

When Does Financial Regulation Deepen Finance? Macroeconomic Moderation in East African Community Countries

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Abstract

This study determines whether inflation, lending interest rates and exchange-rate conditions moderate the relationship between financial regulation and financial development in East African Community countries. A balanced panel of 120 country-year observations for Burundi, the Democratic Republic of the Congo, Kenya, Rwanda, Tanzania and Uganda over 2005-2024 was analysed. Financial development was measured as domestic credit to the private sector relative to gross domestic product, and financial regulation by a composite index. Diagnostic-led country fixed-effects models used panel-corrected standard errors and a common AR(1) disturbance. The moderated model was significant (Wald chi-square(12) = 19,210.35, $p < .001$; R-squared = .9640). Inflation strengthened the regulation slope ($b = 0.35192$, $p = .019$), lending rates weakened it ($b = -1.36222$, $p = .024$), and the logged exchange rate strengthened it ($b = 0.05932$, $p < .001$). Conditional effects show regulation was positively associated with financial depth at low and median lending rates but not high rates; it was significant at median and high exchange-rate values. Inflation changed the slope, although selected conditional effects were not significant at 5%. Regulatory effectiveness is state dependent. EAC authorities should combine common safeguards with country-sensitive calibration, reduce avoidable lending costs, and strengthen liquidity and foreign-exchange risk oversight.

JEL classification numbers: E31, E43, F31, G18, O16.

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1. Introduction

Financial development enables savings mobilisation, risk sharing and the allocation of capital to productive private activity. In bank-centred developing economies, domestic credit to the private sector is a particularly important channel because it finances working capital and investment. Yet financial development is multidimensional, and a larger private-credit ratio is not automatically welfare enhancing when lending is poorly screened or concentrated in low-productivity uses. This paper therefore interprets private credit relative to gross domestic product as a measure of financial depth rather than an exhaustive measure of financial development (Svirydzenka, 2016).

Financial regulation can improve intermediation by strengthening disclosure, depositor confidence, governance, liquidity management and risk discipline. It can also restrict finance when reserve, pricing or compliance requirements immobilise lendable resources, raise costs or encourage non-price rationing. Evidence from Sub-Saharan Africa consequently indicates instrument-specific and nonlinear regulatory effects rather than a uniformly positive relationship (Aliamutu and Msomi, 2024; Thamae and Odhiambo, 2024). The relevant question is not simply whether regulation is tighter, but whether a development-supportive regulatory configuration translates into sustainable private credit under the prevailing economic conditions.

The East African Community (EAC) provides a revealing setting. Member states share regional integration objectives but retain different monetary regimes, financial depth, supervisory capacity, lending costs and exposure to external shocks. Recent evidence identifies high lending rates as a constraint on East African financial-sector development and shows that institutional quality changes the benefits associated with finance (Damasa, 2026; Xu and Wubishet, 2024). Common regional goals therefore need not produce common regulatory transmission.

Macroeconomic conditions are plausible boundary conditions. Inflation changes real returns, contracting horizons and monetary-policy responses. Lending rates determine whether viable borrowers can afford formal credit and affect adverse selection and default risk. Exchange-rate movements alter imported costs, foreign-currency liabilities, liquidity needs and balance sheets. African threshold evidence confirms that inflation can change the contribution of finance to economic performance (Ibrahim et al., 2022). A model that estimates one average regulatory coefficient can therefore conceal economically important state dependence.

This study addresses that gap by testing whether inflation, the lending interest rate and the logged official exchange rate each change the relationship between a composite Financial Regulation Index (FRI) and private-credit depth in six EAC countries over 2005-2024. Its contribution is threefold. First, it estimates the three moderators within one hierarchical panel framework. Second, it combines formal interaction tests with conditional marginal effects at observed percentiles, identifying where the regulatory slope is statistically distinguishable from zero. Third, it converts the findings into a coordination principle: regional safeguards

should be common, but calibration should remain sensitive to national borrowing-cost and external-price conditions. The paper proceeds through theory and hypotheses, methodology, results, discussion, and policy implications.

The paper makes three related contributions. First, it separates the direct macroeconomic effects from the interaction effects that determine whether regulation changes private-credit depth under different states. This distinction is important because a significant inflation, lending-rate or exchange-rate coefficient does not itself demonstrate moderation. Second, the study evaluates the conditional regulatory slope at observed quartiles rather than interpreting interaction coefficients in isolation. The marginal effects therefore show where regulation is associated with deeper finance and where that relationship becomes statistically indistinguishable from zero. Third, the analysis brings a common specification to six EAC economies over a twenty-year period. This regional focus responds to evidence that East African financial development remains uneven and that institutional quality affects the finance-growth relationship (Damasa, 2026; Xu and Wubishet, 2024). It also provides a basis for evaluating whether shared integration objectives translate into comparable regulatory transmission.

The analysis is deliberately bounded. Financial development is represented by domestic credit to the private sector as a share of GDP, so the results concern the depth of formal private intermediation rather than every dimension of access, efficiency or stability. The composite regulation index captures reserve, credit-allocation and intermediation-price conditions; it is not a complete measure of supervisory quality. Moreover, the estimated associations do not establish that changing a single regulation will mechanically produce the reported marginal effect. They reveal how the observed regulation-development relationship varies with macroeconomic conditions after country fixed effects and serially correlated panel errors are addressed. These boundaries sharpen the policy question: under what observed macro-financial conditions is a more supportive regulatory configuration associated with deeper private credit in the EAC?

2. Literature Review and Hypotheses

2.1 Theoretical foundation

Financial Intermediation Theory provides the primary mechanism. Intermediaries connect savers and borrowers, reduce transaction and information costs, evaluate risk, transform maturities and allocate funds. Regulation affects these functions through liquidity rules, allocation requirements, pricing conditions, disclosure and supervision (Konstantakopoulou, 2023). Credible and proportionate arrangements may stabilise funding and improve screening; poorly calibrated requirements may raise spreads, reduce lendable resources or encourage portfolio shifts away from private borrowers.

The theory also explains why the regulatory effect is conditional. Inflation changes the real value of deposits and repayments; lending rates affect affordability and borrower composition; and exchange-rate pressure affects funding costs, foreign-

currency exposures and collateral values. The same regulatory framework can therefore support intermediation under one macroeconomic state yet have a weak association under another.

Financial Accelerator Theory supplies the complementary shock-amplification mechanism. Macroeconomic disturbances affect borrower net worth, collateral, external-finance premia and bank balance sheets; tighter credit then feeds back into investment and cash flow. Financial frictions can consequently transform moderate shocks into large movements in lending and activity (De Groot, 2021). Monetary and macroprudential policies interact through collateral constraints, bank capital and credit spreads rather than acting as independent levers (Rubio, 2020; Tayler and Zilberman, 2016). Regulation may dampen this amplification through liquidity discipline and timely loss recognition, but high borrowing costs may overpower those safeguards.

The two theories operate at different but complementary levels. Financial Intermediation Theory explains the institutional production of credit: deposit mobilisation, screening, monitoring, liquidity creation and maturity transformation. Svirydenka (2016) similarly treats financial depth as one component of a broader financial-development system, while Konstantakopoulou (2023) shows that intermediation and the business cycle are mutually connected. Regulation can improve that production process by reducing information asymmetry and excessive risk, yet reserve burdens and compliance costs may tie up lendable resources. Financial Accelerator Theory then explains why the response is magnified when macroeconomic shocks alter collateral, net worth and external-finance premia. De Groot (2021) demonstrates how leverage and liquidity frictions can turn coordination failures into larger real contractions. Regulation therefore affects the credit-production mechanism, whereas the accelerator describes the feedback that makes its effect stronger or weaker across macroeconomic states.

This synthesis generates precise expectations for the moderators. Inflation reduces the informational content of nominal prices and may shorten loan maturities, but effective disclosure, provisioning and liquidity oversight can become more valuable when price uncertainty is elevated. The interaction sign is consequently an empirical question: inflation may overwhelm regulation, or regulation may buffer the disruption. Lending rates have a clearer affordability channel. By raising debt-service costs and the external-finance premium, high rates should weaken the translation of regulatory quality into loan demand and credit supply. Rubio (2020) and Tayler and Zilberman (2016) show theoretically that monetary and macroprudential policies jointly determine collateral constraints and credit spreads. Exchange-rate movements affect foreign-currency mismatches, imported costs and bank liquidity; credible exposure and classification rules may therefore matter more when those risks intensify. These mechanisms justify separate interactions rather than a single composite stability term.

The framework also clarifies how the coefficients must be interpreted. Once centred interactions are included, the coefficient on FRI is the regulation slope when inflation, lending rates and the logged exchange rate equal their sample means. It is

not an unconditional average effect. The slope at any other macroeconomic state equals the lower-order FRI coefficient plus the relevant interaction coefficients multiplied by the centred moderator values. A statistically significant interaction may coexist with individually insignificant slopes at selected points, because the interaction tests whether slopes differ while a margin tests whether one particular slope differs from zero. This distinction is especially important for the inflation result. It prevents the theoretical claim from becoming stronger than the evidence and ensures that the hypotheses concern variation in the regulatory effect rather than the desirability of inflation, high interest rates or currency depreciation.

2.2 Empirical evidence and hypotheses

Empirical evidence on regulation and lending is mixed. Supportive supervisory conditions can expand bank credit, whereas restrictive pricing rules can contract it (Aliamutu and Msomi, 2024). Regulatory stringency also displays nonlinear associations with bank lending across Sub-Saharan African countries (Thamae and Odhiambo, 2024). These results reject the assumption that every regulatory instrument has the same effect and motivate explicit tests of the environment in which regulation operates.

Inflation typically damages financial performance after relevant thresholds by eroding real returns, increasing uncertainty and shortening contracting horizons (Ibrahim et al., 2022). It may nonetheless increase the marginal importance of credible supervision if liquidity, provisioning and disclosure rules prevent an abrupt withdrawal of credit. The sign of the regulation-inflation interaction is therefore an empirical matter. H01a states that inflation does not significantly moderate the relationship between financial regulation and financial development.

The lending rate is a more direct credit-pricing mechanism. Higher rates reduce loan-portfolio size and quality across Sub-Saharan Africa and can weaken otherwise favourable financial-development conditions (Danquah and Osei Adu, 2025). They suppress demand, increase debt-service risk and may cause safer borrowers to exit, leaving a riskier applicant pool. H01b states that the lending interest rate does not significantly moderate the regulation-development relationship.

Exchange-rate conditions affect banks through portfolio constraints and affect borrowers through imported costs and currency mismatches. Evidence shows that binding financial regulations interact with bank foreign-exchange positions (Perez-Reyna and Villamizar-Villegas, 2019), while exchange-rate volatility reduces private-sector credit in Sub-Saharan Africa (Wajebo and Geda, 2026). Regional monetary shocks also propagate asymmetrically across EAC economies (Bilgili et al., 2026). Regulation may become more valuable as currency risk rises, but severe depreciation can also weaken borrowers and bank capital. H01c states that the logged official exchange rate does not significantly moderate the regulation-development relationship.

Evidence on the regulation-finance relationship supports this conditional approach. Aliamutu and Msomi (2024) find that regulatory arrangements can support lending

in emerging Sub-Saharan African economies, but restrictive interest-rate regulation can reduce it. Thamae and Odhiambo (2024) report nonlinear effects of regulatory stringency, showing that entry restrictions and capital requirements do not operate uniformly across regimes. These studies caution against treating tighter rules as automatically developmental. Regulation can preserve confidence, improve screening and limit destabilising risk, yet the same rules can increase compliance costs, immobilise liquidity or induce banks to substitute away from private lending. Because bank-level lending outcomes and country-level private-credit depth are not identical, the present study extends rather than duplicates this evidence by examining the aggregate credit-to-GDP outcome within a common EAC panel.

The regional evidence also indicates that macroeconomic context cannot be treated as a nuisance control. Damasa (2026) documents substantial differences in the trajectory and determinants of financial-sector development across East Africa. Xu and Wubishet (2024) show that institutional quality changes how financial development translates into economic performance, reinforcing the broader proposition that financial mechanisms are context dependent. Bilgili, Garang, Kassouri and Kuskaya (2026) find asymmetric monetary transmission within the EAC, implying that a common regional ambition does not eliminate national differences in prices, interest rates or exchange-rate adjustment. The present hypotheses therefore focus on shared moderating mechanisms while country fixed effects absorb persistent structural heterogeneity.

For inflation, Ibrahim et al. (2022) show that the finance-growth relationship in Sub-Saharan Africa is sensitive to the inflation environment. Their evidence implies that nominal instability can erode the benefits produced by a deeper financial system. The unanswered question is whether inflation also changes the marginal association between regulation and private credit. Regulation may lose effectiveness if volatile prices overwhelm contracts and liquidity planning; alternatively, credible supervision may preserve confidence and become more consequential during inflationary stress. These competing mechanisms motivate a two-sided moderation test rather than assuming a negative interaction a priori.

For lending rates, Danquah and Osei Adu (2025) provide direct Sub-Saharan African evidence that elevated rates reduce the size and quality of loan portfolios. The result aligns with the external-finance-premium mechanism in Financial Accelerator Theory: expensive loans reduce viable demand, worsen adverse selection and increase expected default. For exchange rates, Perez-Reyna and Villamizar-Villegas (2019) show that financial regulation and banks' foreign-exchange positions are jointly relevant to currency responses, and Wajebo and Geda (2026) report that exchange volatility constrains private-sector credit in Sub-Saharan Africa. Together, these studies suggest that lending costs and external-price conditions alter the environment in which prudential and allocative rules are transmitted to credit.

3. Methodology

3.1 Research design, sample and data

The study used a positivist, explanatory and longitudinal panel design (Baltagi, 2021). Annual secondary data were assembled for Burundi, the Democratic Republic of the Congo, Kenya, Rwanda, Tanzania and Uganda from 2005 to 2024. Each country contributed 20 observations, yielding a balanced panel of 120 country-years. Somalia and South Sudan were excluded because comparable series for the full period were materially incomplete. Inference is therefore confined to the six-country analytical panel.

Comparable macro-financial series were drawn principally from World Development Indicators, International Financial Statistics and national central-bank publications (World Bank, 2026). A source register recorded the country, year, definition, original unit, source and transformation for every observation. Records were checked for uniqueness, completeness, plausible ranges and consistent units. No unsupported interpolation or model-based imputation was used in the principal panel.

3.2 Variables and measurement

Financial development (FD) was domestic credit to the private sector relative to GDP. Financial regulation was represented by an FRI combining the cash reserve ratio (CRR), credit-allocation ratio (CAR) and reverse-coded interest-rate spread (IRS). Positively directed components were pooled min-max normalised and weighted 0.40, 0.30 and 0.30, respectively. This theory- and design-based weighting gives CRR a moderately higher weight because it is the most direct system-wide liquidity constraint on banks' lendable resources; CAR and reverse-coded IRS receive equal secondary weights because they capture complementary allocative and pricing dimensions. The scheme retains all three regulatory dimensions without allowing any single component to dominate and is not presented as a statistically estimated or universally optimal weighting. The index measures a more development-supportive observed configuration; it is not a universal scale of regulatory stringency. Inflation and lending rates were stored as decimal ratios. The official exchange rate, expressed as local-currency units per United States dollar, was logged for regression analysis.

Table 1: Operational definition and measurement of variables

Variable	Code	Measurement	Primary source	Analytical role
Financial development	FD	Domestic credit to private sector relative to GDP	WDI; IMF IFS	Outcome
Financial regulation	FRI	0-1 weighted index of CRR, CAR and reverse-coded IRS	Central banks; WDI/IFS	Predictor
Inflation	INF	Annual CPI change, stored as a ratio	WDI; IMF IFS	Moderator
Lending interest rate	LIR	Annual nominal lending rate, stored as a ratio	WDI; IMF IFS	Moderator
Official exchange rate	LEXR	Natural log of local-currency units per US dollar	WDI; IMF IFS	Moderator

Note. WDI = World Development Indicators; IFS = International Financial Statistics.

The descriptive table uses a country-specific exchange-rate ratio (2005 = 1); the regression models use the logged official rate.

3.3 Model specification and estimation

Analysis was conducted in Stata 17. FRI and the moderators were mean-centred before interactions were formed. Centring does not create or eliminate an interaction; it makes the lower-order FRI coefficient interpretable at the moderators' sample means (Shieh, 2011). The hierarchical equations were:

$$\text{Model A: } FD_it = \alpha_i + \beta_1 cFRI_it + \epsilon_it$$

$$\text{Model B: } FD_it = \alpha_i + \beta_1 cFRI_it + \beta_2 cINF_it + \beta_3 cLIR_it + \beta_4 cLEXR_it + \epsilon_it$$

$$\text{Model C: } \text{Model B} + \beta_5(cFRI \times cINF)_it + \beta_6(cFRI \times cLIR)_it + \beta_7(cFRI \times cLEXR)_it$$

The interaction coefficients β_5 , β_6 and β_7 supplied the formal moderation tests. Individual Wald tests evaluated each interaction, and a joint Wald test evaluated their simultaneous null. Conditional marginal effects of FRI were then estimated at the 25th, 50th and 75th percentiles of each centred moderator while the other two moderators were held at their sample means.

Diagnostics supported country fixed effects and detected groupwise heteroskedasticity and first-order residual persistence. The principal equations therefore used country fixed effects, panel-corrected standard errors and a common AR(1) disturbance (Beck and Katz, 1995). This choice is suitable for time-series cross-sectional data with $T = 20$ and $N = 6$. Moderate overlap between FRI and lending rates was retained on theoretical grounds and addressed by reporting uncertainty and conditional effects. Panel cointegration supported cautious interpretation of persistent level associations, while weaker first-differenced estimates counsel against claims of immediate annual causation.

Estimation proceeded hierarchically to preserve interpretability. Model A established the bivariate within-country FRI association; Model B added the three centred macroeconomic conditions; and Model C introduced all interactions simultaneously. Entering the interactions together reduces the risk of attributing to one moderator a pattern that is actually associated with another. The Wald statistics test coefficient restrictions under the same FE-PCSE covariance structure, while the margins translate the interaction equation into substantively interpretable slopes. Consistent with Shieh (2011), centring was used for interpretation and not presented as a remedy that eliminates structural multicollinearity. The principal inferential threshold was 5%; a 10% result is described only as marginal evidence.

Several safeguards were used to avoid mechanical claims from a small regional panel. The common AR(1) correction addresses average temporal persistence, and the panel-corrected covariance matrix accommodates contemporaneous panel dependence and heteroskedasticity in the manner advocated for time-series cross-section data by Beck and Katz (1995). Country effects control for time-invariant legal origins, geography and persistent institutional differences. Nevertheless, these procedures do not solve all endogeneity. Regulation may respond to financial depth, and unobserved time-varying reforms or shocks may affect both. Accordingly, coefficients are interpreted as conditional within-panel associations. Statistical significance is combined with sign, confidence interval, model fit and marginal-effect patterns rather than used as a stand-alone criterion.

4. Results

4.1 Descriptive and diagnostic results

Table 2: Descriptive statistics for the moderation variables

Variable	N	Mean	SD	Minimum	Maximum
Financial development	120	0.15935	0.07596	0.04055	0.29009
Financial Regulation Index	120	0.55071	0.19374	0.04257	0.79470
Inflation rate	120	0.08850	0.04808	0.04326	0.28498
Lending interest rate	120	0.17795	0.02906	0.13461	0.26824
Exchange-rate ratio, 2005 = 1	120	1.79996	0.90555	1.00000	6.41402

Note. FD, inflation and lending rates are ratios; 0.15935 equals 15.935%. The exchange-rate ratio is included for descriptive comparability only.

Private-sector credit averaged 15.94% of GDP and ranged from 4.06% to 29.01%. Inflation averaged 8.85% and reached 28.50%, while lending rates averaged 17.80% and reached 26.82%. The exchange-rate ratio rose to more than six times its country-specific 2005 base. The panel therefore contains substantively different price, borrowing-cost and currency conditions. Country-effects and Hausman tests supported fixed effects; heteroskedasticity and serial correlation required corrected inference. These diagnostics justify the FE-PCSE AR(1) specification while limiting interpretation to adjusted associations in the observed panel.

4.2 Hierarchical moderated regression

Table 3: Hierarchical moderated regression estimates

Model	Predictor	b	SE	z	p	R-squared
A	Centred FRI	0.08878	0.03007	2.95	.003	.91494
B	Centred FRI	0.04556	0.01595	2.86	.004	.94796
B	Centred inflation	0.04403	0.02592	1.70	.089	.94796
B	Centred lending interest rate	-0.09681	0.11360	-0.85	.394	.94796
B	Centred logged exchange rate	0.04056	0.00435	9.33	< .001	.94796
C	Centred FRI	0.02905	0.01793	1.62	.105	.9640
C	Centred inflation	0.05077	0.02987	1.70	.089	.9640
C	Centred lending interest rate	-0.13155	0.13615	-0.97	.334	.9640
C	Centred logged exchange rate	0.04920	0.00390	12.62	< .001	.9640
C	FRI x inflation	0.35192	0.15031	2.34	.019	.9640
C	FRI x lending rate	-1.36222	0.60330	-2.26	.024	.9640
C	FRI x logged exchange rate	0.05932	0.00792	7.49	< .001	.9640

Note. N = 120; six countries. Prais-Winsten FE-PCSE estimates with a common AR(1) disturbance and country fixed effects. For Model C, Wald chi-square(12) = 19,210.35, $p < .001$; $\rho = .5745$. Country coefficients are omitted.

Model A shows a positive baseline association between FRI and private-credit depth ($b = 0.08878$, $p = .003$). After the additive macroeconomic terms entered in Model B, FRI remained positive and significant ($b = 0.04556$, $p = .004$) and R-squared increased from .91494 to .94796. Inflation was positive but marginal at 10%, the lending-rate main effect was negative and insignificant, and the logged exchange-rate main effect was positive and significant. These lower-order terms are not moderation tests.

Model C explains 96.4% of in-sample variation and is jointly significant. At the moderators' sample means, FRI was positive but not significant ($b = 0.02905$, $p = .105$). The decisive evidence is in the interactions: FRI x inflation was positive ($b = 0.35192$, $p = .019$), FRI x lending rate was negative ($b = -1.36222$, $p = .024$), and FRI x logged exchange rate was positive ($b = 0.05932$, $p < .001$). The signs show how the FRI slope changes; conditional effects are needed to establish where that slope differs from zero.

Table 4: Wald tests of the moderating effects

Tested restriction	Chi-square	df	p	Decision
FRI x inflation	5.48	1	.0192	Reject H01a
FRI x lending interest rate	5.10	1	.0239	Reject H01b
FRI x logged exchange rate	56.06	1	< .001	Reject H01c
Joint test of three interactions	60.54	3	< .001	Joint moderation confirmed

Note. Each individual null states that the relevant interaction coefficient equals zero; the joint test evaluates all three interactions simultaneously.

The individual Wald tests reject H01a, H01b and H01c, and the joint test confirms that the macroeconomic conditions collectively alter the regulation-development relationship. These decisions are based on the interaction terms, not on the significance of macroeconomic main effects.

4.3 Conditional marginal effects

Table 5: Conditional marginal effects of financial regulation

Moderator	Pct.	Centred value	dy/dx	SE	p	95% CI
Inflation	25 th	-0.02945	0.01868	0.01723	.278	[-0.01509, 0.05246]
Inflation	50 th	-0.01854	0.02252	0.01736	.195	[-0.01151, 0.05655]
Inflation	75 th	0.01061	0.03278	0.01843	.075	[-0.00334, 0.06891]
Lending rate	25 th	-0.02002	0.05632	0.02465	.022	[0.00801, 0.10464]
Lending rate	50 th	-0.01030	0.04307	0.02079	.038	[0.00233, 0.08382]
Lending rate	75 th	0.01416	0.00975	0.01718	.570	[-0.02391, 0.04342]
Logged exchange rate	25 th	-0.33484	0.00918	0.01835	.617	[-0.02679, 0.04515]
Logged exchange rate	50 th	0.30339	0.04705	0.01788	.008	[0.01201, 0.08208]
Logged exchange rate	75 th	0.77831	0.07522	0.01844	< .001	[0.03909, 0.11135]

Note. dy/dx is the conditional marginal effect of FRI. The varied moderator is shown in centred units; the other two centred moderators are held at zero. The 75th-percentile inflation slope is marginal at 10%, not significant at 5%.

Inflation significantly changed the FRI slope, which increased from 0.01868 at the 25th percentile to 0.03278 at the 75th percentile. However, all three 95% confidence intervals included zero; the upper-percentile estimate was only marginal at 10% ($p = .075$). H01a is rejected because the interaction is significant, not because regulation is proven to deepen finance at every evaluated inflation level.

For lending rates, the FRI slope was positive and significant at the 25th percentile ($dy/dx = 0.05632$, $p = .022$) and median ($dy/dx = 0.04307$, $p = .038$), but declined to 0.00975 and became insignificant at the 75th percentile ($p = .570$). High borrowing costs therefore weakened and ultimately neutralised the positive regulation-development association.

For the logged exchange rate, the FRI slope was insignificant at the 25th percentile, positive and significant at the median ($dy/dx = 0.04705$, $p = .008$), and larger at the 75th percentile ($dy/dx = 0.07522$, $p < .001$). Because higher local-currency units per US dollar generally indicate depreciation, regulation appears more consequential under higher exchange-rate pressure. The finding does not imply that depreciation is desirable.

The full pattern also distinguishes statistical moderation from a direct macroeconomic effect. Each interaction passed its individual Wald test and the three interactions were jointly significant, so the evidence supports slope variation even where a moderator's additive coefficient is not the central result. The lower-order FRI estimate in Model C is likewise not a test of whether regulation matters at every observed state; it is the slope at the joint mean of the centred moderators. Comparing it directly with the Model A coefficient without recognising the changed conditioning set would be misleading. The conditional margins show the economically relevant pattern: gradual strengthening across inflation quartiles, erosion across lending-rate quartiles and strengthening across exchange-rate quartiles.

The results are robust in an interpretive rather than experimental sense. The signs of the interactions accord with the hypothesised channels, the individual and joint Wald tests agree, and the margins reveal coherent monotonic changes across quartiles. At the same time, the inflation margins demonstrate why coefficient significance must not be overstated: the interaction is significant, but no selected inflation-specific slope reaches the 5% level. Conversely, the lending-rate and exchange-rate margins identify ranges in which the FRI slope is distinguishable from zero. These results support conditional inference within the observed data and specification; they do not establish policy treatment effects or validate extrapolation beyond the sample range.

5. Discussion

5.1 Inflation as a conditioning environment

The positive inflation interaction establishes state dependence, but the marginal effects prevent overstatement. Inflation-threshold research in Sub-Saharan Africa finds that high inflation compromises the finance-growth relationship (Ibrahim et al., 2022), and broader evidence identifies macroeconomic stability as a necessary condition for finance to support growth (Ehigiamusoe and Samsurijan, 2021). The present estimand is different: it asks whether inflation changes the regulation-private-credit slope. A difficult inflation environment may increase the importance of liquidity discipline, provisioning, disclosure and supervisory engagement

without making inflation beneficial.

A regulatory-buffering mechanism is plausible. Inflation erodes real deposits, complicates nominal contracting and may trigger monetary tightening. Credible oversight can preserve confidence and reduce disorderly credit contraction. Policy endogeneity is an alternative explanation because authorities may intensify supervision or alter reserve and allocation rules in response to inflation. Annual inflation also conceals volatility and expectations. The evidence therefore supports inflation as a moderator while retaining price stability as the objective.

This interpretation is consistent with Ibrahim et al. (2022), who find that inflation changes the contribution of finance to growth in Sub-Saharan Africa, and with Ehigiamusoe and Samsurijan (2021), who emphasise macroeconomic stability as a boundary condition. The present result adds a different margin: it shows that inflation changes the estimated regulation-private-credit slope itself. Financial Intermediation Theory suggests that supervision may protect deposit confidence, underwriting discipline and liquidity planning when nominal uncertainty is high (Konstantakopoulou, 2023). Financial Accelerator Theory adds that early recognition of deterioration can limit feedback from weaker real cash flows to collateral, risk premia and credit supply (De Groot, 2021). The positive interaction is compatible with this buffering account, although it cannot identify which regulatory component provides the buffer.

The non-significant quartile-specific slopes impose an important qualification. The evidence does not show that regulation reliably expands credit at each selected inflation state, and it certainly does not imply that authorities should tolerate inflation to make regulation effective. Instead, the significant difference in slopes indicates that the regulatory association changes as inflation changes. This nuance helps reconcile the result with the adverse threshold evidence reviewed by Ibrahim et al. (2022). Inflation may directly damage the financial environment even as the marginal value of orderly supervision increases. Policy should therefore pursue price stability and regulatory resilience simultaneously rather than treating them as substitutes.

5.2 Lending rates as the binding constraint

The lending-rate margins identify the clearest boundary. Regulation was positively associated with private-credit depth when rates were low or moderate, but the association disappeared at the upper percentile. This pattern agrees with African evidence that high lending rates reduce loan-portfolio size and quality (Danquah and Osei Adu, 2025) and East African evidence that lending rates constrain financial-sector development (Damasa, 2026).

The mechanism operates through both demand and supply. Higher rates make marginal investments unviable, increase debt-service burdens and encourage safer borrowers to exit. Banks face a riskier applicant pool and may ration credit or shift towards government securities. A stable and compliant banking system can therefore fail to deliver development-enhancing finance when viable firms cannot

afford loans. The result favours reducing avoidable intermediation costs through competition, credit information, collateral enforcement, digital delivery and stable funding rather than relying primarily on rigid rate ceilings.

Danquah and Osei Adu (2025) provide the closest empirical parallel: across Sub-Saharan Africa, elevated lending rates weaken loan-portfolio size and quality. The present margins locate that constraint inside the regulation-development relationship. At low and median rates, FRI retains a positive and statistically significant association with private-credit depth; at the upper quartile, that relationship is nearly extinguished. Rubio (2020) and Tayler and Zilberman (2016) explain why. Monetary tightening, bank funding costs, capital regulation and borrower collateral jointly determine spreads and credit quantities. A regulatory configuration that supports sound intermediation cannot offset an external-finance premium that excludes viable borrowers or makes repayment risk unacceptable.

The result also sharpens the interpretation of interest-rate regulation. A mechanically low administered rate can discourage loan supply or generate non-price rationing, as the heterogeneous regulation evidence in Aliamutu and Msomi (2024) suggests. The policy implication is not simply to cap lending rates. It is to reduce structural components of spreads through credit information, enforceable collateral, payment efficiency, competition, stable funding and proportionate compliance. Oyadeyi (2026) shows that financial development and inclusion are intertwined with monetary transmission in Africa; therefore, high rates can both reflect and reinforce a weak transmission environment. The negative interaction identifies lending cost as the strongest observed obstruction to translating regulation into deeper finance.

5.3 Exchange-rate pressure and regulatory buffering

The exchange-rate result also requires an evidence-bounded interpretation. Depreciation can raise imported input costs and the local-currency value of unhedged liabilities, weakening repayment capacity. During such pressure, exposure limits, liquidity rules, provisioning and close supervision may prevent an abrupt credit withdrawal. Binding bank regulations are known to interact with foreign-exchange portfolios (Perez-Reyna and Villamizar-Villegas, 2019), while exchange-rate volatility restricts private-sector credit in Sub-Saharan Africa (Wajebo and Geda, 2026).

The insignificant FRI slope at the lower percentile and significant slopes at the median and upper percentiles suggest that regulatory discipline becomes more consequential as external-price and balance-sheet pressure rises. This is not an endorsement of depreciation. The official exchange rate does not measure volatility, misalignment, dollarisation or borrower currency mismatches, and the pooled EAC coefficient can conceal national differences. The implication is stronger foreign-exchange risk management and country-sensitive supervision.

Perez-Reyna and Villamizar-Villegas (2019) show that the effects of financial regulation are connected to banks' foreign-exchange positions, while Wajebo and

Geda (2026) find that exchange volatility restricts private credit in Sub-Saharan Africa. The present evidence complements those studies by estimating how exchange-rate conditions change the regulation slope. Financial Accelerator Theory provides a plausible chain: depreciation or volatility weakens firms with imported inputs or unhedged foreign liabilities, deteriorating net worth and collateral; banks then tighten screening and credit limits. Prudential rules governing currency mismatch, liquidity and asset classification may become more consequential as that feedback intensifies (De Groot, 2021; Tayler and Zilberman, 2016).

Yet the variable is the logged official bilateral rate, not a direct volatility or misalignment measure. A higher value usually denotes domestic-currency depreciation against the United States dollar, but cross-country units and regime differences make a welfare interpretation inappropriate. The positive interaction therefore says that the estimated FRI slope is larger at higher observed values; it does not show that depreciation deepens finance. Bilgili et al. (2026) document asymmetric monetary and exchange-rate transmission across EAC economies, reinforcing the need for country-sensitive surveillance. Authorities should strengthen foreign-currency exposure monitoring and borrower stress tests while continuing to pursue orderly exchange conditions.

5.4 Integrated contribution

Taken together, the interactions refine Financial Intermediation Theory by showing that regulation affects liquidity, information, risk and allocation within a macroeconomic price system. High lending rates obstruct transmission; inflation and exchange-rate pressure can make safeguards more consequential. Financial Accelerator Theory adds the feedback mechanism: macroeconomic shocks change net worth and risk premia, which alter lending and then reinforce the initial shock. Regulation can buffer this process, but only within limits.

The findings also clarify the non-significant lower-order FRI coefficient in Model C. That coefficient is the estimated regulation effect only when all centred moderators are at their sample means. It does not make regulation irrelevant. The percentile-specific effects identify where the slope is positive and significant and where it is statistically indistinguishable from zero. Combining interaction tests with margins is the paper's main methodological contribution because it prevents interaction signs from becoming unsupported general claims.

For the EAC, harmonisation should mean shared minimum safeguards, comparable information and coordinated responses rather than identical instrument settings. Monetary shocks propagate asymmetrically in the region (Bilgili et al., 2026), and financial structure affects monetary transmission in Africa (Oyadeyi, 2026). State-contingent regulatory assessment is therefore more defensible than a fixed rule presumed to deepen finance everywhere.

The integrated evidence contributes to Financial Intermediation Theory by replacing a constant regulatory-production function with a state-contingent one. Regulation influences the capacity to mobilise deposits, screen borrowers and

allocate credit, but the conversion of those institutional gains into private lending depends on nominal stability, the price of credit and external-balance-sheet pressure. Konstantakopoulou (2023) links intermediation to cyclical conditions, while Svirydzhenka (2016) cautions that financial development is multidimensional. By focusing on private-credit depth, this paper identifies one specific transmission outcome and shows why it cannot be inferred from regulatory strength alone.

The contribution to Financial Accelerator Theory is equally specific. The negative lending-rate interaction shows a state in which the external-finance premium dominates the supportive regulatory channel. The positive exchange-rate interaction is consistent with regulation becoming more consequential when balance-sheet risk is elevated, while the inflation interaction suggests a similar but statistically less settled buffering pattern. De Groot (2021), Rubio (2020) and Tayler and Zilberman (2016) all emphasise feedback among balance sheets, credit spreads and policy constraints. The EAC results bring those mechanisms to a regional panel and demonstrate that interaction significance must be read together with conditional slopes.

Empirically, the paper connects literatures that are usually separate. Regulation studies document positive, negative and nonlinear lending effects (Aliamutu and Msomi, 2024; Thamae and Odhiambo, 2024); macro-financial studies show that inflation, lending rates and exchange volatility condition finance or credit (Ibrahim et al., 2022; Danquah and Osei Adu, 2025; Wajebo and Geda, 2026; Ehigiamusoe and Samsurijan, 2021); and regional research finds uneven financial development and monetary transmission (Damasa, 2026; Xu and Wubishet, 2024; Bilgili et al., 2026). The joint model shows that all three macroeconomic conditions alter the FRI slope, but in different directions and with different regions of statistical significance. This heterogeneity is the central finding. It explains why a single average claim that regulation deepens finance would be incomplete and why coordinated EAC standards still require national calibration.

6. Conclusion and Policy Implications

6.1 Conclusion

This study concludes that inflation, lending interest rates and logged exchange-rate conditions are material boundary conditions in the relationship between financial regulation and private-credit depth in the six EAC countries over 2005-2024. All three interactions and the joint Wald test were significant. Inflation changed the slope positively, although none of its selected conditional slopes reached 5% significance. Higher lending rates progressively weakened the regulatory slope until it became insignificant at the upper percentile. Higher logged exchange-rate values strengthened the slope, which was significant at the median and upper percentiles. Regulatory effectiveness is therefore a macro-financial coordination question rather than a constant average effect. The results do not imply that inflation or depreciation is desirable. They indicate that prudential oversight, liquidity discipline and foreign-exchange risk management may become more consequential during price and

currency pressure, while high borrowing costs can prevent supportive regulation from translating into productive private credit. The conclusion is strongest as evidence of persistent adjusted association within the observed panel, not immediate annual causation.

The conclusion rests on convergence across the interaction coefficients, Wald tests and conditional margins. Inflation produces a positive change in the regulatory slope, although the selected slopes remain statistically weak at 5%. Lending rates progressively erode the positive FRI association until it becomes insignificant at the upper quartile. Exchange-rate conditions strengthen the estimated slope at the median and upper quartiles, but this pattern must be understood as regulatory buffering under pressure rather than a benefit from depreciation. These distinctions are consistent with the mixed regulation evidence (Aliamutu and Msomi, 2024; Thamae and Odhiambo, 2024), the African macro-stability literature (Ibrahim et al., 2022; Ehigiamusoe and Samsurijan, 2021) and the documented asymmetry of EAC monetary transmission (Bilgili et al., 2026).

6.2 Policy implications

The EAC Secretariat should integrate macroeconomic conditioning into regional financial-sector surveillance. A shared dashboard should track regulatory instruments, inflation, lending rates, exchange-rate conditions, private credit and asset quality. Harmonisation should use common principles and reporting standards while permitting national calibration for financial depth, liquidity structures and currency exposure.

National central banks and regulators should assess major reforms *ex ante* and *ex post* over a multi-year horizon. During inflationary or exchange-rate pressure, supervision should emphasise liquidity, material currency mismatches, unhedged borrower exposure, provisioning, asset classification and repayment capacity. Inflation should remain a conditioning variable, not a development instrument.

Monetary, fiscal and financial-sector authorities should identify and reduce avoidable drivers of high lending rates. Priorities include reliable credit information, efficient collateral registration and enforcement, competition, operational efficiency, payment interoperability and stable funding. These measures should preserve risk-reflective pricing rather than replace it with indiscriminate credit targets.

Banks and other credit providers should incorporate lending-rate and exchange-rate scenarios into credit planning, asset-liability management and borrower risk segmentation. Regulatory impact assessment should track not only compliance, but also borrowing costs, approvals and rejections, sectoral allocation, non-performing loans and the distribution of credit across firm sizes.

Implementation should be evaluated with conditional indicators. Regional and national dashboards should report not only whether a regulation was adopted, but also how private-credit growth, loan pricing, approval rates, currency mismatches, non-performing loans and liquidity behave across inflation, interest-rate and exchange-rate states. Because financial depth is only one dimension of development

(Svirydzenka, 2016), credit expansion should be assessed alongside access, efficiency and stability. Periodic regulatory impact assessments can then distinguish a rule that genuinely supports productive intermediation from one that merely shifts risk, increases rationing or expands nominal credit during unstable conditions.

6.3 Limitations and future research

The study is limited to six countries, 120 observations, aggregate secondary data and selected proxies. Country fixed effects address stable national differences but not omitted time-varying conditions, structural breaks or reverse causality. The FRI combines reserve, allocation and pricing components and does not establish that each instrument has the same conditional effect. The small country count constrains cluster-level inference, while moderate overlap between FRI and lending rates may inflate uncertainty. Future research should test instrument-specific interactions, country-varying slopes, structural breaks, dynamic panel models, credible external instruments or policy-reform designs, and regions of significance for the marginal effects.

Future research should test the same conditional relationships with disaggregated bank- or sector-level data, alternative regulatory-index constructions, including equal weighting and PCA-derived weights, and direct measures of supervisory enforcement. Dynamic panel, instrumental-variable or event-study designs could better address reverse causality, while threshold models could identify whether the interaction changes abruptly rather than linearly. Separate measures of exchange-rate volatility, depreciation and misalignment would clarify the external channel. Researchers should also examine whether the results differ by bank ownership, firm size, financial inclusion, institutional quality and crisis period. Such extensions would connect the present private-credit-depth result to the broader finance-development dimensions emphasised by Svirydzenka (2016) and to the institutional heterogeneity identified by Xu and Wubishet (2024).

Declarations

Funding: The authors received no external funding for this study.

Competing interests: The authors declare no competing interests.

Ethics: The study used aggregated secondary country-level data and involved no human participants or personal identifiers.

Data availability: The study relies on publicly available macro-financial series and national regulatory publications. The harmonised analytical file, variable dictionary, source ledger and Stata code are available from the corresponding author on reasonable request.

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