems, economies, social aspects of a society and a country’s overall well-being (Jaffery & Mughal, 2020). Money laundering has jeopardised the integrity and stability of the global financial system and caused economic and reputational harm (Basaran-Brooks, 2022). McDowell and Novis (2001) and Stevandić (2021) discussed the economic consequences of money laundering, including economic instability and distortions, loss of revenues and weak integrity of the financial system. Socially, money laundering provides fuel to criminal activities such as corruption, drug trafficking, terrorism, arms dealing and bribery (Jaffery & Mughal, 2020). Furthermore, it helps criminals to avoid prosecution, conviction, and confiscation of their illegal funds, while proficient anti-money laundering efforts prevent the ability of criminals to use their illegal money for further crimes (McDowell & Novis, 2001). As such, the complex nature of money laundering has become challenging to the law enforcement agencies and relevant authorities in prosecuting money laundering offences (Zolkafilil et al., 2019). Thus, it has far-reaching consequences on the soundness and survival of countries’ financial sector development. As the banking system intermediates, an extremely large number of economic and financial transactions executed in the wider economy, banks are in a special position to detect and forestall these crimes with their due diligence and compliance services. The large capital inflows and outflows artificially exacerbated by money laundering constitute a substantial threat to the financial system’s stability (Aluko & Bagheri, 2012a). These unplanned inflows and outflows of funds could create liquidity challenges for financial institutions, thus, affecting their financial stability (Ruozi & Ferrari, 2013).

The worldwide battle against money laundering necessitated the establishment of the Financial Action Task Force (FATF) by the G-7 summit, which was held in Paris in 1989 (Nance, 2018). FATF was responsible for analysing ML activities and proposing, measuring, and monitoring the anti-ML measures of its member countries (Financial Action Task Force, 2018). The establishment of FATF is necessary because ML is a crime that has the potential to undermine financial sector development and economic systems in the long term (Pol, 2020; Vitvitskiy et al., 2021). Given the far-reaching consequences of money laundering for financial sector development, there are reasons to believe that AML law will have a significant impact on how financial development influences economic growth. Tight AML implementation has a positive impact on the banking sector stability (Durguti et al., 2023). According to Ofoeda (2022), effective AML regulation creates competitive output markets resulting in the reallocation of resources from less productive firms (front companies) to productive ones. However, the average annual cost of financial crime compliance continues to increase globally. The level of cost increases spiked during the onset of the pandemic and appear to be levelling off, though the overall costs remain significantly higher than the pre-pandemic period (LexisNexis Risk Solutions, 2022).

LexisNexis Risk Solutions (2022), indicated that the yearly cost of financial crime compliance has reached \$56.7 billion, a 13.6% increase for financial institutions in the United States and Canada Combined. The report revealed that a significant majority of U.S. (73%) and Canadian (86%) financial institutions reported an increase in financial crime compliance costs in a 12-month period

beginning in April 2021. The report further indicated that the average annual cost of financial crime compliance per organization has increased up to 14% among mid to large U.S. financial institutions. The cost among larger U.S. firms is 121% higher than before the pandemic and 71% higher among larger Canadian firms for this same period. Again, LexisNexis Risk Solutions (2021) survey report also estimated that AML compliance costs UK financial firms to the tune of \$39.8 billion, and \$57.1 billion for Germany, \$24.8 billion for France, and \$20.0 billion for Italy. According to the report, the projected total cost of financial crime compliance across financial institutions worldwide is \$274.1 billion, up from \$213.9 billion in 2020.

Studies, however, revealed that AML compliance has become a resource-intensive and costly business for financial institutions in developed and developing economies (Mccarthy et al., 2015). This suggests that too stringent AML requirements might hurt the financial sector and its ability to influence growth. As a result, we contend that, while AML regulations are expected to have a positive impact on the financial development, AML regulations' favourable effects on the financial sector development may be eroded if AML regulations become excessive or exceed a certain threshold.

Several studies have focused on the disclosure of AML activities by banks (Van der Zahn et al., 2007); the drivers of money laundering compliance (Götz & Jonsson, 2009; Vaithilingam & Nair, 2007); the overview of the AML law (Dhillon et al., 2013; Mohammad et al., 2016; Nasir, 2019; Sandler & Enders, 2008), description of money laundering techniques and cases (Aluko & Bagheri, 2012b; Bacwa, 2018) the effect on money laundering on performance (Huang, 2015; Nobanee & Ellili, 2018); and determinants of AML compliance (Mekpor et al., 2018; Yepes, 2011). However, a few studies exist on the effect of anti-money laundering regulation and compliance on financial sector development (Aluko & Bagheri, 2012b; Bartlett, 2002; Shehu, 2010). This study departs from earlier studies by empirically assessing the impact of anti-money laundering compliance on financial sector development in Africa at different levels of anti-money laundering compliance. This is supported by (Ofoeda, Agbloyor, et al., 2022) who revealed that there is a threshold relationship between AML regulation and economic growth across the globe (Ofoeda, Agbloyor, et al., 2022) and (Ofoeda, 2022) who also established a non-linear relationship between AML regulation and financial inclusion. Unlike other studies, this study investigates the non-linear relationship between AML legislation and financial development and contributes to the field in three ways.

First, from an academic point of view, it contributes to the provision of detailed knowledge on the degree of impact of AML regulation on financial sector development, this argument is based on econometric findings where it eliminates dilemmas regarding the interconnection of these variables in Africa. This is because most empirical studies in this field have concentrated on large economies and industrialized countries, hence literature on AML regulations and financial sector development in the African continents have received little attention. Second, it provides a unique empirical contribution utilizing data from recent years on the economies involved in the analysis, utilizing a combined econometric approach system GMM and Seo et al. (2019) dynamic panel threshold regression. Lastly, from the standpoint of policymaking, it contributes to the identification and updating of policies that influence financial sector development.

The remaining sections are structured as follows: The review of the theoretical and empirical literature on AML regulations and FSD is presented in Section 2; the study design, empirical model specification, and source of data were all described in Section 3, while the analysis and discussion of results are presented in Section 4. The study concluded with conclusions, and policy recommendations were also shown in the final section.

## 2. Literature review

### 2.1. Agency theory

This theory was developed by (Ross, 1973) and (Mitnick, 1975) albeit independently in the 1960s. Ross is accredited with the development of the economic theory of agency whereas Mitnick is

credited with the development of the institutional theory of agency (Jensen & Meckling, 1976). Ross (1973) viewed agency to be a consequence of compensation whereas Mitnick introduced the institutional form of agency. Ross argued that it is difficult for the principal to get the agent to work to the best level as he would have wished (Fama & Jensen, 1983). The agency theory helps explain the relationship that exists when one party enters into an agreement with another party so that one-part acts on behalf of another. The theory views a firm as a nexus of contracts between the resource holders and those entrusted in the management of the resources (Ross, 1973).

This theory is relevant because it explains the existing relationship between the governments in African continents who are responsible for controlling the occurrence of money laundering and commercial banks and other financial institutions obliged to report on the occurrence of suspicious activities related to money laundering (Fama & Jensen, 1983). Financial institutions are required to identify suspicious transactions and alert the government so that appropriate action can be taken against the perpetrators. Agency theory is mainly concerned with the management of conflicts that are likely to arise following the agency contraction relationship (Fama & Jensen, 1983). For the case at hand, conflicts are likely to exist between financial institutions that have been entrusted by the Government to identify suspicious transactions (Jensen & Meckling, 1976). It is possible that financial institutions could collude with money launderers and sneak into the country or clean money which has been gotten in an illegal manner. The agency theory helps explain ways that such conflicts between the agent and their principals can be dealt with harmoniously. This theory is relevant for the study because it helps explain the agency-principal relationship that exists between the Central Banks in Africa which has entrusted commercial banks with the function of identifying suspicious transactions and relaying information about them to the Central Banks. Therefore, commercial banks act as agents of the Central Banks in Africa in identification of suspicious transactions of which relevant authorities can use to carry out investigations.

## **2.2. Linkage of anti-money laundering and financial sector development**

Money laundering has been noted as having a negative influence on countries' financial systems and, therefore, may affect how financial development promotes growth (Aluko & Bagheri, 2012b; Ofoeda, 2022). According to Raweh et al. (2017a), the financial sector is the principal channel for laundering proceeds of illegal activities. As a result, money laundering destabilizes financial institutions and the financial system by corrupting the financial market and eroding client confidence and trust (Mekpor et al., 2018). Money laundering also has catastrophic consequences for FSD and the economies of nations around the globe (Aluko & Bagheri, 2012). Furthermore, AML can impair the growth of economies by leading to capital flight from such economies meant for financial development (B. Bartlett, 2002). The financial sector of a country may be severely impacted by money laundering activities (Raweh et al., 2017b; Rose-Ackerman & Palifka, 2018), which may affect customers' trust (Alshaer et al., 2021). The probability of financial institutions and their customers being defrauded by criminal elements increases when ML becomes pervasive (B. Bartlett, 2002). Undoubtedly, ML has severe implications for financial institutions and their growth. McDowell and Novis (2001) accentuated that financial institutions that depend on the proceeds of crime have an additional challenge in adequately managing their assets, liabilities and operations. This is because large amounts of money may be deposited in a financial institution and disappear almost immediately without notice. After all, such financial institutions may be used just to launder those funds. This may have severe implications for the asset-liability management of financial institutions and, therefore, their stability. It is found that AML activities negatively affect banking performance as supported by Salehi and Molla Imeny (2019).

The fundamental principles and policies of anti-money laundering regulations help promote good governance of financial institutions, which is critical to the stability of financial institutions (B. Bartlett, 2002). Jayasuriya (2009) explains that anti-money laundering regulations contribute to the good governance of financial institutions. Shehu (2010) indicated that an effective anti-money laundering regime through proper customer due diligence (CDD) principles and record keeping are



necessary for financial sector development. Many developing countries have qualities and attributes that entice money launderers to carry out their act that affects the stability of the financial system in Africa (Issah, Antwi, Antwi, & Amarh, 2022). Money laundering in developing economies such as Africa has received much too little attention, even though, the Basel Institute on Governance indicated that, sub-Saharan Africa is a prominent destination for money laundering globally (Basel Institute on Governance, 2020). AML regulation, therefore, in developing countries has been adopted to comply with the global AML standards such as the FATF 40 + 9 recommendations against money laundering (Fisher et al., 2005; Fridson & Fridson, 2002). It is worth noting, however, that owing to development challenges in less developed economies, some of the foregoing standards are too sophisticated for them to domesticate (Mugarura, 2020). Intuitively, given the far-reaching effects of money laundering on FSD, there is a good reason to believe that AML regulations will significantly impact how financial development can influence economic growth (Ofoeda et al., 2020).

### 3. Methodology

#### 3.1. Research approach, research design and data source

A quantitative technique was used to analyze the relationship between the model's dependent variable and the multiple independent variables. Quantitative research is concerned with figuring out how much something is worth. It may describe numerically significant occurrences (Kothari, 2004). This study employs a formal, objective, systematic process to define and test the relationships between aggregate AML and financial sector development. An explanatory/causal research design and correlation were conducted in this current study. Causal explanatory research describes how an independent variable influences an outcome variable (Shadish; Cook; Campbell, 2002). The population constituted 51 countries in Africa. This study, however, considered only countries that the Basel Institute on Governance had assessed. Panel data for the period 2010–2020 was used to address a broader range of variables and time spans and investigate how variables and their relationships change dynamically over time. The data on anti-money laundering were collected from the Basel Institute on Governance. The Basel Institute on Governance has an Anti-Money Laundering Index (Basel AML index) annual ranking that assesses the risk of money laundering and terrorist financing (ML/TF) around the world. The index spans five main criteria and a score from 0 to 10 is allocated to a country. An index value of 0 indicates the lowest risk level of money laundering and terrorist financing while a value of 10 indicates the highest risk level of money laundering and terrorist financing. The data on financial sector development, inflation, bank size, borrowing and unemployment were collected from a myriad of financial websites and databases such as the Global Financial Development database, Bank scope, World Bank, and World Development Indicators. Previous researchers have collected data from these data bases for their empirical papers (Bukhtiarova et al., 2020; I. Ofoeda, E. Agbloyor, et al., 2022; Issah, Antwi, Antwi, & Amarh, 2022; Nobanee & Ellili, 2018; Ofoeda et al., 2020; Rose-Ackerman & Palifka, 2018).

#### 3.2. Model variables and measurement

##### 3.2.1. Dependent variable

The study captures financial sector development utilizing domestic credit to the private sector (DCPS) as a percentage of GDP, as used by other researchers in the literature (Asongu & De Moor, 2017; Iheonu et al., 2020; Tchamyou, 2019). Domestic credit to the private sector encompasses the financial resources provided to the private sector by financial institutions. A high ratio of domestic credit to GDP indicates a higher level of domestic investment and a higher financial system development. Financial systems that allocate more credit to the private sector are likely engaged in researching firms, exerting corporate control, providing risk management control, facilitating transactions, and mobilizing savings (Levine, 2005), which requires a higher degree of financial development.

### 3.2.2. Independent variables

The Basel Anti-Money Laundering Index was employed to measure the effectiveness of the anti-money laundering regulations. Money laundering and terrorist financing (ML/TF) are perennial concerns for the Basel Institute for Governance, which gives it an annual worldwide rating. Structures, strategies, and processes used to combat money laundering are evaluated using these indices. Using the index's five major criteria, a nation is rated on a scale of 0 to 10.0 represents the lowest possible danger of money laundering and terrorist funding, while 10 represents the highest risk. For each nation, a score is assigned based on the following criteria: quality. We used a score used by Ofoeda et al. (2020) to scale the AML index, with lower risk scores indicating a lower efficacy of anti-money laundering measures and higher risk scores indicating better effectiveness. Anti-money laundering regulations index (AMLR-10) will be  $-1*(AMLR-10)$ , according to research by Ofoeda et al. (2020).

### 3.2.3. Control variables

In line with the literature, we include inflation (Laub, 1999; Muazu et al., 2022; Boateng et al., 2015), borrowing (Issah, Antwi, Antwi, & Amarh, 2022) and bank size and unemployment (Duho & Onumah, 2019; Issah, Antwi, Antwi, & Amarh, 2022) as controls. Inflation reduces the value of future cash flows, interest rates rise, and the cost of financing for businesses increases (Ofoeda et al., 2020). Increases in daily running expenditures (also known as "operating costs") caused by inflation might impact a company's bottom line and the financial industry. The unemployment rate was measured as a percentage of the total labour force (Ozili, 2013). Unemployment is a macroeconomic factor that might affect financial sector development (Boateng et al., 2015). The chance of loan default increases when there is unemployment. Borrowers will have difficulty repaying their loans' principal and interest if they lose their jobs during high unemployment, which might lead to a high default rate and instability in financial growth. To calculate unemployment, the total employed population was used as a basis for calculation (Ozili, 2013). Borrowing was also used as a control variable in the present study. Borrowing helps to quantify the amount of funds borrowed from the banking industry. Higher values imply a high confidence level in the banking sector, while lower values suggest a lower confidence level. In terms of bank size, the greater the size of a country's banking industry, the greater the depth and breadth of financial intermediation in its financial system (Ozili, 2013). The ratio of private credit by deposit money banks to GDP was used to determine the size of the banking sector. Table 1 provides the variables, description and expected signs of the variables.

### 3.3. Models specification

Alhassan and Asare (2016), Chen et al. (2020), Elyasiani and Wang (2012) and Pennathur et al. (2012) regression models were adopted in this paper. The study also relied on a dynamic panel model, Generalized Methods of Moments (GMM) estimation techniques (Beck et al., 2007; Beck &

**Table 1. Measurement and descriptions of variables in the model above**

Variables	Description	Measurement	Expected sign
DCPS	Domestic credit to private sector	domestic credit to the private sector (DCPS) as a percentage of GDP%	
AML	Anti-money laundering regulation	Basel AML Index	+
CPI	Inflation	Consumer price index	-
UMP	Unemployment	Unemployment percentage of the total labour force	-
BSZ	Bank size	Private credit by deposit money banks to GDP	+
BRW	Borrowing from banks	Rate of borrowing	-

Note: Source: Authors' Construct (2022).



Levine, 2004). A dynamic model allows the researcher to include lags of the outcome variable as a predictor variable. The dynamic model permitted us to have lags of the outcome variable as a predictor variable. To predict the effect of AML on financial sector development, the study deployed the short-run model, also referred to as the dynamic panel model. Models in the short run assumed that the immediate previous period's performance, lagged dependent explanatory variable, influenced the present period's performance. The researcher made use of a Two-Step System Generalized Method of Moments estimator, following the work of Fagbemi and Olatunde (2019), and the models estimated are as follows: To test Hypothesis 1 by measuring the relationship between AML and FDI, the following model is specified:

$$FSD_{it} = \beta_0 + \beta_1 FSD_{i,t-1} + \beta_2 AML_{it} + \beta_3 CPI_{it} + \beta_4 UMP_{it} + \beta_5 BSZ_{it} + \beta_6 BRW_{it} + \epsilon_{it} \quad (1)$$

where  $\beta_0$  Represents the constant. As an indicator of financial sector development,  $FSD_{it}$  represents the country  $i$  financial sector development at point  $t$ .  $AML_{it}$  is the acronym for the index of anti-money laundering rules. At a given time, the  $CPI_{it}$  serves as a gauge for the inflation rate within country  $i$ .  $UMP_{it}$  represents the unemployment rate in country  $i$  at time  $t$ . Again,  $BSZ_{it}$  represents private credit by depositing money banks to GDP as an indicator of bank size, whereas  $BRW_{it}$  represents borrowing from country  $i$  at the time.  $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$  and  $\beta_6$  are also the coefficients of the variables used in the model.

### 3.4. Estimation technique

#### 3.4.1. System generalized method of moments

The potential problem of endogeneity, where explanatory variables are mainly correlated with the error term, is widely associated with panel data. Another common potential problem is the problem of autocorrelation, which describes the correlation between error terms of the current value of a variable and its lagged value, which can lead to inconsistent estimates. Also, the use of different countries with diverse cultural, political, social, and technological backgrounds presents a potential problem of heterogeneity which ought to be taken care of by using appropriate estimation techniques. Therefore, the Generalized Method of Moments (GMM) of Arellano and Bond (1991) was used to deal with these problems. The GMM estimator deals with this endogeneity problem by transforming that data, i.e., subtracting previous data values from their present importance. This is known as the Generalized Difference Method of Moments. However, the estimates generated may be invalid when using the first difference of the explanatory variables. Also, the first differences in explanatory variables may not provide adequate information about them (Arellano & Bover, 1995; Blundell & Bond, 1998; Roodman, 2009a). Hence, a better version is known as the System GMM introduced by Arellano and Bover (1995) and (Blundell & Bond, 1998) controls for that limitation by building original and transformed equations under the assumption that the first differences are uncorrelated with the fixed effects (Roodman, 2009b). The system GMM also controls for the potential sample biases and asymptotic imprecision associated with the difference estimator (Blundell & Bond, 1998). Against these backgrounds, the study employs the Two-Step System GMM estimator, which is more relevant for studies with shorter periods than the number of countries and as seen in this study.

#### 3.4.2. Dynamic panel threshold regression

The dynamic panel threshold regression by Seo et al. (2019) is an alternative threshold regression method to (Kremer et al., 2013) for estimating the baseline threshold model. A dynamic panel threshold regression was employed to determine the nonlinear or threshold effect of AML on FSD in this study. The panel threshold regression has evolved over the years, beginning with the traditional method of introducing a quadratic term in the model as specified by researchers such as Aibai et al. (2019) and Taghizadeh-Hesary et al. (2019). The quadratic approach, however, does not estimate the exact threshold value and cannot address structural breaks likely to be present in the data, according to Huang et al. (2018). Therefore, this study employs

the dynamic panel threshold model suggested by Seo et al. (2019), which works based on the Generalized Method of Moments (GMM) principles and addresses the endogeneity problem. Seo et al. (2019) model also can estimate a threshold value which was very relevant for policy formulation. The threshold regression model, which is modelled after the work of Ofoeda (2022), can be described as follows;

$$FSD_{i,t} = \psi X_{it} + \begin{cases} \alpha_i + \beta_1 FSD_{it-1} + \theta_1 AML_{i,t} + \mu_{i,t} AML_{i,t} < Y \\ \alpha_i + \beta_2 FSD_{it-1} + \theta_2 AML_{i,t} + \mu_{i,t} AML_{i,t} \geq Y \end{cases} \quad (2)$$

where subscripts  $i$  and  $t$  refer to country and time, respectively.  $FSD_{it}$  represents Financial Sector Development, and  $FSD_{it-1}$  denote the lag of Financial Sector Development.  $\alpha_i$  denotes the country-specific fixed effects while  $U_{it}$  is a zero mean, finite variance, i.i.d. disturbance.  $X_{it}$  represent the independent variable and  $\beta_1$ , and  $\beta_2$  represent the coefficients of these independent variables.  $q_{i,t}$  is the threshold variable,  $\gamma$  is the threshold value and  $\theta_1$  is the threshold coefficient when the threshold value is lower than  $\gamma$ , and  $\theta_2$  is the threshold coefficient when the threshold value is higher than  $\gamma$ .

### 3.5. Pre-estimation diagnostics

This study tested for endogeneity, heteroscedasticity, multicollinearity, serial correlation, and cross-sectional dependency tests. Diagnostics tests are vital before regression estimations since failure to perform or perform only after the regression estimation can make all earlier inferences potentially invalid (Brooks, 2014). The tests for endogeneity, heteroscedasticity, multicollinearity, serial correlation and cross-sectional dependency help make the appropriate corrections for testing and estimating robust results. The endogeneity test indicated a small p-value ( $p = 0.0090$ ) below the threshold of 5%; therefore, it suggests that the regression suffers from endogeneity. Since the p-value is below 0.05, it shows that the null hypothesis, which states that the variables are exogenous, has to be accepted. The alternative hypothesis has to be rejected. Therefore, OLS regression is inconsistent, and GMM and Panel threshold regression will be more suitable for the analysis. The Shapiro-Wilk normality test was conducted, indicating that Kurtosis is not asymptotically distributed (p-value of Kurtosis  $< 0.05$ ). The joint Prob  $> \chi^2(2)$  is  $0.000 < 0.05$ ; thus, the normality skewness/kurtosis test results are normally distributed, giving sufficient evidence for rejecting the null hypothesis. The two-step system GMM used is also robust to take care of normality problems in the data. The data set also indicates the presence of heteroscedasticity. The findings indicated that the  $\chi^2(1)$  value was 10.77 and the p-value was 0.0000, revealing that the null hypothesis was rejected because the p-value was less than 0.05, which indicated the variance of the error term is not constant. Thus, the assumption of constant variance was not violated. The presence of high heteroscedasticity suggests that the GMM method is preferable to instrumental variables (Baum et al., 2003). The Wooldridge test was used to verify the Serial Correlation/Autocorrelation Test. The results from the trial revealed the probability values (p-values 10.33 and 0.0021), giving clear signs of autocorrelation. The presence of autocorrelation suggests that the GMM method and panel threshold is preferable to instrumental variables (Baum et al., 2003).

## 4. Results and discussions

This section presents a summary of descriptive statistics and correlation matrix, the empirical results of the Two-Step System Generalized Method of Moment's regression and the Panel Threshold regression.

### 4.1. Descriptive analysis

The study first presents descriptive statistics, which enabled us to explore the appropriateness of the data for the estimations. Pallant (2011) emphasizes the importance of performing a descriptive data analysis before moving on to statistical analysis. Descriptive statistics provide basic information about the variables in a data set while highlighting potential relationships. Table 2 shows the

results of the descriptive statistics with a total of 459 observations from 51 African countries for the period 2012 to 2020.

DCPS (Domestic Credit to Private Sector (%GDP)), a commonly used accounting-based measure of banking sector stability (Cuestas et al., 2020), has a mean value of 25.601 and ranges between a maximum of 128.85 and a minimum of 1.123, and a standard deviation of 24.231 and positively skewed at 2.341. The mean value of 25.601 suggests that the Domestic Credit to Private Sector in the banking sector in Africa over the period 2012 and 2020 averagely is 25.601. The sample mean is less than 50%, suggesting a very low level of domestic credit to the African private sector over the study period. The dispersion among the observation in the panel, representing the variance for Domestic Credit to Private Sector, is 6.039. Since the skewness is more significant than zero ( $2.341 > 0$ ), it indicates that the Domestic Credit to Private Sector in Africa is generally distributed from 2012 through 2020. The Kurtosis recorded in the panel was 8.269. It can be concluded that Domestic Credit to Private Sector is leptokurtic because it has a higher value of ( $8.269 > 3$ ) than the sample mean.

One of the key variables of the analysis is anti-money laundering regulation (AML). Anti-Money Laundering regulation (AML) had a mean of 3.992 and a standard deviation of 0.975. The index ranges from 0 to 10, such that 0 indicates the lowest level of anti-money laundering regulation effectiveness. In contrast, a score of 10 indicates the highest level of anti-money laundering regulation effectiveness. The implication of the mean of 3.992 indicates a very weak low level of anti-money laundering regulation effectiveness in Africa over the study period. The study revealed that the average mean of 3.992 in this current study is higher than what was reported by Ofoeda et al. (2020) within the period 2012–2019 and Issah, Antwi, Antwi, and Amarh (2022) within the period 2012–2019, with their average mean of 3.7 and 3.48, respectively. This suggests that AML regulatory effectiveness is relatively weak in Africa and keeps falling and increasing over the years. The most negligible value in the panel is 1.627, and the maximum value is 7.81. The dispersion among the observations was 0.949, while the skewness was 0.331, and the Kurtosis was 4.730. It can be concluded that ALM is leptokurtic because it has a higher value of ( $4.730 > 3$ ) than the sample mean. The skewness value ( $0.331 > 0$ ) also indicated that the panel mirrors a normal distribution because the skewness is more significant than zero.

The results also indicated that as a proxy for CPI (inflation), the consumer price index also recorded a mean value of 3.957 and a standard deviation of 0.387. The average mean of 4.957 for inflation could be deduced that the inflation rate in Africa is relatively high (Agoba et al., 2017; Economist, 2008; Laub, 1999; Mahawiya et al., 2020; Ndoricimpa, 2017; Tiwari et al., 2021). The panel data for CPI also reported a minimum value of 4.43 and a maximum of 8.43. The study also revealed that UMP and BSZ recorded a mean value of 8.432 and 68.642 and a standard deviation of 6.542 and 12.966, respectively. The average mean of 5.957 for inflation could be deduced that the inflation rate in Africa is relatively high. The panel data for UMP and BSZ also reported a minimum value of 0.384 and 32.521 and a maximum of 28.181 and 100.00, respectively. Finally, Table 2 shows that the level of borrowing (BRW) in Africa over the study period had a very high average of 145.818 and a standard deviation of 91.352, indicating a high dependency on the banking system in Africa for funds (Issah, et al., 2022). The high mean suggests that a lot of financing is done through debt in Africa, and African banks provide most of this debt financing. The minimum value in the panel for BRW was  $-0.566$ , and the maximum was 336.55.

#### 4.2. Pairwise correlation matrix

The results of the correlation matrix are presented in Table 3, which shows the strength of the relationship between the variables. Statistically, multicollinearity is present when correlation coefficients are above 0.9 (Hair, 2007; Saunders et al., 2009); Saunders et al. (2009), 0.8 (Gujarati, 2012), and 0.7 (Sekaran & Bougie, 2016). Again, in keeping with Hair, Anderson, Tatham, and Black (1995), multicollinearity exists when the correlation coefficients between any two (2) variables are more significant than 0.80. Looking at all the variables, none of the pairwise correlations is greater

Table 2. Descriptive statistics

Variables	Obs	Mean	Std. Dev.	Min	Max	Variance	Skew.	Kurt.
DCPS	459	25.601	24.231	1.123	128.85	6.039	2.341	8.269
AML	459	3.992	.975	1.673	7.81	.949	.331	4.73
InCPI	459	4.957	.387	4.627	8.43	.150	4.028	27.083
UMP	459	8.432	6.542	.384	28.181	42.802	1.082	3.35
BSZ	459	68.642	12.966	32.521	100	168.104	.271	4.349
BRW	459	145.81	91.352	.566	336.55	1.494	−.372	5.336

Where DCPS is Domestic Credit to Private Sector (%GDP), AML is Anti-Money Laundering regulations, CPI is Consumer Price Index (Inflation), UMP is unemployment, BSZ is bank size, and BRW is Borrowing.

than 0.9 (Saunders et al., 2009), 0.8 (Garson, 2013; Gujarati, 2012), and 0.7 (Sekaran & Bougie, 2010). Again, in keeping with Hair, Anderson, Tatham, and Black (1995) indicate that there are no potentially harmful collinear relationships that could bias the models' coefficients. These variables are not strongly correlated. Gujarati (2003) and Hair et al. (1995) suggest that, statistically, multicollinearity may damage or threaten the regression analysis if the degree of correlation exceeds 80%.

Where DCPS is Domestic Credit to Private Sector (%GDP), AML is Anti-Money Laundering regulations, CPI is Consumer Price Index (Inflation), UMP is unemployment, BSZ is bank size, and BRW is Borrowing.

The Variance Inflation Factor (VIF) test was an additional multicollinearity check, and VIF should not exceed 10 as a rule of thumb (Wooldridge, 2016). With a mean VIF of 1.103, the VIF test demonstrated little correlation among the independent variables, indicating that multicollinearity was not an issue. Therefore, none of the model's variables exhibits severe multicollinearity as they all have VIFs less than 10, and the mean VIF is 1.130, which is also less than 10.

#### 4.3. Presentation of empirical results

The presentation of the results is in two sections. The first section used the two-step system GMM in analyzing the impact of anti-money laundering measures on Africa's financial sector development. The second used the Seo et al. (2019) dynamic panel threshold estimation to test the effect of the various levels of AML regulations on African financial sector development.

##### 4.3.1. The effect of anti-money laundering regulations on financial sector development

The results in Table 4 (Model 1) show the impact of AML regulations measured using domestic credit to the private sector on FSD in Africa, holding key determinants of Financial Sector Development (CPI, BSZ, BRW) constant. The magnitude and significance levels of the reported lagged dependent variable indicated that FSD persists over time. The lag of FSD is first seen to be positively significant at 1%. This confirms that FSD past values can influence the current values of the variable, thereby making it dynamic. Therefore, a 1 percentage increase in FSD in Africa in a year will lead to a corresponding increment of FSD by 1.381 percent points in the following year. The result is consistent with studies (Ofoeda et al., 2020; Ofoeda, 2022; Vitvitskiy et al., 2021).

The results in Table 4 show that the condition of an insignificant second-order autoregressive process is met for all SGMM estimation outputs, i.e.  $AR(2) > 0.05$ . Therefore, the study fails to reject the null hypothesis of no second-order autocorrelation, indicating that the original error term in each model is serially uncorrelated and moment conditions are correctly specified. With reference to Table 3, the p-values are greater than 0.05 regarding the Hansen (1982) J test. Therefore, the

**Table 3. Pairwise correlation matrix**

Variables	(1)	(2)	(3)	(4)	(5)
(1) AML	1.000				
(2) CPI	0.069 (0.138)	1.000			
(3) UMP	0.146* (0.002)	0.076 (0.106)	1.000		
(4) BSZ	-0.022 (0.638)	-0.037 (0.435)	0.139* (0.003)	1.000	
(5) BRW	0.129* (0.006)	-0.091 (0.051)	0.163* (0.000)	0.050 (0.282)	1.000

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

**Table 4. Effect of anti-money laundering regulations on financial sector development**

	(1)
	DCPSG
L.DCPSG	1.381***
	(.053)
AML	.359
	(.346)
CPI	-.029**
	(.011)
UMP	-.433*
	(.225)
BSZ	.239**
	(.091)
BRW	-.005
	(.008)
Observations	357
AR(1)	0.031
AR(2)	0.982
Sargan	0.000
Hansen	0.244
Number of groups	51
Number of instruments	19
Pseudo R <sup>2</sup>	.z

Standard errors are in parentheses.

\*\*\*  $p < .01$ , \*\*  $p < .05$ , \*  $p < .1$ .

researcher fails to reject the null hypothesis. Thus, the validity of instruments used in the System's Generalized Method of Moment estimation is confirmed.

The present analysis shows that AML regulation positively influences FSD in Africa. However, the relationship is statistically insignificant. The insignificant AML regulation coefficient may suggest a nonlinear relationship between AML regulations and FSD. This means that AML will affect FSD only when it reaches a certain magnitude before its positive effect can be felt. AML can record all-time high or low values; these figures will not significantly affect Africa's financial sector's development. However, it shows its theoretically expected sign of positive. What this means is that an increase in AML by 1% will result in an increase in FSD in Africa by 35.9%. However, the coefficient is insignificant, so one cannot emphasize it. Nonetheless, results do suggest that AML regulations promote the development of both financial institutions and financial markets. Supporting the idea that anti-money laundering regulations promote good governance and enhance financial institutions' reputations, which is expected to promote FSD. One of the most recent studies in this area was conducted by Ofoeda et al. (2020), which identified that effective money laundering regulations could impart confidence and trust of customers in the financial system, which would, in turn, promote the development of the financial market. AML policies and procedures help financial institutions in Africa combat money laundering by stopping criminals from engaging in transactions to disguise the origins of funds connected to illegal activity. In addition to assisting financial institutions in complying with AML and counter-terrorism financing laws and regulations, anti-money laundering policies and procedures help to set the tone for banks in Africa and reinforce a culture of compliance.



Additionally, the present study reports a negative impact of inflation on financial sector development in Africa over the study period and its statistically significant. This implies that higher levels of inflation hurt the financial sector. Inflation negatively affects the banking sector in Africa because it reduces the present value of future cash flows and leads to the increased cost of capital for banks in Africa (Mahawiya et al., 2020; Nduricimpa, 2017). This is expected to impact the financial sector negatively. On the other hand, unemployment also yielded a significant negative relationship with FSD. Another variable of interest is bank size, which had a coefficient estimate of 0.239 and a probability value of 0.011. Bank size also exhibits a positive and statistically significant relationship with FSD. This implies that the size of a bank matter for in financial sector development in Africa (Issah, Antwi, Antwi, & Amarh, 2022). The study also revealed that borrowing negatively impacts African financial sector development with a  $\beta$  coefficient of  $-0.005$ . This implies that a 1% increase in borrowing will lead to a 0.5% decrease in financial sector development in Africa. It can be inferred that the process of disbursing loans by financial institutions such as banks in Africa may be easy; however, the recovery operation of this amount might be a bit challenging for banks in Africa.

#### 4.3.2. The nonlinear relationship between AML regulation and FSD

The study employs the Seo et al. (2019) dynamic panel threshold estimation to test whether a nonlinear relationship exists between AML and FSD. That is to say, the impact of AML on FSD varies across different points or levels of AML. Table 5 presents the dynamic panel threshold test results used to test the linearity of the variables. The bootstrap  $p$ -values of all 51 African countries sampled are 0.000, indicating a nonlinear relationship between AML and FSD, suggesting a threshold effect between AML and FSD does exist. Earlier in the present study, the authors hypothesized ( $H_2$ ) that anti-money laundering has no threshold effect (i.e., nonlinear relationship) with African financial sector development. In Table 5, the authors present the results of the existence of the threshold test. The results confirm the presence of nonlinearity and a threshold effect of the impact of FSD at various levels of AML as the bootstrap  $p$ -value is 0.000 ( $p < 0.05$  – significant at 1%). This is demonstrated by  $p$ -values far less than .01. This suggests a nonlinear relationship between FSD and AML at various levels of AML regulations. For this reason, the researcher fails to reject the null hypothesis of no threshold ( $\theta_1 = \theta_2$ ).

The study's findings suggest that the nonlinear relationship between FSD and AML is determined at various levels of AML in African banks. Hence, we divided the sample into two groups: regime one is below the threshold, and regime two is above the threshold. Given that threshold effects exist in the hypothesized relationships, the researcher proceeds with the dynamic panel threshold regression as proposed by (Seo et al., 2019). The Seo et al. (2019) threshold regression presents the overall or linear regression, the low-regime, and the high-regime results. The researcher presents the results of the dynamic panel threshold regression in Tables 6 in columns (1), (2), and (3) for the low regime, high regime and overall regression, respectively.

The present study finds threshold values of (4.228) for DCPS as a percentage of GDP to represent financial sector development. In column 1, the study found a significant positive coefficient of (2.863) for AML below the threshold value at a 1% significant level and a significant negative coefficient of  $(-1.477)$  for AML above the threshold in column 2. This indicates that AML laws favour financial sector development below the threshold, but this link disappears for regimes with high AML requirements. This suggests that the banking industry in nations with strict AML

**Table 5. Dynamic panel threshold test of AML and FSD**

	AML
Linearity Test (Prob)	0.000
No. of bootstrap replications	2000
Trimming percentage	0.15
Grid number	100

**Table 6. Dynamic panel threshold regression results of AML regulations and FSD**

	(1) Low-regime ( <b>&lt;4.228</b> )	(2) High-regime ( <b>&gt;4.228</b> )	(3) Overall
Lag of DCPS	.529*** (.014)	.127*** (.016)	.608*** (.008)
CPI	−3.365*** (.835)	−.246 (1.217)	−2.579*** (.406)
UMP	.1344*** (.183)	.161*** (.044)	1.174*** (.104)
BSZ	−0.089*** (.017)	.078*** (.026)	.034*** (.003)
BRW	.019*** (.0002)	−.023*** (.004)	−.007*** (.001)
AML	<b>2.863**</b> <b>(.616)</b>	<b>−1.477***</b> <b>(.678)</b>	<b>−3.296***</b> <b>(.626)</b>
Cons	1.672 (6.407)		
Kink_slope			5.557*** (.626)
Threshold value	Yes	<b>(4.228)</b>	3.872
Country Effect	Yes		Yes
Time Effect			Yes

Standard errors are in parentheses \*\*\*  $p < .01$ , \*\*  $p < .05$ , \*  $p < .1$ .

legislation may not profit from AML restrictions. This indicates that stringent AML regulations are unfavourable for Africa's financial sector development, and this suggests that excessive AML structures might discourage financial sector development.

It may be additionally argued that, AML compliance has become a costly and resource-intensive endeavour for financial institutions in Africa. Costs associated with AML compliance result in higher transaction costs for African financial institutions (LexisNexis Risk Solutions, 2022), rendering them extremely uncompetitive. This current study is in line with an investigation by Ofoeda et al. (2020), which concluded that a high level of anti-money laundering imposes an additional cost burden on the financial sector.

## 5. Conclusion and policy recommendations

As a result of the threat that money laundering poses to the global financial system and national economies, most governments have taken measures to reduce its prevalence. It is, however, opined that excessive AML regulations could lead to undesirable outcomes since it leads to increased transaction costs for financial institutions. The study's main objective was to evaluate the link between anti-money laundering regulations and financial sector development in Africa and to test the nonlinearities in the AML regulations-FSD nexus. The analysis shows that AML regulation positively influences FSD in Africa. However, the relationship is statistically insignificant, so one cannot emphasize it. The study also indicates that although AML systems favour FSD, the positive effect is below a particular threshold value of AML. This implies that banks in Africa are unable to invest in AML-compliance-related cost as compared with developed economies.

The findings show that the positive impact of AML regulations on FSD fades away and becomes negative when AML regulations exceed the threshold value or become excessive. This suggests that excessive AML structures might discourage FSD in African countries. It may be argued, additionally, that

AML compliance has become a costly and resource-intensive endeavour for financial sector organizations in Africa. This also implies that the costs associated with AML compliance result in higher transaction costs for African financial institutions, rendering them extremely uncompetitive with advanced countries. It can further be argued that due to the cost and resource intensive nature of AML compliance, banks in Africa are unable to invest in labour and robust IT infrastructure to combat criminal activities such as corruption, drug trafficking, terrorism, arms dealing, confiscation of their illegal funds and bribery. As a result, financial institutions are being exposed to an increasing level of various types of financial crime, including those involving digital payments, cryptocurrency, third parties and trafficking of proceeds (LexisNexis Risk Solutions, 2022).

Although this study shows a positive and insignificant effect of AML on financial sector development in Africa, the study further indicates a positive effect of AML regulations below a threshold and a negative effect of AML regulations above the threshold value. This shows that for African countries to attract more financial sector development, they need to strengthen their AML systems by investing in AML systems involving digital payments, cryptocurrency, third parties and trafficking of proceeds despite the cost associated with AML compliance. Financial institutions in Africa should invest in technology solutions to support financial crime compliance efforts in combating criminal crimes involving digital payments, cryptocurrency, third parties and trafficking of proceeds and other crime-related activities such as drug trafficking, corruption, terrorism, arms dealing, confiscation of their illegal funds and bribery. This is because the Basel Institute on Governance Report in 2021 on money laundering across the globe considered Africa the highest overall money laundering risk, discouraging foreign investors due to low invest in AML systems.

Therefore, implementing effective AML systems will encourage more foreign direct investment in Africa. It is also recommended that African countries make conscious efforts to combat the incidence of money laundering by establishing sound AML regulatory regimes, promoting a transparent public sector, controlling corruption in the public sector, and implementing policies that foster financial transparency and standards. Again, regulators should develop methodologies for integrating AML oversight into their supervisory regimes to make AML implementation and compliance cost-effective in Africa. Again, we recognized that each country's AML framework might be different. As a result, AML regulations' potential to promote FSD may be country specific. Future research could focus on how AML regulatory systems in individual African countries will affect them. Finally, further studies could consider different econometric estimations to determine if this study's results are not biased toward the econometric framework adopted in this study.

#### Author details

Samuel Antwi<sup>1</sup>

E-mail: [antwi.samuel@upsamail.edu.gh](mailto:antwi.samuel@upsamail.edu.gh)

Anthony Buawolor Tetteh<sup>1</sup>

Patience Armah<sup>1</sup>

Eric Opoku Dankwah<sup>2</sup>

<sup>1</sup> Faculty of Accounting and Finance, University of Professional Studies, Accra, Ghana.

<sup>2</sup> School of Business, All Nations University, Koforidua, Ghana.

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