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Anti-money laundering regulations and financial inclusion: empirical evidence across the globe

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Abstract

Purpose – This study aims to examine the impact of anti-money laundering (AML) regulations on financial inclusion using a comprehensive measure of AML regulations developed by the Basel Institute on Governance. Again, this study investigates the existence of threshold effects in the AML regulations–financial inclusion nexus.

Design/methodology/approach – This study uses panel data across 212 economies (developed, developing and Africa) of the globe-spanning from 2012 to 2019. This study uses the dynamic panel threshold estimation technique proposed by Seo *et al.* (2019).

Findings – In general, the results indicate that AML regulations promote financial inclusion across the globe. However, AML regulations spur financial inclusion below the threshold of AML regulations, whereas, above the thresholds, AML regulations have damaging effects on financial inclusion. Further, the author finds that AML regulations have a detrimental impact on financial inclusion for developed economies. In contrast, AML regulations promote financial inclusion at all levels of AML regulations for African countries.

Practical implications – The findings of this study imply that countries must make conscious efforts in combating the incidence of money laundering by establishing sound AML regulatory regimes as a means of promoting financial inclusiveness. However, there is a need for regulators to ensure cost-effective and efficient implementation of AML regulations.

Originality/value – The value of this paper is its contribution to literature as it is a major attempt in empirically assessing the impact of AML regulations on financial inclusion. Again, to the best of the author's knowledge, this is the first study to examine the non-linear relationship between AML regulations and financial inclusion.

Keywords Anti-money laundering regulations, Financial inclusion, Money laundering, Threshold regression, Financial services, Anti-money laundering

Paper type Research paper

1. Introduction

In recent times, financial inclusion has become a topical issue among policymakers and regulators, especially of developing nations, because of its role in poverty reduction, provision of affordable credit, provision of employment opportunities, facilitation of savings for productive activities, promotion of financial sector stability and promotion of human capital development among others (Agbloyor *et al.*, 2022; Asongu *et al.*, 2018; Park and Mercado, 2018; Sethi and Acharya, 2018; Tchamyou, 2020). Over the years, countries have made significant efforts and adopted policies in improving financial inclusiveness among their citizenry by formalizing financial inclusion goals for implementation. However, in spite of the considerable efforts made by countries to promote financial inclusiveness, it appears

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the extent of financial inclusion, although improving, is still low across the globe. According to the World Bank's Global Findex 2017, around 1.7 billion adults are unbanked, that is, they do not have a bank account or access to mobile money (Demirguc-Kunt *et al.*, 2018). This is close to about 30% of the global adult population. This means there is the need for deliberate policy direction from policymakers and creating the right environment to promote inclusive finance. In spite of the proliferation of literature on the factors that drive financial inclusion in a country, it appears empirical literature has not paid particular attention to how anti-money laundering (AML) regulations influence financial inclusion.

Money laundering has become a global canker, mainly because of its impact on nations' global financial systems and economies. Thus, it has far-reaching consequences on the soundness and survival of countries' financial systems. The large capital inflows and outflows artificially exacerbated by money laundering, according to Aluko and Bagheri (2012), constitute a substantial threat to the financial system's stability. These unplanned inflows and outflows of funds could create liquidity challenges for financial institutions, thus, affecting their stability. For instance, the international monetary fund estimates between $2.17 and $3.61tn, whereas the United Nations estimates between $1.6 and $4tn as proceeds of criminal activities laundered every year [Weeks-Brown, 2018; Financial Action Task Force (FATF), 2020]. Aluko and Bagheri (2012) noted that more than $1tn of illicit funds flowed annually through the international financial systems into the USA alone. Further, money laundering exposes the financial system to criminal elements that may defraud the financial institution or its customers. In addition, money laundering affects the trust and confidence of customers in the financial system which has implication for the soundness of the entire financial system. This is because unchecked money laundering suggests financial institutions and their officials are complicit in the crimes that generate the illicit funds [Financial Action Task Force (FATF), 2020].

According to Greenspan (1998), the entire financial system thrives on the trust and confidence of customers. Therefore, customer trust and confidence may determine the financial system's ability to promote financial inclusion. The World Bank's Global Findex 2014 reports that about 13% of unbanked adults cited the lack of trust in financial institutions as a barrier to account ownership (Demirgüç-Kunt *et al.*, 2015). Again, Ghosh (2021) provides evidence that trust leads to a significant improvement in account ownership and use in India, whereas Xu (2020) reports that social trust remains an important indicator of financial inclusion around the world. Undoubtedly, money laundering and how it is regulated has the potential to influence financial inclusion. AML regulations prevent the infiltration of criminal elements into the financial systems, protect the financial system's integrity, enhance the reputation of financial institutions and promote good governance and prudent management of financial institutions. Consequently, effective AML regulations promote customer trust and confidence in the financial system and thereby a major tool in promoting financial inclusion.

Although we argue that AML regulation can promote financial inclusion, this positive effect may be reversed if AML regulation becomes excessive or goes beyond a certain threshold. AML compliance has become a resource-intensive enterprise and may discourage financial institutions from offering products to low-end customers as it may be costly to institute AML compliance mechanisms in such environments (Mccarthy *et al.*, 2015). According to a LexisNexis Risk Solutions study report for 2021, AML compliance costs US financial firms $35.2bn, $39.8bn in the UK, $57.1bn in Germany, $24.8bn in France and $20.0bn in Italy, whereas the global AML compliance cost is projected at $213.9bn (LexisNexis Risk Solutions, 2021). Also, FATF acknowledges that the implementation of overly cautious/stringent AML controls may frustrate the financial inclusion efforts of

financial institutions (FATF, 2017). Bester *et al.* (2008) noted that the implementation of AML controls hurts the access and usage of financial services. Therefore, we hypothesize a threshold effect in the AML regulations–financial inclusion nexus.

Empirical studies by Ofoeda *et al.* (2020) examined the impact of AML regulations on financial sector development across the globe, whereas Esoimeme (2020), in documentary research, examined how countries could balance their AML controls with the financial inclusion efforts of financial institutions. Further, Balani (2019) investigated the influence of AML legislation on bank stock prices in the USA. In an event study, Premti *et al.* (2021) examined how the announcement of the Fourth AML Directive impacted European Bank's performance. Further, Kodongo (2018) assessed the influence of financial regulation on financial inclusion in Kenya, whereas Anarfo *et al.* (2020) investigated the impact of financial regulation on financial inclusion in sub-Sahara African. Unlike previous studies, this present study examines the impact of AML regulations on financial inclusion across the globe. This present study contributes to the literature in three ways.

Firstly, we examine the impact of AML regulations on financial inclusion using a comprehensive measure of AML regulations developed by the Basel Institute on Governance. The Basel AML Index ranks nations' AML risks based on the strength of their AML frameworks, control of bribery and corruption, financial transparency and standards, public sector accountability and transparency and legal and political risk. Secondly, we investigate if there are threshold effects in the AML regulations–financial inclusion nexus, and if so, whether the impact of AML regulations on financial inclusion varies depending on the level of AML regulations. Thirdly, we analyze the impact of AML regulations on financial inclusion in developed, developing and African countries using Seo *et al.*'s (2019) dynamic panel threshold regression technique. This is because the institutional environment, the financial systems and the design of the AML framework may differ across economies and therefore may impact financial inclusion differently. The rest of this paper is organized as follows: Section 2 reviews literature relevant to our study. Section 3 details the methodology used for the analysis. Section 4 discusses the empirical results, and in Section 5, we conclude the study and offer policy recommendations.

2. Review of literature

In recent times, financial inclusion has taken centre stage in the policy agenda of nations because it is considered a significant tool in achieving about seven of the Sustainable Development Goals (Kuada, 2019). Extant literature has shown that the quality of institutions (Corrado, 2020; Ongo Nkoa and Song, 2020), financial institutions regulation (Kodongo, 2018; Anarfo *et al.*, 2020), illiteracy (Chikalipah, 2017), good governance (Eldomiaty *et al.*, 2020), financial institutions concentration (Babajide *et al.*, 2020), political stability (Alhassan *et al.*, 2019), participation of foreign banks (Gopalan and Rajan, 2018), FinTech and artificial intelligence (Kshetri, 2021), GDP growth rate, presence of financial institutions and business freedom (Asuming *et al.*, 2019) explain inclusive finance of countries. In spite of the abundance of literature on financial inclusion, the importance of AML regulations in encouraging financial inclusion in countries continues to be overlooked. Although the relationship between AML regulations and financial inclusion appears unexplored, theoretical prescriptions show that AML regulations may have an impact on financial inclusion.

AML regulations engender customer trust and confidence in the financial system, which is critical in influencing the account ownership decisions of the adult populace. A significant number of adults (about 13% of unbanked adults) consider trust as a major factor in influencing their account ownership decisions (Demirgüç-Kunt *et al.*, 2015).

Again, AML regulations prevent the infiltration of criminal elements into the financial system, thereby promoting its soundness and stability. As a result, effective AML regulations should promote financial inclusion. Jayasekara (2020) assessed how the AML and counter-terrorist financing (CFT) regime affects financial inclusion and found that the level of a country's AML compliance has a considerable impact on its financial inclusion. In a related study, Isern *et al.* (2005) noted that customer due diligence regulations frustrate the account opening efforts of many low-income people. Kodongo (2018), using a probit regression over a cross-section of households in Kenya, provides evidence that agency banking regulations could improve financial inclusions, whereas regulations in the form of know-your-customer rules and capital regulations may frustrate financial inclusion. Again, Ofoeda *et al.* (2020) examined the impact of AML regulations on financial sector development. Although their study provides evidence that AML regulations promote the financial sector globally, this impact is concentrated in developing countries. Again, they find that AML regulations impact financial sector development below the threshold. However, Anarfo *et al.* (2020) investigated the impact of financial regulation on financial inclusion in sub-Saharan Africa (SSA) and found evidence that strengthening prudential laws could stymie SSA countries' efforts to achieve financial inclusion. Similarly, Bester *et al.* (2008) intimated that AML regulations might have adverse consequences for the financial access of the poor.

3. Methodology

This section provides a description of the data and the empirical approach adopted to estimate our hypothesized relationships in this study. We use panel data spanning 2012–2019 across 212 economies of the world. We used the dynamic panel threshold regression approach in analyzing our data. The threshold regression models are able to examine the impact of the different levels of the independent variables on the dependent variables.

3.1 Empirical model

In this study, we attempt to examine the threshold effect of AML regulations on financial inclusion. We posit that although AML regulation can promote financial inclusiveness, the gains may be completely eroded if AML regulations become too excessive. In line with our hypothesized relationships, we specify the following dynamic panel threshold regression model:

$$FI_{it} = \varphi X_{it} + \left\{ \begin{array}{ll} \propto_i + \beta_1 FI_{it-1} + \theta_1 AMLR_{it} + \mu_{it} & AMLR_{it} < \gamma \\ \propto_i + \beta_2 FI_{it-1} + \theta_2 AMLR_{it} + \mu_{it} & AMLR_{it} \geq \gamma \end{array} \right\} \quad (1)$$

where subscripts i and t refer to country and time, respectively. FI_{it} represents financial inclusion, whereas FI_{it-1} denote the lag of financial inclusion. Again, $AMLR_{it}$ denote AML regulations, whereas $\propto_i$ represents the country-specific fixed effects. Further, μ_{it} is a zero mean, finite variance, independent identically distributed (i.i.d.) disturbance. We denote our control variables hypothesized to affect FI by a vector X_{it}. Again, AMLR$_{it}$ is the regime-switching or threshold variable that is used in splitting our data into two sample groups while γ is the threshold value. Furthermore, β_1 and θ_1 are the coefficients of the lag of FI and AML regulations below the threshold value γ, whereas β_2 *and* θ_2 are the coefficients of the lag FI and AML regulations above the threshold value.

In line with theoretical prescriptions and empirical examinations, we control for quality of institutions, macroeconomic stability or inflation, infrastructure, income levels, financial stability, bank concentration and human capital. Although the are several proxies for financial inclusion such as automated teller machines per 100,000 people, bank accounts per 1,000 adults, commercial banks per 1,000 adults, bank branches per 100,000 adults, depositors with commercial banks per 1,000 adults and banks' borrower per 1,000 adults. However, in line with Inoue (2019), we digress from other studies (Ajide, 2020; Anarfo *et al.*, 2020) that used a composite index in measuring financial inclusion and we use the number of bank branches to measure access to financial services and bank accounts ownership and number of depositors to measure the usage of financial services. These proxies capture the two major dimension of financial of financial inclusion, that is, access and usage. Unlike the composite financial inclusion index, the use of the individual dimensions of financial inclusion allows for specific policy prescriptions.

Again, we measure AML regulations using the Basel AML Index by the Basel Institute on Governance. The Basel AML Index is an independent assessment of the AML regulatory effectiveness and money laundering risk of countries. The index ranges from 0 to 10, where lower scores suggest strong AML regulatory effectiveness, whereas higher scores indicate a weak AML regulatory framework. However, we rescale the Basel AML Index following Ofoeda *et al.* (2020), where lower scores indicate ineffective AML regulatory effectiveness and higher scores denote strong AML regulatory effectiveness. Institutional interventions at both the local and national levels should foster the confidence of stakeholders in the financial system and therefore promote financial inclusion (Corrado, 2020). We measure the quality of institutions using the simple average of the six dimensions of the World Governance Indicators (i.e. control of corruption, government effectiveness, political stability, voice and accountability, the rule of law and regulatory quality). Again, a sound and stable financial system devoid of the financial crisis should encourage financial inclusion (Anarfo *et al.*, 2020). We measure financial stability using a *z*-score calculated as $\left(\frac{E/A_{it}+ROA_{it}}{\partial ROA_{it}}\right)$, where E/A_{it} is equity to total assets, ROA_{it} is return on assets and ∂ROA_{it} standard deviation of return on assets. Financial service accessibility is the crux of every financial inclusion policy and therefore bank concentration may limit the financial inclusion efforts of countries (Babajide *et al.*, 2020). We measure bank concentration by the extent of concentration of deposits in the five largest banks.

Further, more prosperous economies may be more financially inclusive as individuals with higher income tend to patronize financial services and products than the poor (Anarfo *et al.*, 2019). Therefore, we hypothesize that higher economic growth should promote financial inclusion. We measure economic growth as the growth of real GDP per capita. Again, more educated people understand and can use financial products and services. Therefore, human capital development is expected to stimulate financial inclusiveness (Ofosu-Mensah Ababio *et al.*, 2020). We measure human capital as the percentage of secondary school enrolment to all eligible children. Infrastructural development in the form of providing good roads, electricity, internet and telephony services provide the basis for financial sector development and, therefore, should promote financial inclusion (Ofosu-Mensah Ababio *et al.*, 2020). We use telephone plus mobile subscriptions per 100 people to measure infrastructure. Finally, lower inflation rates ensure stability in the macroeconomic environment and the stability of the financial sector. Therefore, it is expected that a lower inflation rate should promote financial inclusion (Anarfo *et al.*, 2019). We source financial inclusion, financial stability and bank concentration data from Global Financial Development Database, whereas human capital, infrastructure, inflation and economic growth are sourced from the World Development Indicators. We further source for AML

regulations data from the Basel Institute on Governance and the institutional quality data is sourced from the World Governance Indicators.

3.2 Estimation technique

In exploring the non-linear relationship between AML regulations and financial inclusion, we adopt the dynamic panel threshold estimation technique proposed by Seo *et al.* (2019). The conventional way of ascertaining the non-linearity of a relationship is to introduce a quadratic term in the model (Cuestas *et al.*, 2020). However, this approach may present multicollinearity issues as the main variable and its quadratic term may be highly correlated. Again, this approach is unable to identify the exact point where the relationship changes direction and is unable to deal with issues of structural breaks in the data (Huang *et al.*, 2018). In dealing with these challenges, Hansen (2000) proposed a panel threshold estimation technique capable of tracing the turning point for policy decisions, revealing the effects of structural breaks in the data and addressing the problem of multicollinearity. However, the Hansen (2000) panel threshold approach is only applicable to static models and also unable to deal with endogeneity problems in the data set. Again, Hansen (2000) fixed estimator requires the covariates to be strongly exogenous for the estimator to be consistent (Seo *et al.*, 2019).

However, we adopt the Seo *et al.* (2019) dynamic panel threshold estimation, which allows for the lagged dependent variable. Again, this technique is built on the principle of first-differenced generalized methods of moments estimation technique which resolves issues of endogeneity and simultaneity, which is a possibility in our hypothesized relationships. Again, this technique does not impose the functional form of non-linearity on the data. The data determine the type of non-linearity. Further, unlike Hansen (2000) and Seo and Shin (2016), who compute the fixed-effect estimator, which produces inconsistent results under the general setting, the Seo *et al.* (2019) dynamic panel threshold estimation produces consistent and asymptotically normal estimates. Again, this approach reduces sampling errors and simultaneously allows the regressors and threshold variables to be endogenous (Olaoye and Aderajo, 2020; Zhang *et al.*, 2019). Finally, to identify the threshold, the Seo *et al.* (2019) dynamic panel threshold estimation adopts the computationally robust bootstrap algorithm to the non-parametric i.i.d. bootstrap proposed by Hansen (2000) and Seo and Shin (2016).

4. Empirical results

In this section, we present a discussion of the descriptive statistics and the panel threshold regression results of our study. In Table 1, panels A, B, C and D, we present the summary statistics of our full, developed, developing and African country samples, respectively. We report a mean of 60.2, 88.6, 54.6 and 41.7 for accounts ownership per 1,000 adults, whereas we report 18.3, 29.9, 16.0 and 8.9 for commercial bank branches per 100,000 adults for full, developed, developing and African country samples, respectively. Again, we report a mean of 827.9, 1114.2, 759.4 and 533.2 for depositors with commercial banks per 1,000 adults for full, developed, developing and African country samples, respectively. The findings of our study show that the degree of financial inclusion in developed countries is higher than in other parts of the world. Remarkably, Africa ranks lowest on all measures of financial inclusion used in this study. Further, for AML regulations, we report 4.3, 5.4, 4.03 and 3.7 as averages for our full, developed, developing and African country samples. This suggests that AML regulatory effectiveness is quite weak globally. However, developed countries comparatively report stronger AML regulatory effectiveness than other parts of the world.

Variable	Obs	Mean	SD	Min	Max
Panel A – full sample					
Account ownership	1,704	60.224	27.936	4.854	100
Bank branches	1,704	18.314	20	0.421	258.716
Depositors	1,704	827.91	612.772	2.766	3,706.135
AML regulations	1,704	4.263	1.277	1.39	8.221
Institutional quality	1,704	49.27	26.627	0.314	98.792
Inflation	1,704	137.632	158.811	96.404	4,583.71
Infrastructure	1,704	124.655	51.474	8.274	364.872
Economic growth	1,702	1.723	5.663	−36.557	121.78
Financial stability	1,704	14.204	9.716	0.25	69.039
Bank concentration	1,704	79.179	16.626	23.399	123.773
Human capital	1,704	87.298	27.513	12.467	184.509
Panel B – developed countries					
Account ownership	304	88.55	12.149	39.965	100
Bank branches	304	29.899	16.136	1.431	83.888
Depositors	304	1,114.187	657.338	−13.296	3,706.135
AML regulations	304	5.442	0.874	2.144	8.221
Institutional quality	304	80.427	15.963	25.62	98.792
Inflation	304	110.324	9.105	97.745	180.75
Infrastructure	304	157.862	19.521	100.441	202.506
Economic growth	304	1.935	2.621	−8.85	23.986
Financial stability	304	13.818	8.458	1.503	47.573
Bank concentration	304	80.511	15.436	38.057	123.773
Human capital	304	111.546	17.603	80.909	184.509
Panel C – developing countries					
Account ownership	1,320	54.551	26.327	5.527	100
Bank branches	1,320	16.018	20.276	0.421	258.716
Depositors	1,320	759.353	582.117	2.766	3,383.36
AML regulations	1,320	4.033	1.218	1.39	8.221
Institutional quality	1,320	42.875	23.264	0.314	94.885
Inflation	1,319	138.675	146.266	96.404	4,583.71
Infrastructure	1,320	117.883	53.942	8.274	364.872
Economic growth	1,318	1.763	6.156	−36.557	121.78
Financial stability	1,320	14.556	10.141	0.25	69.039
Bank concentration	1,320	79.603	16.612	23.399	123.773
Human capital	1,320	82.019	26.748	12.467	184.509
Panel D – African countries					
Account ownership	416	41.724	23.663	5.527	100
Bank branches	416	8.91	11.097	0.648	54.362
Depositors	416	533.159	560.365	24.354	2,173.18
AML regulations	416	3.666	1.212	1.541	7.222
Institutional quality	416	28.882	18.746	0.314	77.48
Inflation	416	166.383	254.385	102.206	4,583.71
Infrastructure	416	86.059	42.334	11.242	218.74
Economic growth	416	1.502	7.526	−36.557	121.78
Financial stability	416	13.648	8.864	0.25	54.235
Bank concentration	416	81.348	15.213	40.245	100
Human capital	416	61.686	27.515	12.467	158.458

Table 1.
Descriptive statistics

NB: We measure financial inclusion using accounts ownership per 1000 adults, commercial bank branches per 100,000 adults, and depositors with commercial bank per 1000 adults. We measure AML regulations using the Basel AML Index published by the Basel Institute on Governance. We rescale the Basel Index following (Ofoeda *et al.*, 2020). Quality of institutions is

measured as the simple average of the six (6) dimensions of the World Governance Indicators, while consumer price index is used to measure inflation. Again, infrastructure is measured as telephone and mobile subscription per 100 people, and economic growth is measured as the growth in GDP per capita income. We measure financial stability using bank z-score, while bank concentration is measured as the degree of concentration of deposits in the five largest banks. Finally, human capital is measured as the percentage of secondary school enrolment to all eligible children.

For institutional quality, we report an average of 49.3 for our full sample, 80.4 for developed countries, 42.9 for developing countries and 28.9 for African countries. This shows a relatively weak level of institutional quality across the globe. However, our results show that developed countries have strong institutions. Again, inflation reports averages of 137.6, 110.3, 138.7 and 166.4, whereas we report 124.7, 157.9, 117.9 and 86.1 as averages for infrastructure for full, developed, developing and African country samples. Further, the mean for economic growth is 1.7, 1.9, 1.8 and 1.5, whereas the mean for financial stability is 14.2, 13.8, 14.6 and 13.6 for full, developed, developing and African country samples. Also, bank concentration reports averages of 79.2 for the full sample, 80.5 for developed countries, 79.6 for developed countries and 81.3 for African countries. Finally, the average human capital is 87.3 for the full sample, 111.5 for developed countries, 82.02 for developing countries and 61.7 for African countries.

Further, we examine the impact of AML regulations on financial inclusion across developed, developing and African countries. Hence, we divide our samples into developed, developing and African countries using the United Nations classifications of economies. Again, we aim to establish the non-linearities in the AML regulations–financial inclusion nexus. Therefore, we use the Seo *et al.* (2019) dynamic panel threshold estimation to test whether the hypothesized relationships are monotonic. We use 2,000 bootstrap replications, a 15% trimming percentage and 100 grid numbers to test the non-linear relationship between AML regulations and financial inclusion (account ownership, bank branches, depositors) for our full, developed, developing and African country samples. The results of the threshold test presented in Table 2 suggest that there is a non-linear relationship between all measures of financial inclusion and AML regulations for the full sample, developed, developing and African countries. The findings of our study suggest that the

	Full sample			Developed countries		
	Acct	Deposits	Branches	Acct	Deposits	Branches
Linearity test (Prob)	0.005	0.05	0.035	0.000	0.000	0.000
No. of bootstrap replications	2,000	2,000	2,000	2,000	2,000	2,000
Trimming percentage	0.15	0.15	0.15	0.15	0.15	0.15
Grid number	100	100	100	100	100	100
	Developing countries			Africa		
	Acct	Deposits	Branches	Acct	Deposits	Branches
Linearity test (Prob)	0.000	0.0085	0.000	0.000	0.000	0.000
No. of bootstrap replications	2,000	2,000	2,000	2,000	2,000	2,000
Trimming percentage	0.15	0.15	0.15	0.15	0.15	0.15
Grid number	100	100	100	100	100	100

Notes: Null: There is no threshold effect of AML regulations on financial inclusion relationship. Two thousand bootstrap replications are used with 15% trimming for the threshold tests

Table 2. Dynamic panel threshold test of the relationship between AML regulations and financial inclusion

influence of AML regulations on financial inclusion is determined by the extent of AML regulatory effectiveness of a country. Hence, we divide the sample into two groups: regime one is above the threshold value and regime two is below the threshold value. Given that threshold effects exist in our hypothesized relationships, we proceed 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 and the low- and the high-regime results. We present the results of the dynamic panel threshold regression for accounts ownership, bank branches and depositors with commercial bank for our full, developed, developing and African country samples in Tables 3–6, respectively.

In Table 3, we present the results of our full sample. The overall results for our full sample presented in models 3, 6 and 9 show that AML regulations positively impact accounts ownership and depositors with commercial banks. This suggests that the implementation of AML regulations promotes inclusive finance in a country. This is because AML regulations instill trust and confidence of clients in the financial system, prevent the permeation of the financial system by criminals and enhance the reputation of financial institutions. Consequently, AML regulations are expected to influence the account opening and deposit decisions of people. This is corroborated by Kodongo's (2018) findings, which report that agency banking regulations promote financial inclusiveness. Our study, however, reports a negative effect of AML regulations on bank branches. This finding indicates that AML regulations rather frustrate the ability of commercial banks to expand their branch networks. This, although not expected, is not surprising. This is because AML regulations often come with huge compliance costs in the form of the staff training cost, reporting costs and transaction cost, among others, on the part of financial institutions and therefore limit the ability of financial institutions to expand their branch networks. Again, AML regulations in the area of know-your-customer and customer due diligence policies may limit banks branching into poor communities as most poor people may not be able to meet these AML requirements. This finding resonates with Anarfo *et al.* (2020), who find that prudential regulation may hamper financial inclusion efforts. We find similar results for developing and African countries.

However, the study results presented in Table 4, models 12, 15 and 18 for developed countries, show a negative impact of AML regulations across all proxies of financial inclusion. The results show that AML regulations do not promote account ownership, branch expansion and deposit mobilization in developed economies. AML compliance cost is a major burden on financial institutions especially in developed economies. For instance, AML compliance costs US financial firms $35.2bn, $39.8bn for the UK, $57.1bn for Germany, $24.8bn for France and $20.0bn for Italy, whereas the global AML compliance cost is estimated at $213.9bn (LexisNexis Risk Solutions, 2021). This means that AML compliance cost for the USA, the UK, Germany, France and Italy accounts for about 83% of ($176.9bn) global AML compliance costs. These costs are often passed on to customers, therefore, likely to limit the financial inclusiveness of advanced economies. This is confirmed by the LexisNexis Risk Solutions Report 2021, which indicated that about 63% of stakeholders in the financial system believe that AML compliance adversely affects financial institutions' productivity and customer acquisition (LexisNexis Risk Solutions, 2021).

Beyond the linear evidence, we examine the impact of AML regulations on financial inclusion above and below a certain threshold of AML regulations across all proxies of financial inclusion (accounts ownership, bank branches and deposits) for our full, developed, developing and African country samples. We present the results of our full sample in Table 3. For our full sample, the study's findings revealed a threshold of 3.226 for accounts

Table 3.
Dynamic panel threshold regression results on the relationship between AML regulations and financial inclusion – full sample

	1	2	3	4	5	6	7	8	9
		Account ownership			Bank branches			Depositors	
	Low regime	High regime	Overall	Low regime	High regime	Overall	Low regime	High regime	Overall
Lag of account ownership	−0.121 (0.105)	0.781*** (0.125)	0.615*** (0.027)	–	–	–	–	–	–
Lag of bank branches	–	–	–	0.830*** (0.038)	0.032 (0.038)	0.947*** (0.005)	–	–	–
Lag of depositors	–	–	–	–	–	–	0.447*** (0.039)	0.219*** (0.062)	0.624*** (0.016)
AML regulations	7.124*** (1.843)	−7.267*** (2.263)	8.703** (1.262)	−1.208*** (0.435)	−2.290*** (0.468)	−0.308*** (0.061)	5.284*** (1.054)	−9.968*** (1.352)	7.819*** (1.046)
Institutional quality	−0.627* (0.325)	0.710 (0.439)	−0.035 (0.073)	−0.010 (0.021)	0.032 (0.029)	−0.020 (0.010)	−1.797 (1.412)	11.374*** (2.157)	4.304*** (0.789)
Inflation	0.037*** (0.011)	−0.040*** (0.010)	−0.002*** (0.000)	−0.000 (0.000)	−0.000*** (0.000)	−0.000 (0.000)	0.003 (0.005)	0.052*** (0.011)	−0.025*** (0.003)
Infrastructure	0.958*** (0.181)	−1.091*** (0.192)	0.053*** (0.014)	0.003 (0.003)	−0.006 (0.007)	−0.001 (0.001)	3.138 (0.468)	−5.516*** (0.646)	0.479*** (0.139)
Income	0.883*** (0.254)	−1.632*** (0.342)	0.089*** (0.040)	0.041*** (0.018)	−0.082*** (0.030)	0.025*** (0.005)	0.361 (0.822)	−3.673 (3.097)	0.910*** (0.289)
Financial stability	−0.895*** (0.279)	1.264*** (0.372)	0.115*** (0.044)	−0.084*** (0.025)	0.105*** (0.032)	0.007* (0.004)	6.796*** (1.242)	−12.295*** (2.203)	0.036 (0.415)
Bank concentration	−0.613*** (0.143)	0.758*** (0.188)	−0.123*** (0.026)	−0.032*** (0.015)	0.071*** (0.024)	−0.008*** (0.003)	1.519* (0.780)	−5.285*** (1.468)	−1.035*** (0.197)
Human capital	0.577 (0.166)	−0.675*** (0.194)	0.030 (0.030)	0.036** (0.018)	−0.078*** (0.023)	0.012*** (0.004)	1.060 (0.740)	−0.074 (1.327)	0.165*** (0.307)
Constant	6.564*** (1.251)	–	–	−5.273* (2.981)	–	–	1.747*** (0.055)	–	–
No. of countries	212			212				212	
Threshold value	3.226			3.735			4.197		
Confidence interval		[2.872, 3.580]			[3.120, 4.349]			[3.866, 4.528]	

Notes: Robust standard errors are in parentheses *** $p < 0.01$; ** $p < 0.05$; ** $p < 0.1$

Table 4.
Dynamic panel threshold regression results on the relationship between AML regulations and financial Inclusion – developed countries

	10	11		12	13		14		15	16		17		18
		Account ownership					Bank branches					Depositors		
	Low regime	High regime		Overall	Low regime		High regime		Overall	Low regime		High regime		Overall
Lag of accounting ownership	−0.202 (0.217)	0.171 (0.369)		0.172*** (0.048)	–		–		–	–		–		–
Lag of bank branches	–	–		–	0.797*** (0.078)		0.090 (0.078)		0.710*** (0.019)	–		–		–
Lag of depositors	–	–		–	–		–		–	0.226** (0.095)		0.098** (0.045)		0.354*** (0.022)
AML regulations	9.343 (17.754)	−10.345** (4.926)		−5.696*** (1.399)	−0.646 (1.943)		3.113 (2.512)		−1.715*** (0.373)	5.084 (7.695)		−10.068*** (2.808)		−9.529*** (2.996)
Institutional quality	−3.540** (1.501)	2.137 (1.396)		0.191 (0.274)	−0.422* (0.255)		0.092 (0.119)		0.023 (0.066)	1.125 (8.249)		0.329* (5.014)		−3.278*** (0.564)
Inflation	1.861*** (0.622)	−1.861 (1.501)		0.302*** (0.070)	−0.163 (0.119)		0.204 (0.147)		−0.251*** (0.037)	5.791** (2.508)		−19.228** (8.222)		9.864*** (0.960)
Infrastructure	0.192 (0.270)	−0.417 (0.524)		−0.087*** (0.019)	−0.031 (0.033)		0.095* (0.049)		0.033*** (0.011)	3.086** (1.220)		−8.749* (5.145)		−1.889*** (0.312)
Income	−1.284 (2.469)	1.755 (2.667)		−0.359** (0.173)	0.215 (0.209)		−0.530* (0.294)		0.120*** (0.032)	3.473 (5.761)		1.321 (16.912)		14.267*** (1.598)
Financial stability	0.987 (0.715)	−3.099*** (1.137)		0.421*** (0.131)	0.209*** (0.081)		−0.147 (0.102)		−0.055** (0.025)	−7.100* (4.240)		3.835 (6.734)		−9.641*** (1.299)
Bank concentration	−0.669*** (0.207)	0.848* (0.459)		0.005 (0.020)	0.048 (0.039)		−0.136*** (0.057)		0.001 (0.008)	−2.149* (1.200)		−7.102** (3.099)		−1.805*** (0.264)
Human capital	−0.527 (1.213)	−0.936 (0.855)		0.130** (0.064)	0.069 (0.051)		−0.130* (0.071)		0.050* (0.028)	5.466 (4.364)		4.620 (3.532)		0.898** (0.392)
Constant	2.976*** (0.597)	–		–	−5.277*** (1.462)		–		–	2.206*** (0.846)		–		–
No. of countries	38				38							38		
Threshold value	5.423				5.517					5.970				
Confidence interval		[4.185, 6.661]					[4.510, 6.523]					[4.036, 7.904]		

Notes: Standard errors are in parentheses; ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

ownership, 3.735 for bank branches and 4.197 for deposits with commercial banks. Below the AML regulations threshold value, the results of the study show a positive coefficient. In contrast, we show a negative coefficient above the threshold value for accounts ownership and depositors with commercial banks. This indicates that although AML regulations generally promote accounts ownership and deposits with commercial banks, this impact is completely reversed if AML regulations go beyond the identified threshold to become excessive:

NB: We measure financial inclusion using accounts ownership per 1000 adults, commercial bank branches per 100,000 adults, and depositors with commercial bank per 1000 adults. We measure AML regulations using the Basel AML Index published by the Basel Institute on Governance. We rescale the Basel Index following (Ofoeda *et al.*, 2020). Quality of institution is measured as the simple average of the six (6) dimensions of the World Governance Indicators, while consumer price index is used to measure inflation. Again, infrastructure is measured as telephone and mobile subscription per 100 people, and economic growth is measured as the growth in GDP per capita income. We measure financial stability using bank z-score, while bank concentration is measured as the degree of concentration of deposits in the five largest banks. Finally, human capital is measured as the percentage of secondary school enrolment to all eligible children.

Although regulators introduce more AML regulations to strengthen the AML regulatory regimes, any additional AML requirement introduced calls for additional compliance requirements on the part of financial institutions. These requirements further increase the AML compliance costs for financial institutions and may also introduce identification requirements that may frustrate financial inclusiveness. However, we find a negative impact of AML regulations on bank branches below and above the threshold values. This means that AML regulations do not promote bank branching across all levels of AML regulations. AML compliance does not only occur at the headquarters of financial institutions but also at the branch. Trained personnel to ensure AML compliance at every branch is a necessity. Therefore, AML regulations may limit banks' ability to branch or may result in banks de-risking or de-banking of clients because of the high compliance cost. Again, bank effort to branch to informal/rural sectors of the economy may be significantly hampered by AML regulations as most people in these sectors of the economy do not have what it takes to meet most of the AML regulatory requirements.

Further, the results of the threshold effects for developed countries presented in Table 4 revealed thresholds of 5.423 for accounts ownership, 5.517 for bank branches and 5.970 for deposits with commercial banks. The results show that AML regulations have an insignificant positive coefficient across all proxies of financial inclusion (accounts ownership, bank branches, deposits with commercial banks) below the threshold. However, above the threshold value, the study revealed a significant negative impact of AML regulations on accounts ownership, bank branches and deposits with commercial banks. This means that AML regulations are not beneficial for financial inclusion in developed economies. This is because developed economies have stringent AML regimes and regulators are ready to impose hefty fines if financial institutions fail to comply and thereby may limit the financial inclusion efforts of financial institutions in developed economies. Again, the results of the study presented in Table 5 revealed thresholds of 4.186 for accounts ownership and 4.885 for bank branches and deposits with commercial banks for developing economies. We find significant positive coefficients for accounts ownership, bank branches and deposits with commercial banks below the threshold value of AML regulations. However, the study shows a significant negative influence of AML regulations on accounts

Table 5.
Dynamic panel threshold regression results on relationship between AML regulations and financial Inclusion – developing countries

	19	20	21	21	22	23	24	25	26
		Account ownership			Bank branches			Depositors	
	Low regime	High regime	Overall	Low regime	High regime	Overall	Low regime	High regime	Overall
Lag of account ownership	0.367*** (0.054)	0.031*** (0.140)	0.654*** (0.028)	–	–	–	–	–	–
Lag of bank branches	–	–	–	0.827*** (0.006)	0.509*** (0.029)	0.918*** (0.003)	–	–	–
Lag of depositors	–	–	–	–	–	–	0.827*** (0.006)	0.509*** (0.029)	0.585*** (0.017)
AML regulations	0.703*** (0.092)	−9.784** (4.394)	6.244*** (0.557)	0.102*** (0.115)	−0.381 (0.398)	−0.143*** (0.037)	0.102*** (0.015)	−0.181*** (0.298)	5.729*** (0.489)
Institutional quality	0.270* (0.143)	−0.378 (0.262)	0.002 (0.062)	−0.017 (−0.017)	−0.093*** (0.023)	0.003 (0.007)	−0.017 (0.013)	−0.093*** (0.023)	5.170*** (0.704)
Inflation	0.003 (0.002)	0.598*** (0.090)	−0.001*** (0.000)	−0.000 (0.000)	0.009 (0.011)	−0.000*** (0.000)	−0.000 (0.000)	0.009 (0.011)	0.010*** (0.002)
Infrastructure	0.091* (0.049)	−0.111 (0.112)	0.036*** (0.012)	−0.002 (0.002)	0.009 (0.006)	−0.001* (0.001)	−0.002 (0.002)	0.009 (0.006)	0.576*** (0.121)
Income	0.771*** (0.134)	−1.763*** (0.395)	0.116*** (0.039)	−0.007 (0.007)	0.076** (0.037)	0.023*** (0.004)	−0.007 (0.007)	0.076** (0.037)	−0.677*** (0.181)
Financial stability	0.681*** (0.125)	−0.963*** (0.221)	0.195*** (0.041)	−0.004 (0.007)	−0.023 (0.022)	−0.003 (0.003)	−0.004 (0.007)	−0.023 (0.022)	1.019*** (0.267)
Bank concentration	−0.269*** (0.088)	0.478** (0.193)	−0.124*** (0.026)	−0.007 (0.004)	0.001** (0.018)	−0.005*** (0.002)	−0.007 (0.004)	0.001 (0.018)	−0.430** (0.186)
Human capital	0.113 (0.077)	−0.240 (0.164)	−0.006 (0.03)	−0.009*** (0.003)	−0.072*** (0.013)	−0.012*** (0.002)	−0.009*** (0.003)	−0.072*** (0.013)	0.102 (0.195)
Constant	15.867 (24.915)	–	–	0.060 (2.822)	–	–	0.060 (2.822)	–	–
No. of countries		163			163			163	
Threshold value		4.186			4.885		4.885		
Confidence interval		[4.166, 4.205]			[4.857, 4.912]			[4.857, 4.912]	

ownership and deposits from commercial bank banks above the thresholds. These results are similar to our results of the full sample.

Although so far, our results generally show that AML regulations may promote financial inclusion, these benefits may be completely negated if AML regulations become excessive. However, Africa presents interesting findings. The results of the study presented in Table 6 revealed threshold values of 2.968 for accounts ownership, 4.084 for bank branches and 4.263 for deposits with commercial banks. Again, we find insignificant negative coefficients for accounts ownership and bank branches below the threshold value. In contrast, we find a significant positive effect of AML regulations on deposits with commercial banks below the threshold. However, the study finds a significant positive impact of AML regulations on accounts ownership, bank branches and deposits with commercial banks above the threshold:

NB: We measure financial inclusion using accounts ownership per 1000 adults, commercial bank branches per 100,000 adults, and depositors with commercial bank per 1000 adults. We measure AML regulations using the Basel AML Index published by the Basel Institute on Governance. We rescale the Basel Index following (Ofoeda *et al.*, 2020). Quality of institution is measured as the simple average of the six (6) dimensions of the World Governance Indicators, while consumer price index is used to measure inflation. Again, infrastructure is measured as telephone and mobile subscription per 100 people, and economic growth is measured as the growth in GDP per capita income. We measure financial stability using bank z-score, while bank concentration is measured as the degree of concentration of deposits in the five largest banks. Finally, human capital is measured as the percentage of secondary school enrolment to all eligible children.

This is in sharp contrast with our earlier findings. This means that for African countries, more stringent AML regulations rather promote financial inclusiveness. Although we expect AML regulations to rather frustrate financial inclusion in Africa because of the informal nature of most its economies, our finding is possible. According to the Basel Institute on Governance (2021), Africa has the highest overall money laundering risk score, which has implications for the soundness and stability of financial institutions and the entire financial system. Deterioration and instability of financial institutions because of the incidence of money laundering hinders the financial inclusion efforts of financial institutions. Therefore, the implementation of a sound AML regulatory framework in Africa should promote a sound financial sector, thus, promoting financial inclusion.

5. Conclusion and policy implications

The importance of financial inclusion in the development process of nations cannot be overemphasized. Countries across the globe have made significant efforts in promoting financial inclusion because it is seen as a critical tool in poverty alleviation. However, the role of AML regulations in promoting financial inclusion remains unexplored empirically. In this study, we aim to establish the impact of AML regulations on financial inclusion across different economies of the world (developed, developing and African countries). Again, we aim to test the non-linearities in the AML regulations–financial inclusion nexus. We use panel data of 212 countries across the globe-spanning 2012–2019. We use the dynamic panel threshold regression proposed by Seo *et al.* (2019) to estimate the data. In general, our findings indicate that AML regulations promote financial inclusion across the globe. However, we learn that AML regulations' impact on financial inclusion depends on the degree of AML regulations. More specifically, AML regulations spur financial inclusion below the threshold of AML regulations. Above the thresholds, AML regulations have damaging effects on financial inclusion. However, we find that AML regulations have a

Table 6.
Dynamic panel threshold regression results on relationship between AML regulations and financial Inclusion – Africa

	27	28		29	30	31		32	33	34		35
		Account ownership				Bank branches				Depositors		
	Low regime	High regime		Overall	Low regime	High regime		Overall	Low regime	High regime		Overall
Lag of account ownership	−0.599*** (0.131)	1.127*** (0.231)		0.182*** (0.031)	–	–		–	–	–		–
Lag of bank branches	–	–		–	0.187*** (0.029)	0.422*** (0.079)		0.477*** (0.009)	–	–		–
Lag of depositors	–	–		–	–	–		–	0.557 (0.032)	−0.153** (0.065)		0.420*** (0.016)
AML regulations	−4.010 (13.182)	2.548*** (0.805)		4.684*** (0.716)	−0.247 (0.171)	1.010*** (0.323)		0.686*** (0.071)	1.405*** (0.408)	2.637*** (0.228)		6.482*** (0.367)
Institutional quality	−3.459*** (0.771)	1.557* (0.924)		−0.559*** (0.263)	0.006 (0.011)	−0.087* (0.051)		−0.006 (0.006)	−4.616*** (1.587)	12.996*** (4.024)		−4.946*** (1.462)
Inflation	−0.063*** (0.021)	0.060*** (0.018)		−0.002*** (0.000)	0.000 (0.000)	−0.016*** (0.005)		−0.000*** (0.000)	−0.002 (0.025)	0.983** (0.417)		0.019*** (0.001)
Infrastructure	−0.443** (0.196)	1.136*** (0.231)		0.098** (0.043)	0.008*** (0.002)	−0.014 (0.012)		−0.010*** (0.001)	1.365** (0.263)	−0.398 (0.611)		0.313** (0.140)
Income	0.251 (0.225)	1.520*** (0.547)		0.608*** (0.062)	−0.003 (0.003)	0.050** (0.020)		−0.008*** (0.001)	1.535*** (0.670)	−2.578 (4.397)		−0.909*** (0.159)
Financial stability	0.379 (0.343)	−0.872 (0.563)		−0.219 (0.178)	0.014 (0.004)	−0.049* (0.029)		0.032*** (0.003)	1.392*** (1.148)	1.925 (2.189)		−3.629*** (0.493)
Bank concentration	−0.076 (0.218)	−0.457 (0.371)		−0.209*** (0.020)	0.009* (0.005)	−0.063*** (0.023)		0.005*** (0.001)	1.134** (0.507)	−0.516 (1.942)		−1.105*** (0.117)
Human capital	0.298 (0.250)	−0.354*** (0.289)		−0.282*** (0.092)	0.014*** (0.004)	0.030 (0.020)		0.007** (0.002)	1.131*** (0.798)	1.873 (1.752)		3.898*** (0.284)
Constant	−128.047*** (46.561)	–		–	8.522** (3.339)	–		–	−801.815** (338.601)	–		–
No. of countries		52				52				52		
Threshold value		2.968				4.084				4.263		
Confidence interval		[2.402, 3.535]				[4.032, 4.136]				[4.263, 4.405]		

Notes: Standard errors are in parentheses; ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

detrimental impact on financial inclusion for developed economies. Africa rather presented interesting findings. We find that AML regulations promote financial inclusion at all levels of AML regulations, with the impact being more pronounced at higher levels of AML regulations.

Hence, following the findings of the study, we make the following policy propositions. Firstly, countries must make conscious efforts in combating the incidence of money laundering by establishing sound AML regulatory regimes, promoting transparent public sector, controlling corruption in the public sector and implementing policies that foster financial transparency and standards. Secondly, our study shows that the impact of AML regulations on financial inclusion is threshold-specific. Specifically, the contribution of AML regulations in promoting financial inclusion is completely negated if AML regulations go beyond the threshold. Therefore, there is a need for regulators to ensure cost-effective and efficient implementation of AML regulations. Financial institutions must develop systems that will incorporate AML regulations into their normal business operations to reduce the cost associated with AML compliance. Although our study introduces new insights into the AML regulations–financial inclusion nexus, future studies might ascertain the impact of the various components of the Basel AML Index on financial inclusion. Again, we recognize that each country's AML framework may be different. As a result, AML regulations' potential to promote financial inclusion may be country-specific. Future research could focus on how AML regulatory systems in individual nations affect the financial inclusion efforts in those countries. Another limitation of the study is the short data span (2012–2019). A longer data span would have afforded us the opportunity to ascertain the impact of AML regulations on financial inclusion in times of relative stability in the global economy and in times of global crisis.

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