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BANK REGULATION, SUPERVISION AND LENDING: EMPIRICAL EVIDENCE FROM SELECTED SUB-SAHARAN AFRICAN COUNTRIES

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BANK REGULATION, SUPERVISION AND LENDING: EMPIRICAL EVIDENCE FROM SELECTED SUB-SAHARAN AFRICAN COUNTRIES

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Abstract

This study investigates the impact of bank regulation and supervision on bank credit in 23 sub-Saharan African (SSA) countries and their low- and middle-income groups from 1995 to 2017. The long-run results indicated that stringent entry barriers and supervisory power reduced bank lending, but supervisory power mitigated the negative effect of entry barriers. Furthermore, positive shocks to entry barriers impacted negatively on bank credit, while negative shocks to capital requirements had an adverse impact on lending. In the short run, positive shocks to entry barriers, activity restrictions and capital regulations led to increases in bank credit, particularly in low-income SSA economies.

Keywords: bank regulation; bank lending; common correlated effects; linear and nonlinear panel ARDL; sub-Saharan Africa

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1. Introduction

Inadequate regulation and supervision of the financial system were often cited as some of the main causes of financial crises (Merrouche and Nier 2017). In response, countries around the world continued to introduce reforms in bank regulation and supervision. Facing the pressure to keep up with other economies, most countries in Sub-Saharan Africa (SSA) implemented bank regulatory and supervisory reforms since the 1990s, and even after the 2007-2008 global financial crises, in line with the Basel accord (Nyantakyi and Sy 2015; Anginer et al. 2019). The reforms in bank regulation involved changes in entry barriers, activity restrictions and capital regulations, while the ones in bank supervision included changes in the ability of supervisory authorities to prevent, correct and resolve problem banks.

Although adopting higher bank regulatory and supervisory standards could enhance the resilience of the banking sector, there exists a trade-off between gaining such benefits and improving financing through increased lending, which could be constrained by stringent bank regulatory and supervisory measures (Adesina 2019). It is, therefore, imperative to empirically investigate the role played by bank regulatory and supervisory reforms in influencing bank lending, especially in the longer term, since banks at times prepare in advance so that they can comply with the upcoming regulations. Moreover, given that changes in bank regulation involve costs and benefits (see Thamae and Odhiambo 2021, 2022), their impact on bank lending could be asymmetric as positive and negative shocks to bank regulation are not expected to have the same impact on bank lending.

Many empirical studies have assessed how bank regulatory and/or supervisory measures affected bank credit using country- or bank-level datasets, but most of them focused only on linear and mainly short-run adjustments with mixed evidence. For example, for studies using country-level data, Barth, Caprio and Levine (2004) revealed that regulatory restrictions on bank activities and limitations on foreign bank entry or ownership prohibited bank lending in 107 countries over the world during the period 1997 to 1999. Conversely, capital regulatory requirements and prompt corrective and supervisory powers had no significant impact. However, Merrouche and Nier (2017) obtained partly different results in 22 OECD countries from 1999 to 2007 by establishing that the tightening of entry barriers and supervisory power limited bank lending, while activity restrictions did not affect it.

Concerning studies using bank-level data, Amidu (2014) established that stringent capital requirements restricted bank credit delivery in 24 SSA countries from 2000 to 2007, while activity restrictions promoted it. Alternatively, Bridges et al. (2014) affirmed the impact of capital requirements on bank lending to be heterogeneous across different economic sectors in the UK from 1990 to 2011. In response to an increase in regulatory capital requirements, the UK banks reduced their commercial real estate, other corporates and household secured lending, whereas their household unsecured lending remained unaffected. Additionally, Fratzscher, König and Lambert (2016) found that higher capital regulations exerted no impact on bank credit in 50 advanced and emerging market economies from 2003 to 2013, while enhanced supervisory independence mitigated the fall in bank lending. Nonetheless, the considered studies did not analyse how bank regulatory and supervisory measures influenced bank lending in the long run possibly owing to the short period of the datasets employed. Again, they did not account for the possible asymmetric response of bank lending to bank regulation.

This study aims to fill the identified gaps by using 23 SSA countries and their low- and middle-income groups from 1995 to 2017 to estimate the impact of bank regulation and supervision on bank lending, especially in the long run. It specifically contributes to the literature in several ways. First, it employs the dynamic common correlated effects (CCE) method to estimate the panel autoregressive distributed lag (ARDL) models. This method allows for country-specific heterogeneity and controls for endogeneity and cross-sectional dependence. Second, it uses the dimensions of bank regulatory and supervisory measures obtained from the Bank Regulation and Supervision Surveys (BRSS) of the World Bank (WB), namely, entry barrier index, activity restriction index, capital regulation index and supervisory power index. Third, it assesses whether the supervisory environment enhances or mitigates the impact of bank regulation on bank lending by adding the interaction term between bank regulatory and supervisory measures. Lastly, it introduces nonlinear bank regulatory effects in the empirical model to analyse the asymmetric response of bank lending to bank regulation. To the best of our knowledge, this is the first paper to adopt the above-mentioned methods to investigate the impact of bank regulation and supervision on bank credit in SSA economies.

2. Data and Methodology

2.1. Data Sources

This study used annual sample data from 23 SSA economies, with 11 middle-income countries and 12 low-income countries, covering the period 1995 to 2017. The income classifications were based on the World Bank Atlas method for 2017. The selection is based on countries that have information on at least three BRSS, including the latest one available, distributed in 2017 and its report released in 2019. Given that these surveys generally cover the current and preceding years, time series values for the periods 1995-1999, 2000-2003, 2004-2007, 2008-2011 and 2012-2017 are given by the indices from Surveys I to V, respectively (see Table A1).

The data on the measure of bank lending, namely, bank credit to the private sector as a share of GDP, were obtained from the Financial Development and Structure and the Global Financial Development databases of the WB, as well as from the International Financial Statistics of the International Monetary Fund (IMF). For bank regulatory and supervisory measures, the study used the entry barrier index, activity restriction index, capital regulation index and supervisory power index, normalised to one, from the WB's BRSS[2]. Furthermore, the study used the data on economic growth, proxied by the log of real GDP; inflation, captured by the log of consumer price index, as well as current account balance as a share of GDP, reflecting capital net flow, as control variables that are common in the literature[3]. The data for these macroeconomic control variables came from the World Economic Outlook of the IMF and the World Development Indicators of the WB. Table A2 summarises the source of data and describes these variables, while Tables A3 and A4 offer their summary statistics and correlation matrix, respectively.

2.2. Empirical Model and Estimation Techniques

This study followed the empirical model of Merrouche and Nier (2017) and specified the relationship between bank lending and bank regulation and supervision (plus controls) as follows:

[2] See Barth, Caprio and Levine (2001, 2004, 2008, 2013), Cihak et al. (2013) and Anginer et al. (2019) for the sub-components, qualification criteria and range for each index.
[3] Other explanatory variables were not incorporated because of lack of data in some of the selected SSA countries.

$$L_{i,t} = \beta_{i0} + d_t + \beta_{i1} R_{i,t} + \beta_{i2} S_{i,t} + \boldsymbol{\beta}'_{i3} \boldsymbol{X}_{i,t} + \nu_{i,t} \quad (1)$$

where $L_{i,t}$ is a bank lending variable for country i at time period t; $R_{i,t}$ is a bank regulatory measure; $S_{i,t}$ is bank supervisory power index; $\boldsymbol{X}_{i,t}$ is a vector of macroeconomic control variables; β_{i0} captures country-specific fixed effects; d_t is a time dummy; β_{i1} and β_{i2} are scalars while $\boldsymbol{\beta}_{i3}$ is a vector, representing coefficients to be estimated; $\nu_{i,t}$ is an error term that is independently and normally distributed with mean zero and constant variance.

Bank regulatory and supervisory measures are expected to either limit or promote bank lending as their impact on bank lending is ambiguous (Barth, Caprio and Levine 2004). Moreover, economies with high-income levels normally have bigger and deeper credit markets since they benefit from economies of scale in the organisation of the supporting institutions (Djankov, Mcliesh and Shleifer 2007). Alternatively, rising inflation is anticipated to deter consumers from contracting additional credit because banks are likely to hike rates during periods of increasing inflation, and this may induce a fall in the demand for bank lending (Adesina 2019). Lastly, increases in the current account deficits need to be offset by net capital inflows, and this could result in credit for the domestic private sector (Merrouche and Nier 2017).

To assess whether the supervisory environment enhanced or mitigated the impact of bank regulation on bank lending, the study also modified Equation (1) by adding the interaction term of bank regulatory measure and supervisory power index ($R_{i,t} \times S_{i,t}$).

The Linear Panel Autoregressive Distributed Lag (ARDL) Model

If cointegration existed among variables, the study further specified the ARDL model based on Pesaran, Shin and Smith (1999) but estimated through the dynamic CCE mean group (CCEMG) or CCE pooled (CCEP) approach (see Holly, Pesaran and Yamagata 2010; Chudik and Pesaran 2015). The error correction model derived from Equations (1) is presented as follows:

$$\Delta L_{i,t} = \mu_i + \Omega_t + \phi_i ECT_{t-1} + \sum_{j=1}^{p-1} \alpha_{ij} \Delta L_{i,t-j} + \sum_{j=0}^{q-1} \delta_{ij} \Delta R_{i,t-j} + \sum_{j=0}^{r-1} \varphi_{ij} \Delta S_{i,t-j}$$
$$+ \sum_{j=0}^{s-1} \boldsymbol{\lambda}'_{ij} \Delta \boldsymbol{X}_{i,t-j} + \sum_{\ell=0}^{p_T} \omega_{i\ell} \bar{Z}_{t-\ell} + \varepsilon_{i,t} \qquad (2)$$

where Δ is a first difference operator; μ_i is a country-specific intercept; Ω_t is a time effect variable; ϕ_i captures the speed of adjustment towards a long-run equilibrium; ECT_{t-1} represents the lagged error-correction term; α_{ij}, δ_{ij} and φ_{ij} are scalars representing the coefficients of the lagged dependent variable, bank regulatory measure and bank supervisory power, respectively; $\boldsymbol{\lambda}_{ij}$ is a vector of coefficients for macroeconomic control variables; $\varepsilon_{i,t}$ is a composite error term; $\bar{Z}_t$ is a cross-sectional average [$\bar{Z}_t = (\Delta\bar{L}_t, \Delta\bar{R}_t, \Delta\bar{S}_t, \Delta\bar{\boldsymbol{X}}_t, \overline{ECT}_{t-1})'$ with $\overline{ECT}_{t-1}$ being the equilibrium error]; p, q, r and s are the optimal lag lengths determined by the Schwarz information criterion[4]; all other variables are as explained previously. The study still determined the impact of including $R_{i,t} \times S_{i,t}$ in Equation (2).

The Nonlinear Panel Autoregressive Distributed Lag (NARDL) Model

The study also employed the NARDL model to cater for the asymmetric response of bank lending to bank regulation. Following Shin, Yu and Greenwood-Nimmo (2014), the asymmetric representation of Equation (2) is as follows:

$$\Delta L_{i,t} = \mu_i + \Omega_t + \phi_i ECT_{t-1} + \sum_{j=1}^{p-1} \alpha_{ij} \Delta L_{i,t-j} + \sum_{j=0}^{q-1} \left(\delta_{ij}^{+} \Delta R_{i,t-j}^{+} + \delta_{ij}^{-} \Delta R_{i,t-j}^{-}\right)$$
$$+ \sum_{j=0}^{r-1} \varphi_{ij} \Delta S_{i,t-j} + \sum_{j=0}^{s-1} \boldsymbol{\lambda}'_{ij} \Delta \boldsymbol{X}_{i,t-j} + \sum_{\ell=0}^{p_T} \omega_{i\ell} \bar{Z}_{t-\ell} + \varepsilon_{i,t} \qquad (3)$$

where $R_{i,t}^{+}$ and $R_{i,t}^{-}$ are positive and negative shocks of a bank regulatory measure, respectively, while δ_{ij}^{+} and δ_{ij}^{-} are the corresponding short-run coefficients (and all other variables are as

[4] A common lag structure can still be imposed when faced with data limitations (see Pesaran, Shin and Smith 1999).

specified earlier). These shocks are theoretically defined as positive and negative partial sum decompositions of changes in bank regulation and are expressed as follows:

$$R_{i,t}^{+} = \sum_{k=1}^{t} \Delta R_{ik}^{+} = \sum_{k=1}^{t} \max(\Delta R_{ik}^{+}, 0) \quad (4)$$

$$R_{i,t}^{-} = \sum_{k=1}^{t} \Delta R_{ik}^{-} = \sum_{k=1}^{t} \min(\Delta R_{ik}^{-}, 0) \quad (5)$$

Equation (3) was also estimated using the CCE estimator. After this, the Wald (1943) test was used to determine if there were asymmetric long-run and short-run responses of bank lending to changes in bank regulation. The study also analysed the impact of including $R_{i,t} \times S_{i,t}$ in Equation (3).

3. Results and Discussion

3.1. Cross-Sectional Dependence Test Results

The study employed four tests of cross-sectional dependence (CD), namely, the Lagrange multiplier (LM) test, the scaled LM test, the bias-adjusted LM test and the CD test (Breusch and Pagan 1980; Pesaran, Ullah and Yamagata 2008; Pesaran 2021). The test statistics in Table 1 generally indicated that the residual cross-correlations were statistically significant for almost all the variables except for real GDP, which had an insignificant residual cross-correlation in low-income SSA economies.

Table 1 Cross-sectional dependence test statistics

Variables	Pesaran scaled LM	Breusch-Pagan scaled LM	Bias-corrected scaled LM	Pesaran CD
		All selected SSA		
L	6.73***	404.03***	6.20***	5.50***
R_{EB}	60.93***	1140.83***	60.54***	18.28***
R_{AR}	82.41***	2106.70***	81.88***	20.32***
R_{CR}	127.24***	3115.16***	126.72***	37.40***
S	76.02***	1963.02***	75.50***	18.94***
Y	3.18***	324.59***	2.66***	2.85***
π	25.02***	815.89***	24.50***	17.61***
C	5.43***	375.06***	4.90***	1.63
		Low-income SSA		
L	2.16**	90.85**	1.89*	0.14
R_{EB}	50.02***	579.57***	49.77***	15.69***
R_{AR}	48.48***	623.04***	48.21***	14.35***
R_{CR}	89.91***	1098.96***	89.63***	16.07***
S	55.04***	698.34***	54.77***	22.08***
Y	1.06	78.13	0.78	1.02
π	20.49***	301.43***	20.22***	12.41***
C	2.02**	89.18**	1.74*	0.67
		Middle-income SSA		
L	3.44***	91.07***	3.19***	4.23***
R_{EB}	20.18***	151.78***	20.02***	4.47***
R_{AR}	28.74***	356.47***	28.49***	4.75**
R_{CR}	44.07***	517.16***	43.82***	7.31***
S	33.25***	400.90***	33.00***	6.93***
Y	4.05***	403.77***	3.80***	3.86***
π	8.36***	97.44***	8.11***	6.71***
C	4.46***	142.66***	4.21***	0.31

*Notes: The reported test statistics are based on the residuals from the 1st order augmented Dickey-Fuller [ADF(1)] regressions, but the results are still robust under other lag orders of p = 2, 3, 4; ADF(p) regressions include an intercept and a linear trend; L = bank lending; R_{EB} = entry barrier; R_{AR} = activity restriction; R_{CR} = capital regulation; S = supervisory power; Y = economic growth; π = inflation; C = current account/GDP; *, ** and *** denote 10%, 5% and 1% statistical singnificance, respectively.*

3.2. Panel Unit Root Test Results

First, the study employed the cross-sectionally augmented Im-Pesaran-Shin (CIPS) unit root test of Pesaran (2007). When considering the trended nature of the variables, the results in Table 2 showed that the null hypothesis of unit root could not be rejected for these variables in levels except for the current account balance in all selected SSA economies and low-income SSA countries. But this null was rejected when these variables were in first differences except for the entry barrier index in middle-income SSA economies. Thus, the current account balance in all selected SSA economies and low-income SSA countries was $I(0)$, while all other reported variables were $I(1)$, except for the entry barrier index in middle-income SSA countries, which was non-stationary in first difference.

Secondly, the study used the Im-Pesaran-Shin (IPS) panel unit root test for real GDP in low-income SSA countries in the absence of cross-sectional dependence. Table 2 indicated that the null hypothesis of unit root could not be rejected even when accounting for the trended nature of this variable in levels. However, this null was rejected in first differences. Thus, real GDP was $I(1)$.

Table 2 Panel unit root test results

Variables	All selected SSA	Low-income SSA	Middle-income SSA
CIPS statistics (with an intercept)			
ΔL	-3.14***	-3.27***	-3.09***
ΔR_{EB}	-3.06***	-3.63***	-1.84
ΔR_{AR}	-4.52***	-4.60***	-4.36***
ΔR_{CR}	-4.64***	-4.57***	-4.35***
ΔS	-4.25***	-4.29***	-4.26***
ΔY	-3.78***	-	-3.00***
$\Delta\pi$	-3.57***	-3.88***	-3.62***
ΔC	-5.02***	-4.65***	-4.87***
L	-1.88	-1.86	-1.64
R_{EB}	-0.38	-0.90	0.11
R_{AR}	-1.33	-1.14	-1.36
R_{CR}	-0.66	-0.55	-0.94
S	-1.30	-0.93	-1.37
Y	-1.56	-	-1.31
π	-2.11*	-2.52***	-1.45
C	-2.30**	-2.66***	-2.08
CIPS statistics (with an intercept and a linear trend)			
L	-1.82	-1.71	-1.63
R_{EB}	-1.59	-1.45	-0.66
R_{AR}	-2.16	-2.46	-1.78
R_{CR}	-2.27	-2.30	-1.79
S	-1.97	-1.89	-1.99
Y	-1.92	-	-1.18
π	-1.78	-2.53	-1.65
C	-2.73**	-2.97***	-2.47
IPS statistics (with an intercept)			
ΔY	-	-5.67***	-
Y	-	6.08	-
IPS statistics (with an intercept and a linear trend)			
Y	-	0.41	-

Notes: The reported test statistics are still robust under other lag orders of p = 2, 3, 4; Δ = first difference operator; see the notes in Table 1.

3.3. Slope Homogeneity Test Results

The study tested for slope homogeneity using the Roy-Zellner test (Schiavo and Vaona 2008). The test result from Table 3 strongly rejected the null hypothesis of slope homogeneity in all selected SSA economies and their income groups. Therefore, the study adopted the CCEMG technique in its estimations since it accounted for parameter heterogeneity.

Table 3 Slope homogeneity test results

Model	Roy-Zellner test statistic
All selected SSA	
$L = f(R_{EB}, S, Y, \pi)$	32189.26***
$L = f(R_{AR}, S, Y, \pi)$	37798.65***
$L = f(R_{CR}, S, Y, \pi)$	39725.96***
Low-income SSA	
$L = f(R_{EB}, S, Y, \pi)$	3161.22***
$L = f(R_{AR}, S, Y, \pi)$	3056.74***
$L = f(R_{CR}, S, Y, \pi)$	3459.28***
Middle-income SSA	
$L = f(R_{AR}, S, Y, \pi, C)$	22828.75***
$L = f(R_{CR}, S, Y, \pi, C)$	22807.80***

Note: see the notes in Table 1.

3.4. Panel Cointegration Test Results

A two-stage second-generation residual-based cointegration procedure proposed by Holly, Pesaran and Yamagata (2010) was used to test for cointegration. The study started by estimating the long-run models using the CCEMG estimator and then subjected their residuals to the CIPS panel unit root test to determine the existence of cointegration. Table 4 showed that the null hypothesis on unit root on the obtained residuals under all models was significantly rejected in all selected SSA countries and their income groups. Thus, it was concluded that the variables were cointegrated.

Table 4 Panel cointegration test results

Model	CIPS statistic (with an intercept)
All selected SSA	
$L = f(R_{EB}, S, Y, \pi)$	-2.86***
$L = f(R_{AR}, S, Y, \pi)$	-4.51***
$L = f(R_{CR}, S, Y, \pi)$	-4.50***
Low-income SSA	
$L = f(R_{EB}, S, Y, \pi)$	-2.99***
$L = f(R_{AR}, S, Y, \pi)$	-6.18***
$L = f(R_{CR}, S, Y, \pi)$	-3.10***
Middle-income SSA	
$L = f(R_{AR}, S, Y, \pi, C)$	-6.19***
$L = f(R_{CR}, S, Y, \pi, C)$	-3.38***

Notes: The reported CIPS(1) statistics are based on the residuals of the specified models estimated through the common correlated effects mean group estimator and are still robust under other lag orders of p = 2, 3, 4; see the notes in Table 1.

3.5. Panel ARDL and NARDL CCEMG Estimation Results

The panel ARDL and NARDL CCEMG long- and short-run estimates for models with entry barrier, activity restriction and capital regulation indices are provided in Tables 5 to 7, respectively. The models with negative and significant error-correction terms confirmed the

presence of a long-run relationship between bank lending and independent variables. The lag of bank lending was also positive and significant under all models, thereby highlighting the persistent nature of bank credit and justifying the use of the dynamic panel data estimation technique.

In models with the entry barrier index, the panel ARDL long-run results in Table 5 showed that the entry barriers impacted positively on bank credit in low-income SSA countries. However, when an interactive term between entry barrier and supervisory power indices was included, entry barriers significantly impacted bank lending negatively in all selected SSA countries and low-income SSA economies. Although supervisory power impacted negatively and significantly on bank lending, it mitigated the negative impact of entry barriers on bank lending, as indicated by strongly significant and positive coefficients of the interactive term. Other long-run results generally indicated that economic growth had a positive and significant effect on bank lending, whereas inflation had an insignificant impact.

Additionally, the reported F-test statistics for the panel NARDL models in Table 5 indicated that the long-run asymmetric impact of entry barriers on bank credit was only significant under models with the interactive term. These results indicated that only positive shocks to entry barriers had a long-run negative and significant impact on bank lending. Supervisory power still mitigated the negative impact of entry barriers on bank credit. Alternatively, the short-run results and F-test statistics showed that positive shocks to entry barriers impacted positively and significantly on bank lending, while negative shocks had a negative and significant effect. The short-run effects of other factors were generally insignificant.

Overall, these results indicated that the benefit of increased bank lending enjoyed by all selected SSA economies and low-income SSA countries, possibly emanating from the increased franchise value of banks owing to the tightening of entry barriers (Keeley 1990), was short-lived. In the long run, increasing entry barriers led to a fall in bank lending. This is consistent with the literature that argues that entry barriers can hamper bank lending by reducing competition and the efficiency benefits coming with it (Barth, Caprio and Levine 2004). Nevertheless, despite that strengthening supervisory power limited bank lending in the long run, this mitigated the negative impact of entry barriers by minimising moral hazard via improved monitoring and well-enforced regulations (Merrouche and Nier 2017).

Table 5 Panel ARDL and NARDL CCEMG estimates (models with entry barrier index)

Variables	All selected SSA				Low-income SSA			
	ARDL		NARDL		ARDL		NARDL	
	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$
Long-run (LR) estimates: The dependent variable is L								
R_{EB}	-2.58 (1.73)	-5.36*** (1.78)	-	-	0.18* (0.11)	-3.55*** (1.25)	-	-
R_{EB}^{+}	-	-	0.10 (0.20)	-15.26* (7.89)	-	-	-0.05 (0.35)	-12.86** (5.91)
R_{EB}^{-}	-	-	-0.27 (0.60)	-7.06 (5.96)	-	-	-0.54 (1.16)	-1.96 (2.52)
$R_{EB} \times S$	-	3.99*** (1.53)	-	25.72** (12.54)	-	5.72*** (2.12)	-	23.10** (10.21)
S	-0.15*** (0.04)	-2.51*** (0.94)	-0.55* (0.29)	-15.02** (6.55)	-0.21*** (0.08)	-3.82*** (1.35)	-0.92* (0.54)	-15.14** (6.30)
Y	0.20*** (0.06)	0.18*** (0.05)	0.17*** (0.06)	0.16*** (0.06)	0.14** (0.04)	0.13*** (0.04)	0.14*** (0.04)	0.13*** (0.04)
π	-0.06 (0.05)	-0.05 (0.05)	-0.05 (0.05)	-0.05 (0.05)	-0.08 (0.06)	-0.08 (0.06)	-0.08 (0.06)	-0.08 (0.06)
Short-run (SR) estimates: The dependent variable is $\Delta(L)$								
ECT_{t-1}	-0.74*** (0.06)	-0.78*** (0.06)	-0.77*** (0.05)	-0.65*** (0.09)	-0.65*** (0.06)	-0.69*** (0.06)	-0.66*** (0.06)	-0.69*** (0.06)
$\Delta(L_{t-1})$	0.43*** (0.05)	0.43*** (0.05)	0.43*** (0.04)	0.39*** (0.07)	0.42*** (0.06)	0.43*** (0.06)	0.43*** (0.06)	0.43*** (0.06)
$\Delta(R_{EB})$	0.07* (0.04)	-0.01 (0.16)	-	-	0.10** (0.04)	0.13 (0.28)	-	-
$\Delta(R_{EB}^{+})$	-	-	0.15* (0.20)	-1.41 (2.07)	-	-	0.12*** (0.04)	0.18** (0.07)
$\Delta(R_{EB}^{-})$	-	-	-0.08** (0.60)	-0.17* (0.09)	-	-	-0.11* (0.06)	-0.11* (0.06)
$\Delta(R_{EB} \times S)$	-	0.08 (0.20)	-	-	-	-0.13 (0.32)	-	-0.09 (0.09)
$\Delta(S)$	-0.08** (0.04)	-0.12 (0.10)	-0.06* (0.03)	-0.06 (0.05)	-0.13** (0.05)	-0.05 (0.16)	-0.08 (0.05)	-0.03 (0.06)
$\Delta(Y)$	0.01 (0.04)	-0.01 (0.03)	-0.003 (0.03)	-0.16** (0.07)	0.001 (0.03)	-0.002 (0.03)	-0.001 (0.03)	-0.002 (0.03)

Variables	All selected SSA countries				Low-income SSA countries			
	ARDL		NARDL		ARDL		NARDL	
	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$
Short-run (SR) estimates: The dependent variable is $\Delta(L)$								
$\Delta(\pi)$	-0.07	-0.06	-0.06	-0.08	-0.05	-0.05	-0.05	-0.05
	(0.04)	(0.04)	(0.04)	(0.06)	(0.04)	(0.04)	(0.04)	(0.04)
C	-0.003	-0.01	-0.003	-0.08	-0.03	-0.03	-0.02	-0.03
	(0.02)	(0.02)	(0.02)	(0.07)	(0.02)	(0.02)	(0.02)	(0.02)
Intercept	0.005	0.005	-0.005	-0.0002	0.002	-0.03	0.003	0.002
	(0.003)	(0.003)	(0.003)	(0.01)	(0.002)	(0.002)	(0.002)	(0.002)
Countries	23	23	23	23	12	12	12	12
Observations	529	529	529	529	276	276	276	276
F-test (LR)	-	-	0.63	5.12**	-	-	0.31	3.22*
F-test (SR)	-	-	6.39**	0.38	-	-	8.12***	9.93***
CD test	0.30	1.35	1.52	-0.47	-0.24	0.71	0.41	0.71

Notes: $R \times S$ is an interactive term between bank regulatory and supervisory indices; standard errors are in parenthesis; CD is cross-sectional dependence; ECT is an error correction term; the chosen lag order for the baseline models is $ARDL(1,0,0,0,0,0)$; see the notes in Tables 1 and 2.

When it came to models with the activity restriction index, Table 6 showed that activity restrictions and supervisory power had no long-run impact on bank lending. Nevertheless, the short-run results indicated that activity restrictions impacted positively on bank lending in low-income SSA economies, with the F-statistic further showing that only positive shocks to the activity restrictions led to increases in bank credit in the short-run. Other results from Table 7 indicated that economic growth had a positive and significant impact on bank lending in the long run under panel NARDL models for low-income SSA countries, whereas inflation had a negative long-run effect on bank credit in all selected SSA economies and low-income SSA countries but under the linear ARDL models in the case of low-income SSA countries.

The finding that activity restrictions promoted bank lending in the short run in low-income SSA countries was in accordance with the asymmetric information theory. This theory contends that limits on the banking activities such as securities, insurance and real estate minimise conflict of interest and moral hazard problems and enhance prudent lending (Boyd, Chang and Smith 1998). The result was also partly similar to the finding obtained by Amidu (2014), who established that activity restrictions enhanced bank credit in the short run in SSA economies.

Table 6 Panel ARDL and NARDL CCEMG estimates (models with activity restriction index)

Variables	All selected SSA countries				Low-income SSA countries				Middle-income SSA countries			
	ARDL		NARDL		ARDL		NARDL		ARDL		NARDL	
	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$
Long-run (LR) estimates: The dependent variable is L												
R_{AR}	-6.93 (6.86)	1.57 (4.89)	-	-	0.36 (0.41)	4.58 (5.20)	-	-	-0.02 (0.30)	8.66 (8.29)	-	-
R_{AR}^{+}	-	-	31.21* (16.84)	14.12** (7.10)	-	-	0.15 (0.41)	0.18 (0.30)	-	-	-6.60 (13.65)	-6.34 (12.69)
R_{AR}^{-}	-	-	15.73** (7.69)	8.05*** (2.61)	-	-	-0.11 (0.15)	-0.11 (0.22)	-	-	21.41 (9.56)	18.22* (9.50)
$R_{AR} \times S$	-	0.36 (6.03)	-	-	-	-6.75 (6.97)	-	0.01 (0.27)	-	-5.26 (7.89)	-	2.50 (0.21)
S	2.26 (2.38)	-0.21 (4.61)	-3.01 (2.10)	-	0.08 (0.47)	2.94 (4.05)	-0.65 (0.49)	-0.65 (0.52)	-0.26 (0.23)	2.51 (5.01)	1.53 (1.30)	-
Y	-0.01 (0.06)	-0.01 (0.06)	-0.01 (0.06)	-0.01 (0.06)	-0.05 (0.09)	-0.02 (0.08)	0.13*** (0.04)	0.13*** (0.04)	0.06 (0.21)	0.06 (0.21)	0.06 (0.21)	0.06 (0.21)
π	-0.09** (0.04)	-0.09** (0.04)	-0.09** (0.04)	-0.09** (0.04)	-0.19** (0.09)	-0.17** (0.08)	-0.06 (0.05)	-0.06 (0.05)	0.02 (0.03)	0.02 (0.03)	0.02 (0.03)	0.02 (0.03)
C	-	-	-	-	-	-	-	-	0.05 (0.07)	0.05 (0.07)	0.05 (0.07)	0.05 (0.07)
Short-run (SR) estimates: The dependent variable is $\Delta(L)$												
ECT_{t-1}	-1.20*** (0.08)	-1.20*** (0.08)	-1.20*** (0.08)	-1.20*** (0.08)	0.005 (0.01)	0.00 (0.001)	-0.76*** (0.08)	-0.77*** (0.07)	-1.04*** (0.11)	-1.14*** (0.12)	-1.43*** (0.13)	-1.43*** (0.13)
$\Delta(L_{t-1})$	0.30*** (0.07)	0.30*** (0.07)	0.30*** (0.07)	0.30*** (0.07)	0.24*** (0.06)	0.23*** (0.06)	0.41*** (0.07)	0.41*** (0.06)	0.29*** (0.10)	0.28*** (0.10)	0.17* (0.09)	0.17* (0.09)
$\Delta(R_{AR})$	-6.84 (6.65)	1.80 (1.67)	-	-	0.10** (0.04)	0.31** (0.20)	-	-	0.23 (0.08)	0.37 (0.62)	-	-
$\Delta(R_{AR}^{+})$	-	-	-0.28 (0.21)	-0.50 (0.60)	-	-	0.17** (0.07)	0.31** (0.16)	-	-	-0.16 (0.40)	-0.17 (0.42)
$\Delta(R_{AR}^{-})$	-	-	-0.01 (0.02)	-0.28 (0.32)	-	-	0.04 (0.04)	0.17 (0.10)	-	-	-0.02 (0.05)	-0.22 (0.46)

Variables	All selected SSA countries				Low-income SSA countries				Middle-income SSA countries			
	ARDL		NARDL		ARDL		NARDL		ARDL		NARDL	
	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$
Short-run (SR) estimates: The dependent variable is Δ(bank credit/GDP (L))												
$\Delta(R_{AR} \times S)$	-	-0.88 (0.74)	-	0.04 (0.05)	-	-0.16 (0.15)	-	-0.18 (0.14)	-	-0.30 (0.72)	-	-0.04 (0.05)
$\Delta(S)$	2.28 (2.36)	-	-	-	-0.10** (0.04)	-0.04 (0.05)	-0.11** (0.05)	0.004 (0.11)	-0.06 (0.07)	0.10 (0.43)	-	-
$\Delta(Y)$	-0.17* (0.097)	-0.17* (0.097)	-0.17* (0.097)	-0.17* (0.097)	-0.02 (0.04)	-0.03 (0.04)	0.01 (0.03)	0.01 (0.04)	-0.07 (0.07)	-0.03 (0.08)	0.06 (0.24)	0.06 (0.24)
$\Delta(\pi)$	-0.17 (0.10)	-0.17 (0.10)	-0.17 (0.10)	-0.17 (0.10)	0.01 (0.03)	0.01 (0.03)	-0.01 (0.04)	-0.01 (0.04)	-0.03 (0.09)	-0.03 (0.08)	-0.05 (0.07)	-0.05 (0.07)
$\Delta(C)$[a]	-0.05 (0.03)	-0.04 (0.03)	-0.05 (0.03)	-0.05 (0.03)	-0.03 (0.03)	-0.03 (0.03)	-0.04 (0.03)	0.001 (0.03)	-0.14 (0.14)	-0.14 (0.15)	-0.05 (0.08)	0.10 (0.08)
Intercept	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	0.004 (0.003)	0.005 (0.003)	0.003 (0.004)	0.003 (0.004)	0.01 (0.01)	0.01 (0.01)	-0.01 (0.02)	-0.01 (0.02)
Countries	23	23	23	23	12	12	12	12	11	11	11	11
Observations	529	529	529	529	276	276	276	276	253	253	253	253
F-test (LR)	-	-	0.08	1.30	-	-	2.25	2.71	-	-	2.52	2.11
F-test (SR)	-	-	1.74	0.21	-	-	3.04*	2.10	-	-	0.11	0.01
CD test	0.29	0.29	0.29	0.29	-0.16	-0.15	0.71	0.37	1.13	0.25	-0.26	-1.31

Notes: [a]C for all selected SSA countries and low-income SSA countries; the chosen lag order for the baseline models is $ARDL(1,0,0,0,0,0)$; see the notes in Tables 1, 2 and 5.

Considering models with the capital regulation index, the long-run results and their corresponding F-statistic from Table 8 revealed that only negative shocks to capital regulations impacted negatively and significantly on bank credit in low-income SSA economies. Nonetheless, the short-run results and their corresponding F-statistic, when accounting for the interaction between capital regulations and supervisory power, indicated that only positive shocks to capital regulations had a positive and significant effect on bank credit in low-income SSA countries. Other results from Table 8 highlighted that supervisory power had a negative linear long-run impact on bank lending in low-income SSA economies, while economic growth affected bank credit positively in the long run mainly in the same group of countries. However, inflation had a negative long-run impact on bank credit in all selected SSA economies.

The result that positive shocks to capital regulation increased bank lending in the short run in low-income SSA countries was in line with the risk-absorption theory, which argues that increasing the stringency of capital regulatory requirements enhances the risk-bearing capacity of banks and encourages prudent lending (Abbas et al. 2021; Abbas, Bashir and Ali 2021). Although this effect disappeared in the long run, the obtained findings indicated that negative shocks to capital requirements had a long-run adverse impact on bank lending in low-income SSA economies, plausibly because they reduced the risk-bearing capacity of banks, thereby hampering their ability to offer loans, especially during times of crisis (Abbas and Masood 2020; Moudud-Ul-Huq et al. 2022).

Table 7 Panel ARDL and NARDL CCEMG estimates (models with capital regulation index)

Variables	All selected SSA countries				Low-income SSA countries				Middle-income SSA countries			
	ARDL		NARDL		ARDL		NARDL		ARDL		NARDL	
	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$
Long-run (LR) estimates: The dependent variable is *L*												
R_{CR}	2.46 (2.70)	-15.10 (12.52)	-	-	0.01 (0.04)	4.27 (6.76)	-	-	-0.09 (0.14)	9.21 (10.78)	-	-
R_{CR}^{+}	-	-	13.54 (18.53)	-4.05** (1.65)	-	-	0.08 (0.07)	-1.96 (2.23)	-	-	-2.97 (5.33)	-4.11 (6.58)
R_{CR}^{-}	-	-	37.57 (72.93)	144.53 (128.75)	-	-	-0.11** (0.05)	-0.23 (0.58)	-	-	206.14 (204.51)	-503.88 (505.19)
$R_{CR} \times S$	-	15.07 (9.56)	-	4.05 (3.59)	-	-1.78 (5.18)	-	2.16 (2.48)	-	-5.64 (10.83)	-	37.62 (37.62)
S	0.10 (0.23)	-0.68 (3.55)	-5.13** (1.55)	-	-0.13** (0.06)	-3.27** (1.55)	0.05 (0.10)	-1.67 (1.79)	-0.08 (0.05)	2.99 (5.27)	-13.61 (13.61)	-
Y	-0.01 (0.06)	-0.01 (0.06)	-0.01 (0.06)	-0.01 (0.06)	0.13*** (0.04)	0.13*** (0.04)	0.13*** (0.04)	0.12*** (0.04)	0.24** (0.11)	0.06 (0.23)	0.06 (0.21)	0.06 (0.21)
π	-0.09** (0.04)	-0.09** (0.04)	-0.09** (0.04)	-0.09** (0.04)	-0.01 (0.06)	-0.05 (0.05)	-0.05 (0.05)	-0.05 (0.05)	-0.02 (0.07)	0.02 (0.03)	0.02 (0.03)	0.02 (0.03)
C	-	-	-	-	-	-	-	-	-0.01 (0.05)	0.05 (0.07)	0.05 (0.07)	0.05 (0.07)
Short-run (SR) estimates: The dependent variable is $\Delta(L)$												
ECT_{t-1}	-1.20*** (0.08)	-1.20*** (0.08)	-1.20*** (0.08)	-1.28*** (0.07)	-0.70*** (0.07)	-0.77*** (0.07)	-0.75*** (0.07)	-0.79*** (0.07)	-0.97*** (0.13)	-1.43*** (0.13)	-1.43*** (0.13)	-1.43*** (0.13)
$\Delta(L_{t-1})$	0.30*** (0.07)	0.30*** (0.07)	0.30*** (0.07)	0.29*** (0.05)	0.41*** (0.06)	0.43*** (0.07)	0.42*** (0.06)	0.41*** (0.06)	0.47*** (0.10)	0.17* (0.09)	0.17* (0.09)	0.17* (0.09)
$\Delta(R_{CR})$	2.91 (3.06)	-1.51 (2.14)	-	-	0.001 (0.02)	-0.51 (0.35)	-	-	-0.07 (0.11)	0.48 (0.47)	-	-
$\Delta(R_{CR}^{+})$	-	-	1.22 (0.92)	1.78* (1.00)	-	-	0.03 (0.04)	0.25* (0.15)	-	-	-1.14 (1.97)	0.33 (0.26)
$\Delta(R_{CR}^{-})$	-	-	0.30 (0.70)	26.65 (25.29)	-	-	-0.02* (0.01)	0.14 (0.12)	-	-	0.23 (0.23)	1.34 (0.98)

Variables	All selected SSA countries				Low-income SSA countries				Middle-income SSA countries			
	ARDL		NARDL		ARDL		NARDL		ARDL		NARDL	
	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$
Short-run (SR) estimates: The dependent variable is $\Delta(\boldsymbol{L})$												
$\Delta(R_{CR} \times S)$	-	-0.91 (0.63)	-	-0.94 (0.65)	-	0.75 (0.58)	-	-0.29 (0.21)	-	-1.21 (1.17)	-	-
$\Delta(S)$	-0.001 (0.20)	0.00 (0.00)	-	-	-0.08* (0.04)	-0.52 (0.39)	-0.03 (0.03)	0.14 (0.12)	-0.05 (0.03)	-	-	-0.05 (0.05)
$\Delta(Y)$	-0.17* (0.097)	-0.17* (0.097)	-0.17* (0.097)	-0.06 (0.06)	0.02 (0.03)	0.03 (0.04)	0.02 (0.03)	0.02 (0.03)	-0.02 (0.07)	0.06 (0.24)	0.06 (0.24)	0.06 (0.24)
$\Delta(\pi)$	-0.17 (0.10)	-0.17 (0.10)	-0.17 (0.10)	-0.10 (0.06)	0.005 (0.04)	-0.01 (0.04)	-0.01 (0.03)	-0.01 (0.04)	-0.09 (0.07)	-0.05 (0.07)	-0.05 (0.07)	-0.05 (0.07)
$\Delta(C)^{a}$	-0.04 (0.03)	-0.04 (0.03)	-0.04 (0.03)	0.03 (0.04)	-0.02 (0.05)	-0.002 (0.03)	-0.004 (0.03)	-0.001 (0.03)	-0.05 (0.05)	0.10 (0.08)	0.10 (0.08)	0.10 (0.08)
Intercept	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	-0.01 (0.01)	0.002 (0.004)	0.003 (0.004)	0.003 (0.004)	0.003 (0.004)	0.01 (0.01)	-0.01 (0.02)	-0.01 (0.02)	-0.01 (0.02)
Countries	23	23	23	23	12	12	12	12	11	11	11	11
Observations	529	529	529	529	276	276	276	276	253	253	253	253
F-test (LR)	-	-	0.16	1.33	-	-	6.89***	0.63	-	-	1.05	0.98
F-test (SR)	-	-	0.63	0.97	-	-	1.22	3.56*	-	-	0.49	0.97
CD test	0.44	0.40	0.39	1.43	0.36	0.89	1.04	1.13	-0.15	-1.31	-1.31	-1.31

Notes: [a]C for all selected SSA countries and low-income SSA countries; the chosen lag order for the baseline models is $ARDL(1,0,0,0,0,0)$; see the notes in Tables 1, 2 and 5.

3.6. Robustness Check

In order to confirm the robustness of the CCEMG estimators over other MG estimators, the study tested for the presence of error cross-sectional dependence in all estimated models. This is important because MG-type estimators are likely to be biased in the presence of cross-sectional dependence, which is brought by the fact that all selected economies could be affected by a similar shock arising from any of the countries within the sample due to their interconnectedness (Holly, Pesaran, and Yamagata 2010). As indicated by the CD test results reported in Tables 5 to 7, the insignificant test statistics showed that all the estimated models were free from error cross-sectional dependence. Therefore, the employed CCEMG estimators were able to account for unobserved error dependence among cross-sectional units and yield unbiased regression coefficients. These results were robust to the choice of bank regulatory measures and in the cases of all selected SSA economies and their income groups.

4. Conclusion And Policy Implications

Although many countries in SSA have implemented bank regulatory and supervisory reforms since the 1990s, and even after the 2007-2008 global financial crises, it was still unclear whether these reforms promoted bank lending, especially in the long term. This study contributed to the empirical literature by employing the dynamic CCE method to estimate the ARDL and NARDL models in 23 SSA countries and their low- and middle-income groups over the period 1995-2017. The ARDL CCEMG estimation results indicated that even though all selected SSA economies and low-income SSA countries enjoyed the benefit of increased bank lending due to stringent entry barriers in the short run, such barriers led to a fall in bank credit in the long run. However, supervisory power mitigated the negative impact of entry barriers on bank lending despite that on its own, it also limited bank credit in the long run. Moreover, the NARDL CCEMG estimation results showed that positive shocks to entry barriers had a long-run negative effect on bank credit in all selected SSA economies and low-income SSA countries. In the context of low-income SSA countries, positive shocks to activity restrictions promoted bank credit in the short run, whereas the positive shocks to capital requirements enhanced bank lending in the short run but the negative shocks prohibited bank credit in the long run.

When it came to policy implications, the results suggested that inasmuch as adopting higher bank regulatory and supervisory standards might be recommended, introducing such reforms

could have a long-term adverse impact on bank lending. Hence, policymakers need to balance the stringency of bank regulation and supervision for the attainment of resilience and safety of the banking systems and the promotion of financing via increased bank lending, especially in the long term. Moreover, regulators should take into account the fact that positive and negative shocks to bank regulatory measures do not have a similar impact on bank lending. It will also be worth investigating in the future whether there are optimal threshold effects in the linkages between bank credit and bank regulation and/or supervision.

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Appendix

Table A1 World Bank's Bank Regulation and Supervision Surveys (BRSS) for selected SSA countries

Country name	Country code	Survey I (1999)	Survey II (2003)	Survey III (2007)	Survey IV (2011)	Survey V (2019)
Low- income countries						
1. Benin	BEN	-	✔	✔	✔	✔
2. Burkina Faso	BFA	-	✔	✔	✔	✔
3. Burundi	BDI	✔	✔	✔	✔	✔
4. Guinea-Bissau	GNB	-	✔	✔	-	✔
5. Madagascar	MDG	-	✔	-	✔	✔
6. Malawi	MWI	✔	-	✔	✔	✔
7. Mali	MLI	-	✔	✔	✔	✔
8. Niger	NER	-	✔	✔	✔	✔
9. Senegal	SEN	-	✔	✔	-	✔
10. Tanzania	TZA	-	-	✔	✔	✔
11. Togo	TGO	-	✔	✔	✔	✔
12. Uganda	UGA	-	-	✔	✔	✔
Middle- income countries						
13. Angola	AGO	-	-	✔	✔	✔
14. Botswana	BWA	✔	✔	✔	✔	✔
15. Cote d'Ivoire	CIV	-	✔	✔	✔	✔
16. Eswatini	SWZ	-	✔	-	✔	✔
17. Ghana	GHA	-	✔	✔	✔	✔
18. Kenya	KEN	✔	✔	✔	✔	✔
19. Lesotho	LSO	✔	✔	✔	✔	✔
20. Mauritius	MUS	✔	✔	✔	✔	✔
21. Namibia	NAM	✔	✔	-	✔	✔
22. Nigeria	NGA	✔	✔	✔	✔	✔
23. South Africa	ZAF	✔	✔	✔	✔	✔

Source: Thamae and Odhiambo (2022).

Notes: The parenthesis gives the year of completion of the survey; A tick (✔) shows that the data is available; A dash (-) shows that the data is unavailable, and thse previous or subsequent available survey data is used instead.

Table A2 Data sources and definitions of variables

Variables	Sources	Definitions
Bank lending variable		
Bank credit/GDP	World Bank Financial Development and Structure Dataset; Global Financial Development Database; International Monetary Fund International Financial Statistics	Credit to the private sector from banks as a ratio of GDP
Bank regulatory and supervisory indices		
Entry barrier	World Bank's Bank Regulation and Supervision Surveys	Measures the degree of restrictions on bank licensing and foreign ownership
Activity restriction	World Bank's Bank Regulation and Supervision Surveys	Measures the degree of restrictions on engagement in securities, insurance, and real estate activities by banks
Capital regulation	World Bank's Bank Regulation and Supervision Surveys	Measures the stringency of bank regulatory requirements regarding capital
Supervisory power	World Bank's Bank Regulation and Supervision Surveys	Measures the degree to which bank supervisory authorities have the power to prevent, correct and resolve problem banks
Macroeconomic variables		
Economic growth	International Monetary Fund World Economic Outlook / World Bank World Development Indicators	Log of real gross domestic product (in purchasing power parity, 2011 international dollar)
Inflation	International Monetary Fund World Economic Outlook / World Bank World Development Indicators	Log of consumer price index
Current account/GDP	International Monetary Fund World Economic Outlook / World Bank World Development Indicators	Current account balance as a ratio of GDP

Source: Thamae and Odhiambo (2022).

Table A3 Summary statistics

Variables	Observations	Mean	Standard Deviation	Minimum	Maximum
All selected SSA					
L	529	0.20	0.18	0.01	1.03
R_{EB}	529	0.56	0.08	0.38	0.75
R_{AR}	529	0.66	0.12	0.42	1.00
R_{CR}	529	0.66	0.16	0.30	1.00
S	529	0.71	0.18	0.29	1.00
Y	529	24.00	1.40	21.14	27.66
π	529	4.33	1.03	-6.91	6.06
C	529	-0.04	0.08	-0.30	0.41
Low-income SSA					
L	276	0.13	0.07	0.01	0.40
R_{EB}	276	0.58	0.07	0.38	0.69
R_{AR}	276	0.64	0.11	0.42	1.00
R_{CR}	276	0.65	0.16	0.30	1.00
S	276	0.69	0.17	0.29	1.00
Y	276	23.48	0.98	21.14	25.73
π	276	4.41	0.67	1.30	6.06
C	276	-0.07	0.05	-0.26	0.03
Middle-income SSA					
L	253	0.27	0.23	0.01	1.03
R_{EB}	253	0.54	0.08	0.44	0.75
R_{AR}	253	0.68	0.13	0.42	0.92
R_{CR}	253	0.67	0.17	0.30	1.00
S	253	0.73	0.18	0.29	1.00
Y	253	24.57	1.55	21.78	27.66
π	253	4.25	1.31	-6.91	5.83
C	253	0.00	0.08	-0.30	0.41

Notes: Bank regulatory and supervisory indices are normalised to one; see the notes in Table 1.

Table A4 Correlation matrix

Variables	L	R_{EB}	R_{AR}	R_{CR}	S	Y	π	C
All selected SSA								
L	1.00							
R_{EB}	-0.30**	1.00						
R_{AR}	-0.08	0.03	1.00					
R_{CR}	0.06	0.20**	0.13**	1.00				
S	-0.11**	0.08	0.25**	0.25**	1.00			
Y	0.25**	0.24**	-0.15**	0.16**	0.23**	1.00		
π	0.11**	0.09**	-0.30**	0.08	-0.09**	0.07	1.00	
C	0.04	-0.07	0.05	0.03	-0.01	0.20**	-0.02	1.00
Low-income SSA								
L	1.00							
R_{EB}	0.12**	1.00						
R_{AR}	-0.30**	0.20**	1.00					
R_{CR}	-0.35**	0.00	0.26**	1.00				
S	-0.42**	0.32**	0.42**	0.46**	1.00			
Y	0.23**	0.45**	0.08	-0.05	0.43**	1.00		
π	0.30**	0.19**	-0.50**	-0.10	0.08	0.44**	1.00	
C	-0.12	-0.08	0.11	-0.09	-0.12	-0.05	-0.10	1.00
Middle-income SSA								
L	1.00							
R_{EB}	-0.34**	1.00						
R_{AR}	-0.15**	-0.01	1.00					
R_{CR}	0.16**	0.42**	0.00	1.00				
S	-0.11	-0.06	0.08	0.03	1.00			
Y	0.09	0.36**	-0.42**	0.26**	0.05	1.00		
π	0.14**	0.02	-0.20**	0.19**	-0.18**	0.00	1.00	
C	-0.20**	0.12	-0.12	0.04	-0.04	0.05	0.06	1.00

*Notes: ** denotes 5% statistical significance or better; see the notes in Table 1.*