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Does financial credit drive sectoral economic growth in Uganda? Evidence from Other Depository Corporations

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ABSTRACT

This study examined the effect of financial credit from Other Depository Corporations (ODCs), namely, commercial banks, credit institutions, and micro-deposit-taking institutions, on sectoral economic growth in Uganda. Using quarterly panel data from 2010/11 to 2023/24 financial years across ten economic sectors, we employed the panel ARDL-PMG model complemented with Dumitrescu-Hurlin panel causality test. The results reveal that commercial bank credit and micro-deposit taking institutions' credit exert significant positive long-run effects on sectoral GDP, though the elasticities are relatively inelastic at 0.38% and 0.12% for a 1% increase in credit from respective ODCs. By contrast, credit institutions' credit shows no significant long run effect. Additionally, credit from all ODCs showed no significant overall short-run effect. Robustness checks, including re-estimation of ARDL-PMG model with a sample of sectors and Prais-Winsten regressions with panel-corrected standard errors (PCSEs), confirm the stability of the findings. Policy implications point to the need for targeted and risk-sharing interventions, such as concessional lending to high-potential sectors, credit guarantee facilities and sector-specific subsidies through commercial banks and micro-deposit-taking institutions, rather than generalized interest rate reductions. These approaches can expand access to affordable credit, improve allocation efficiency and stimulate inclusive development.

IMPACT STATEMENT

In this paper we examined the differential effects of financial credit from Other Depository Corporations on sectoral economic growth in Uganda. The study extends the finance-growth literature by demonstrating that credit effects are heterogeneous across institutional sources, rather than uniform on Sector-inclusive economic growth. By showing that only commercial banks and micro-deposit taking institutions exert significant positive long-run growth effects, the findings provide policy-relevant evidence to guide targeted, sector-specific credit interventions in developing economies.

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Introduction

Inclusive economic growth remains a core aspiration for both developed and developing economies, yet achieving balanced growth across all sectors has proven challenging worldwide. Globally, sectoral imbalances persist due to unequal access to critical production resources, including financial credit (World Economic Forum, 2024). In Sub-Saharan Africa, these disparities are more pronounced, with underfunding in key productive sectors such as agriculture and manufacturing that hold high employment potential thus trapping most economies in low-income state, Uganda mirrors this broader challenge. While financial credit is recognized as a driver of investment and productivity (Diamoutene & Jatoe, 2021; Manaresi & Pierri, 2024; Pham & Phan, 2024), its allocation across Uganda's economic sectors remains inefficient and inequitable. High-growth and labour-intensive sectors like agriculture, which employs over 70% of the workforce, consistently receive less credit than

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capital-intensive sectors such as construction and real estate (BOU, 2023; UBOS, 2023). This inequitable allocation undermines sectoral performance and weakens the overall contribution of critical sectors to national Gross Domestic Product (GDP). Additionally, persistently underfunded sectors struggle to modernize, expand output, create decent jobs and enhance export earnings thus exacerbating unemployment and poverty, especially in rural areas where agriculture dominates livelihoods (Hammad Naeem et al., 2023; Yeboua, 2024).

To address these challenges, both global and national interventions have sought to strengthen access to finance for key sectors. International financial institutions such as the IMF and development partners have supported credit guarantee schemes and sector-specific lending programs targeting agriculture and SMEs (AFI, 2022). Regionally, frameworks under the African Union's Agenda 2063 emphasize inclusive finance as a catalyst for transforming Africa's productive sectors. In Uganda, multiple policy measures have been enacted that is, the government's Vision 2040 and National Development Plans (NDP IV) highlight financial inclusion as central to accelerating economic growth. The expansion of Other Depository Corporations (ODCs) such as commercial banks, credit institutions and micro-deposit taking institutions, has increased the volume of private sector credit, which reached 14.4% of GDP in 2024 (World Bank, 2025). Regulatory bodies such as the Bank of Uganda continue to implement prudential guidelines aimed at enhancing credit flow to priority sectors through interest rate caps, risk-sharing frameworks, and specialized agricultural credit facilities.

Despite these commendable interventions, the problem of inequitable credit allocation remains evident. Globally, evidence shows that policy intentions often fail to translate into equitable credit flows due to structural bottlenecks, market imperfections and macroeconomic instability (Brixiová et al., 2020; Snaije, 2017). In Uganda, recent reports highlight persistent barriers such as high lending rates averaging 20.97% (2010–2024), stringent collateral requirements and perceptions of high risk that impend financial institutions from lending adequately to sectors such as agriculture (BOU, 2023; UBOS, 2023). Small and Medium Enterprises (SMEs) which dominate these sectors, continue to face inaccessibility of affordable credit due to high levels of informality, risk, which undermines their contribution to economic diversification and inclusive growth.

Available empirical studies underscore the important role of financial credit in stimulating economic growth across low- and middle-income countries (Abbas et al., 2022; Alirzayev et al., 2020). However, much of this research remains limited in scope, often neglecting sectoral dynamics and the disaggregated effects of credit from ODCs. In Uganda, while previous studies have examined the link between financial credit and economic growth, they remain limited to either the effect of credit from one ODC on a specific sector's growth (Florence & Nathan, 2020) or the effect of private sector credit in aggregate terms on overall economic growth (Nakijoba & Selotlegeng, 2019). These contributions, although insightful, do not capture the heterogeneous effects of credit across multiple sectors, nor do they provide the disaggregated effects of ODCs' credit. This study advances this literature by applying a sectoral perspective and explicitly distinguishing between credit from each ODC. Methodologically, using quarterly panel data with respect to financial years from 2010/11Q1 to 2023/24Q4 across ten economic sectors as illustrated in Figure 1, this study extends earlier analyses by employing the Panel ARDL-PMG estimator, which accounts for both short-run and long-run, this was complemented this with Dumitrescu-Hurlin causality tests. Thus, we directly address the empirical and methodological gaps in earlier research by situating credit-growth relationships within a broader, sector-sensitive and dynamic econometric framework.

Hypotheses and conceptual framework

This study was guided by the proposition that financial credit from different Other Depository Corporations (ODCs) have a differential effect on sectoral economic growth in Uganda. This was empirically tested following the null hypotheses formulated as below:

- H_{01}: Commercial banks' credit has no significant effect on sectoral GDP contributions.
- H_{02}: Credit institutions' credit has no significant effect on sectoral GDP contributions.
- H_{03}: Micro-deposit taking institutions' credit has no significant effect on sectoral GDP contributions.

As illustrated in Figure 1, the framework posits that financial credit from different ODCs affects sectoral GDP contributions based on the supply-leading hypothesis (Odhiambo, 2007; Patrick, 1966). The relationship is moderated by macroeconomic control variables such as lending rates, inflation and

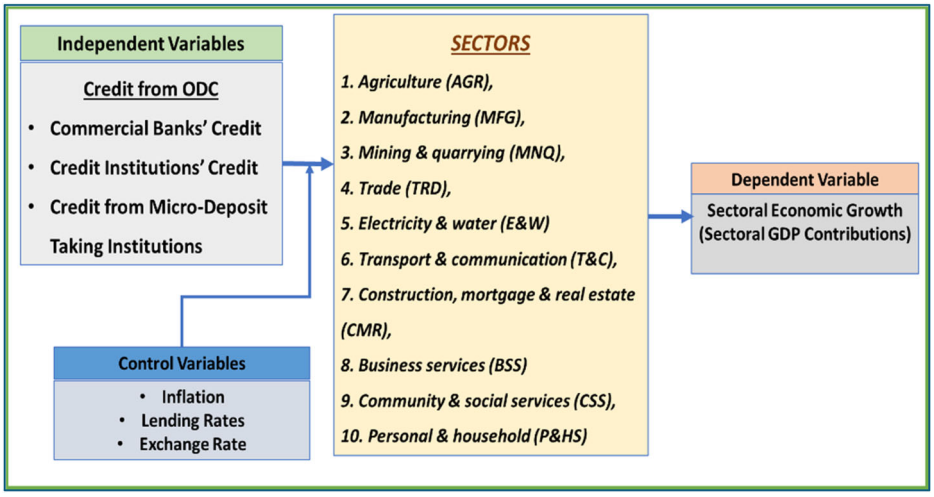

Figure 1. Visualisation of the study's conceptual framework.

exchange rate. Specifically, these influence both the cost and effectiveness of financial credit, thereby shaping its effect on sectoral GDP. High lending rates increase borrowing costs and can dampen credit uptake, while inflation and exchange rate fluctuations may either enhance or constrain sectoral performance (Florence & Nathan, 2020).

It should however be noted that, despite macroeconomic interventions, the structure of Uganda's financial system still prioritizes profitability and regulatory compliance over developmental lending. Prudential regulations, such as capital adequacy ratios, collateral requirements, and risk-weighted asset rules, limit credit extension to high-risk sectors, particularly agriculture and informal enterprises (BOU, 2023). Banks and credit institutions often prefer sectors with predictable cash flows and asset-backed loans, aligning with the risk-return optimization principle rather than developmental equity (Beck, 2014; Stiglitz & Weiss, 1981). This regulatory and profitability bias contributes to the uneven sectoral credit distribution observed in Uganda and other Sub-Saharan African economies (Brixiová et al., 2020).

Literature review

The link between financial credit and economic growth is well established in economic theory. The Supply-Leading Hypothesis (SLH) proposed by Patrick (1966) argues that financial development precedes and stimulates economic growth by facilitating capital accumulation and improving resource allocation. This view is reinforced by King and Levine (1993), who found that countries with more developed financial systems experience faster growth. In contrast, the Demand-Following Hypothesis (DFH) advanced by Robinson (1952) posits that financial development responds to the needs of a growing real economy, implying that sectoral expansion drives credit demand rather than the reverse. These contrasting views suggest that the finance-growth nexus may be context-specific and dynamic over time (Odhiambo, 2007; Said & Hammam, 2024). However, the study adopts the SLH since Uganda is a low-income country. This is supported by the findings of a recent study by Said and Hammam (2024) which identified a dynamic transition from a supply-leading to a demand-following pattern as economies mature. Complementing these hypotheses, is the finance-growth nexus theory pioneered by Schumpeter (1911) arguing that financial intermediaries such as banks play a vital role in identifying and funding innovative entrepreneurs, thereby accelerating economic progress. Schumpeter's theory suggests that access to finance possibly through credit enables entrepreneurs to introduce new products and processes, fostering structural transformation and economic dynamism (Becker & Knudsen, 2002; Sinha, 2001). Additionally, the endogenous growth theory emphasizes the role of stimulating investments in innovation, human capital development and knowledge on long-term economic growth (Lucas, 1988; Romer, 1986). In addition to the finance-growth nexus, this study recognizes the risk-based theory of financial intermediation, which posits that financial institutions allocate credit according to sectoral risk-return trade-offs (Stiglitz & Weiss, 1981). Lending decisions are influenced by asymmetric information, collateral

constraints, and the expected profitability of borrowers. Sectors with higher informality, such as agriculture and small-scale trade, face higher perceived credit risk, limited documentation, and weaker collateral structures, leading to underfunding despite their economic potential. Conversely, capital-intensive sectors like construction attract credit due to tangible assets and formal operations that reduce transaction costs (BOU, 2023; Brixiová et al., 2020; PSIS, 2023; UBA, 2024). These theoretical underpinnings contextualize the heterogeneous sectoral effects of financial credit observed in Uganda.

Empirical research generally supports a positive relationship between financial credit and economic growth. For instance, Bui (2020) found an inverted U-shaped relationship between credit and growth in ASEAN countries, indicating that while initial increases in credit stimulate growth, excessive credit may lead to inefficiencies. Similarly, Duc (2024) reported that credit to the private sector significantly boosts long-term GDP growth in Vietnam, with feedback effects in the short run. In Sub-Saharan Africa, (Adediran and Alege (2020) used ARDL models to show that external credit flows stimulate Nigerian GDP, particularly when used for productive investments. Additionally, Kharel et al. (2024) demonstrated that private sector credit positively influences Nepal's economic growth, correcting for nearly 40% of deviations from long-run equilibrium annually. These findings support the role of financial intermediation via the specific component of credit in enhancing output, especially when credit is well allocated.

Furthermore, recent studies have called for disaggregated analysis of credit by institutional source and sector. Alirzayev et al. (2020) found that credit from non-banking financial institutions significantly influenced Azerbaijan's non-oil GDP. Similarly, Gil-Jardón et al. (2024) highlighted complementary roles of commercial and development banks in supporting Mexico's short- and long-term growth needs. In Uganda's context, credit remains unevenly distributed. Agriculture, employing over 70% of the population, receives a disproportionately small share of formal credit, possibly limiting its contribution to GDP (BOU, 2023; UBOS, 2023). The Uganda Banking Sector Report (2023) revealed that while manufacturing and personal loans saw significant growth, credit to utilities and high-risk sectors like agriculture declined (UBA, 2024). These trends suggest inefficiencies in credit allocation, consistent with the concerns raised by Balana et al. (2022).

Studies that explicitly focus on the sectoral impact of credit have produced mixed results, for instance, Fawaier and Al-Tal (2025) showed that credit to Jordan's industrial sector had a positive effect on GDP, whereas credit to sectors like real estate and transport had negative or negligible effects. Likewise, financial credit to Nigeria's mining sector boosted industrial GDP, while lending to construction had adverse effects (Njoku et al., 2023). There is increasing recognition of the heterogeneous effects of credit based on the type of lending institution, Olawale and Shiloh (2024) found that commercial bank credit to SMEs in Nigeria exhibited a negative short-run but positive long-run effect on GDP. In contrast, Gizaw et al. (2024) reported credit misallocation in Ethiopia, with long-run adverse effects from credit to public and industrial sectors. In Uganda, various studies examined specific institutions or sectors but did not assess the combined effects of different ODCs across multiple sectors, for example Florence and Nathan (2020) examined the effect of commercial bank credit on agricultural sector GDP contribution while Nakijoba and Selotlegeng (2019) investigated the effect of aggregated private sector credit on overall GDP on Uganda. This limits policy insights into how commercial banks, credit institutions, and micro-deposit taking institutions uniquely influence sectoral growth. The existing research rarely considers the effect of ODCs' credit on sectoral GDP contributions while accounting for macroeconomic variables such as interest rates (lending rates), inflation, and exchange rate volatility.

Several studies have demonstrated that macroeconomic conditions significantly shape the effectiveness of credit on sectoral growth. For instance, Florence and Nathan (2020), in analyzing the impact of credit on agricultural GDP in Uganda, found that rising interest rates reduce the effectiveness of credit, as higher borrowing costs discourage farmers from investing. Conversely, inflation had a positive effect, likely driven by food price dynamics rather than input costs, while the effect of exchange rate fluctuations was marginal, indicating limited influence on credit-agricultural growth (Florence & Nathan, 2020). Similarly, Nakijoba and Selotlegeng (2019) examined the effect of private credit on Uganda's overall economic growth, incorporating interest rates, inflation, money supply, and exchange rates as control variables. Their results revealed that interest rates had a negative effect, money supply had a positive effect, while inflation and exchange rates were statistically insignificant (Nakijoba & Selotlegeng, 2019). These findings underscore the importance of a stable macroeconomic environment in enhancing the effectiveness of credit on sectoral and aggregate growth.

Despite these contributions, several gaps remain. A few studies evaluate the differential effects of credit by institutional source on economic growth while accounting for sectoral heterogeneities in Sub-Saharan Africa, particularly in Uganda. Secondly, the speed of adjustment toward equilibrium after credit shocks is rarely analysed. This study contributes to closing these gaps by analysing panel data across ten Ugandan economic sectors from 2010/11Q1 to 2023/24Q4, disaggregating credit by ODCs and applying the panel ARDL and Granger causality methods to estimate dynamic effects under macroeconomic controls.

Methodology

Theoretical framework

This study is benchmarked on the Supply-Leading Hypothesis, which posits that financial development precedes and causes economic growth. An expansion in the financial system mobilizes savings, improves the allocation of capital, lowers transaction and information costs, and facilitates technological upgrading, thereby stimulating real economic activity (Patrick, 1966).

Let, FD_t denote the level of financial development at time t, and Y_t denote real output (GDP).

The supply-leading relationship is summarized as:

$$\frac{\partial Y_t}{\partial FD_t} > 0, FD_t \rightarrow Y_t \tag{1}$$

In the context of this study, financial development is proxied by disaggregated credit from Other Depository Corporations (ODCs).

Consider economic sectors $i = 1, 2, ..., N$, observed over time $t = 1, 2, ..., T$. Sectoral output is generated by a neoclassical production technology:

$$Y_{it} = A_{it}F(K_{it}, L_{it}) \tag{2}$$

where, Y_{it} is real value added (sectoral GDP), A_{it} is sector-specific total factor productivity, K_{it} is physical capital, and L_{it} is labour input (Gallaway & Shukla, 1974; Zheng & Shan, 2025).

Under the supply-leading hypothesis, financial credit affects sectoral growth by raising capital accumulation (K_{it}) and enhancing productivity (A_{it}) through improved investment and technology adoption.

Let total credit from ODCs to sector i at time t be defined as:

$$CR_{it} = CBC_{it} + CIC_{it} + MDTI_{it} \tag{3}$$

where, CBC_{it} is commercial bank credit, CIC_{it} is credit institutions' credit, and $MDTI_{it}$ is micro-deposit taking institutions' credit.

Sectoral capital evolves according to:

$$K_{it} = K_{i,t-1} + I_{it}, I_{it} = \varphi(CR_{it}), \frac{\partial \varphi}{\partial CR_{it}} > 0 \tag{4}$$

Thus, increased ODC credit raises investment, expands capital stock, and ultimately increases sectoral output.

For empirical tractability, a Cobb-Douglas representation is adopted, where credit acts as an enabler of effective capital:

$$Y_{it} = A_{it}(\kappa_i CR_{it})^{\alpha_i} L_{it}^{\beta_i} \tag{5}$$

Taking natural logarithms yields:

$$\ln Y_{it} = \ln A_{it} + \alpha_i \ln CR_{it} + \beta_i \ln L_{it} \tag{6}$$

Given the relatively slow adjustment of labour at quarterly frequency, labour input is approximated as $ln(L_{it}) \approx \ell_i + \varepsilon_{it}$, where ℓ_i captures time-invariant sector-specific labour intensity and ε_{it} represents transitory deviations. The term ℓ_i is absorbed into the sector fixed effects, implying that labour influences sectoral output indirectly through unobserved sectoral heterogeneity rather than as an explicit regressor (Eberhardt & Teal, 2011; Islam, 1995). Additionally, quarterly sector-by-sector labour data seldom exists

thus,

$$\ln(L_{it}) \approx \ell_i + \varepsilon_{it} \tag{7}$$

Substituting (7) into (6):

$$\ln Y_{it} = (\ln A_{it} + \beta_i \ell_i) + \alpha_i \ln CR_{it} + u_{it} \tag{8}$$

$$\ln Y_{it} = (\ln A_{it} + \beta_i \ell_i) + \alpha_i \ln CR_{it} + \beta_i \varepsilon_{it} \tag{9}$$

Let $\mu_i = \ln A_i + \beta_i \ell_i$ denote unobserved sector-specific heterogeneity and $u_{it} = \beta_i \varepsilon_{it}$. Then:

$$\ln Y_{it} = \mu_i + \alpha_i \ln CR_{it} + u_{it} \tag{10}$$

Replacing aggregate credit with its institutional components, equation (3) into (10) yields (11):

$$\ln Y_{it} = \mu_i + \alpha_1 \ln CBC_{it} + \alpha_2 \ln CIC_{it} + \alpha_3 \ln MDTI_{it} + u_{it} \tag{11}$$

Under the supply-leading hypothesis, $\alpha_1, \alpha_2, \alpha_3 > 0$, subject to institutional and sectoral heterogeneity. The magnitude of these effects may differ due to sectoral risk, informality, and regulatory constraints, as highlighted in the credit rationing literature (Stiglitz & Weiss, 1981).

Additionally, the real impact of credit depends on macroeconomic conditions captured by Z_t in equation (12), that influence borrowing costs and the real value of loans. According to Florence and Nathan (2020), we let, LR_t = lending interest rate, INF_t = inflation rate, and XR_t = the exchange rate, constitute Z to obtain equation (13).

$$\ln Y_{it} = \mu_i + \alpha_1 \ln CBC_{it} + \alpha_2 \ln CIC_{it} + \alpha_3 \ln MDTI_{it} + \gamma_i Z_t + u_{it} \tag{12}$$

$$\ln Y_{it} = \mu_i + \alpha_1 \ln CBC_{it} + \alpha_2 \ln CIC_{it} + \alpha_3 \ln MDTI_{it} + \gamma_1 LR_t + \gamma_2 INF_t + \gamma_3 \ln XR_t + u_{it} \tag{13}$$

Equation (13) represents the long-run equilibrium relationship implied by the supply-leading hypothesis. However, sectoral output and credit adjust gradually due to investment gestation periods and financial rigidities. Therefore, the relationship is modelled dynamically using a panel econometric framework.

Data and sources

This study adopted a quantitative research design leveraging panel data econometrics to capture both cross-sectional and time-series dimensions of the dataset. The study relied on quarterly data with respect to financial years spanning from 2010/11Q1 to 2023/24Q4. Data sources include the Bank of Uganda (BOU)[1] and Uganda Bureau of Statistics (UBOS).[2] Table 1 provides a description of the study variables.

Estimation strategy

Cross-sectional dependency

The Pesaran Cross-Sectional Dependence (CD) test was used to assess the presence of cross-sectional dependence in panel data. Cross-sectional dependence arises when the residuals of individual units in a panel are correlated, which can lead to inefficient estimates and biased statistical inference. Testing for cross-sectional dependence is crucial, especially where economy shocks or sectoral interdependencies are common. The Pesaran CD test is based on pairwise correlations of residuals across cross-sections. The test statistic is given in equation (14).

Table 1. Description of variables of study.

Variable type	Variables	Description	Source	Expected outcome
Dependent	GDP_{it}	Sectoral Gross Domestic Product	UBOS	
Independent	CB_{it}	Commercial Bank Credit (Ushs. Millions)	BOU	+
	CIs_{it}	Credit institutions Credit (Ushs. Millions)	BOU	+
	$MDTIs_{it}$	Micro-Deposit Taking Institutions Credit (Ushs. Millions)	BOU	+
Control/ Mediating	LR_{it}	Lending Rates	BOU	−
	INF_{it}	Uganda's inflation rate	BOU	−
	$XRATE_{it}$	Exchange Rate	BOU	−/+

Source: Authors' compilations.

$$CD = \sqrt{\frac{2}{N(N-1)}}\left(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}\right) \tag{14}$$

where $\hat{\rho}_{ij}$ is the sample correlation coefficient of residuals between sectors i and j, and N is the number of sectors. The null hypothesis (H_0) of no cross-sectional dependence $(\hat{\rho}_{ij} = 0\,\forall i \neq j)$ is tested (Pesaran, 2015, 2021).

Panel unit root testing

The subsequent step involved examining the order of integration of the study variables. Given that the Pesaran CD test indicated significant cross-sectional dependence among some variables, we initially employed the Cross-sectionally Augmented Im–Pesaran–Shin (CIPS) test (Pesaran, 2007), a second-generation panel unit root test which accounted for cross-sectional dependence. The CIPS statistics in equation (16) are derived from the Cross-sectionally Augmented Dickey-Fuller which is represented by equation (15):

$$\Delta Z_{it} = \emptyset_i + \alpha_i Z_{i,t-1} + \sigma_i \overline{Z}_{t-1} + \sum_{j=0}^{p}\sigma_{ij}\Delta\overline{Z}_{t-1} + \sum_{j=1}^{p}\gamma_{ij}\Delta\overline{Z}_{t-1} + \varepsilon_{it} \tag{15}$$

$$CIPS = \frac{1}{N}\sum_{i=1}^{n}\Delta Z_{it} \tag{16}$$

where $\overline{z}_{t-1}$ and $\overline{Z}_{t-1}$ are the averages for the lagged and first differences of each cross-section series. While sectoral GDP and ODCs' credit differ across sectors (panels), macroeconomic control variables such as inflation, lending rates and the exchange rate are common to all sectors, thus applying second-generation unit root test alone doesn't capture the stationarity properties of macro variables due to their repetition across panels, distorting the factor structure. Given the relatively small fixed cross-sectional dimension (N = 10) and a relatively large time span (T = 56), the first-generation unit root tests remain valid under such circumstances (Chudik et al., 2011; Das, 2019; Gaibulloev et al., 2014; Pesaran, 2015; Sarafidis & Wansbeek, 2012). Therefore, we test the LLC and IPS test alongside the CIPS test. This offered a complementary approach to determining the order of integration $(I(d))$ for each study variable.

The LLC test assumed a common unit root process across all cross-sectional units. The null hypothesis (H_0) posits the presence of a unit root $(\rho = 0)$, indicating non-stationarity, while the alternative hypothesis (H_0) assumes stationarity $(\rho_i < 0)$ for all i. The LLC model can be expressed as:

$$\Delta Y_{it} = \alpha_i + \rho Y_{i,t-1} + \sum_{j=1}^{p}\theta_j \Delta Y_{i,t-j} + \varepsilon_{it} \tag{17}$$

For $i = 1, 2, \ldots, N$ and $t = 1, 2, \ldots, T$; where, Y_{it} represents the variable of interest for cross-section i at time t, ΔY_{it} is the first difference of Y_{it}, α_i captures individual effects, ρ is the autoregressive coefficient that is assumed to be common across all cross-sections, θ_j are the lagged differences coefficients, and ε_{it} is the error term (Das, 2019; Hurlin, 2010). Unlike LLC, the IPS test allowed for heterogeneity in the autoregressive parameters across economic sectors. The null hypothesis (H_0) remained the presence of a unit root for all panels $(\rho_i = 0\,\forall i)$, while the alternative hypothesis (H_a) allowed some panels to be stationary $(\rho_i < 0$ for $i = 1, \ldots, N_1,$ and $\rho_i = 0$ for $i = N_1 + 1, N,$ with $0 < N_1 \leq N)$ (Das, 2019; Hurlin, 2010). The IPS model can be expressed as:

$$\Delta Y_{it} = \alpha_i + \rho_i Y_{i,t-1} + \sum_{j=1}^{p}\theta_j \Delta Y_{i,t-j} + \varepsilon_{it} \tag{18}$$

Where; ρ_i varies across sectors, allowing for panel-specific persistence. The IPS test statistic is calculated by averaging individual augmented Dickey-Fuller (ADF) test statistics across panels:

$$\bar{t}_{NT} = \frac{1}{N}\sum_{i=1}^{N} t_{iT} \tag{18.1}$$

Note that, t_{NT} is the ADF test statistic for sector i. A standardized $\bar{t}_{NT}$ then compared against critical values to determine stationarity. All the CIPS, LLC and IPS tests were conducted at levels and first differences, with and without trends.

Cointegration tests

The cointegration test was applied to establish the existence of a long-run relationship between the Sectoral GDP and credit allocated by ODCs. The Pedroni test allowed for heterogeneity across economic sectors, which makes it ideal for panel data studies where the dynamics of the relationship may differ across units (Neal, 2014; Pedroni, 2004). The null hypothesis is that no cointegration exist. For each economic sector, a scalar dependent variable Y_{it} was observed and a $m \times 1$ vector of explanatory variables X_{it}. The estimated regression is of the form presented in equation (19):

$$Y_{it} = \alpha_i + \boldsymbol{\beta}'_i \boldsymbol{X}'_{it} + \mathcal{E}_{it} \tag{19}$$

Where, α_i is a sector-specific fixed effect, while β_i is a vector of sector-specific slope coefficients; Y_{it} represents the GDP contribution for economic sector i at time t; X_{it} represents the ODCs' credit variables (CB credit, CIs credit, MDTI credit); $\mathcal{E}_{it}$ is the error term that is expected to be stationary if the variables are cointegrated (Petrova, 2020). We also employed the Kao (1999) panel cointegration test which builds on the Engle-Granger two-step methodology but adapts it to a panel setting. After estimating the panel regression, the residuals $\hat{e}_{it}$ are obtained, and the following augmented Dickey-Fuller (ADF)-type test is performed:

$$\Delta\hat{e}_{it} = \rho\hat{e}_{it-1} + \sum_{j=1}^{p} \theta_j \Delta\hat{e}_{it-j} + v_{it} \tag{20}$$

In equation (20), Δ is the first-difference operator, ρ is the parameter of interest, v_{it} is a white noise error term, and p denotes the lag length. For H_0: $\rho = 0$ (no cointegration) and if H_0: $\rho <$ 0 (cointegration) (Kao, 1999). For robustness, the Westerlund test which is a second-generation cointegration to verify the existence of a long-run equilibrium since it is efficient even in the presence of cross-sectional dependence. It provided robust insights into whether the variables are linked over time, allowing for appropriate modelling of both short-run and long-run dynamics in subsequent analyses.

Model specification

The presence of mixed order of integration as well as the existence of the long-run relationship among the study variables, justified the use of the panel ARDL technique. The general form of the Panel $ARDL(p, q)$ model is given in equation (21) referring to the works of Pesaran & Sh bin

$$Y_{it} = \alpha_i + \sum_{i=0}^{p} \beta_{i,j} Y_{it-p} + \sum_{j=0}^{q} \gamma_{i,j} X_{it-q} + \mu_i + \mathcal{E}_{it} \tag{21}$$

With $i = 1, 2, \ldots, N$ is the number of sectors; $t = 1, \ldots, T$ is the time; j is the number of lags; $Y_{it} =$ Dependent variable (GDP contribution for sector i at time t); $X_{it-q} =$ Independent variables (credit allocated by ODCs and macroeconomic variables); $\alpha_i =$ sector-specific fixed effects; $\beta_p =$ coefficients of the lagged dependent variable, capturing the short-run effects of past values of GDP; $\gamma_q =$ coefficients of the lagged independent variables (ODCs' credit and control variables), capturing both the short-run and long-run effects of credit on sectoral GDP; $p, q =$ lag lengths for the dependent and independent variables, respectively; $\mu_i =$ unobserved individual effects (cross-sectional heterogeneity); $\mathcal{E}_{it} =$ error term (White noise). To consider the adjustment coefficient and the long run dynamics, equation (21) is reparametrized as follows in equation (22)

$$\Delta Y_{it} = \emptyset_i (Y_{it-1} - \theta_i X_{i,t}) + \sum_{j=1}^{p-1} \varphi'_{i,j} \Delta Y_{it-j} + \sum_{j=0}^{q-1} \delta'_{i,j} \Delta X_{it-j} + \vartheta_i + \mathcal{E}_{it} \tag{22}$$

where; $\emptyset_i$ is the adjustment coefficient of the long run dynamics, θ_i indicates the long run equilibrium relationship between Y_{it} and $X_{i,t}$, $\varphi'_{i,j}$ and $\delta'_{i,j}$ represent the short run coefficients linking economic growth with its past values and the variables of interest $X_{i,t}$.

A long run relationship between economic growth and respective ODCs' credit exists if $\emptyset_i$ is negative and significant, then a cointegration relation exists between Y_{it} and $X_{i,t}$. To estimate equation (11), three estimation methods were be used, namely, the MG developed by Pesaran and Smith (1995), the PMG developed by Pesaran et al. and the DFE estimator.

Pooled Mean Group (PMG) estimator: This allowed short run coefficients, including the intercepts, the speed of adjustment to the long-run equilibrium values and error variances to be heterogeneous sector by sector, while the long-run slope coefficients are restricted to be homogeneous across sectors. The short-run adjustment is allowed to be sector specific, due to the widely different impact of the vulnerability of financial crises and external shocks, stabilization policy, monetary policy, etc (Zardoub, 2023).

Mean Group (MG) estimator: The MG technique introduced by Pesaran and Smith (1995) calls for estimating separate regressions for each sector and calculating the coefficients as invariants means of the estimated coefficients for the individual sector. This does not impose any restrictions. It allowed for all coefficients to vary and be heterogeneous in the long-run and short-run. However, the necessary condition for the consistency and validity of this approach is to have a sufficiently large time series dimension of the data.

Dynamic Fixed Effect estimator: The DFE estimator is very similar to the PMG and imposes restrictions on the slope coefficient and error variances to be equal across all sectors in the long run. The DFE model further restricts the speed of adjustment coefficient and the short run coefficient to be equal too. However, the model features sector-specific intercepts. DFE has a cluster option to estimate intra-group correlation with the standard error (Blackburne & Frank, 2007).

The Hausman test was used for determining a better model between the MG, PMG and the DFE models in the panel data setting. The null hypothesis (H_0) represents the Mean Group (MG) model, whereas the alternative hypothesis (H_1) represents the Pooled Mean Group (PMG) model that is if we are comparing MG and PMG at a time. The test is based on the m statistic is given by equation (23) below.

$$m = (\beta - b)(M_0 - M_1)^{-1}(\beta - b) \tag{23}$$

where; β is the statistics vector of Mean Group (MG) variables, b is the statistics vector of Pooled Mean Group (PMG) variables, M_0 is the covariance matrix for the Mean Group (MG) model, and M_1 is the covariance matrix for the Pooled Mean Group (PMG) model. The m statistics follows the chi-square distribution with the degree of freedom equal to P (Utami et al., 2021).

Panel Granger causality test

The Granger Causality test in panel data settings by Dumitrescu and Hurlin (2012) as illustrated in equation (24) provided an extension of the traditional Granger causality test applied in a panel data framework that accounts for both time-series and cross-sectional variations. This approach helped to determine whether respective ODCs' financial credit granger-causes sectoral GDP over time, while accommodating the panel structure of the data. For two variables X_{it} (respective ODC's credit) and Y_{it} (sectoral GDP), the Panel Granger causality test was performed by estimating the models in equation (24):

$$Y_{i,t} = \alpha_{0,i} + \sum_{p=1}^{P} \beta_{ip} Y_{i,t-p} + \sum_{q=1}^{Q} \gamma_{iq} X_{i,t-q} + \varepsilon_{i,t} \tag{24}$$

with $i = 1, \ldots, N$ and $t = 1, \ldots, T$; where $\alpha_{0,i}$ captures the individual-specific fixed effects, $X_{i,t}$ and $Y_{i,t}$ are the observations of two variables for individual i in period t. $\varepsilon_{i,t}$ denotes the innovation for individual i in period t. Coefficients are allowed to differ across. The lag order P and Q are assumed to be identical for all individuals, and the panel must be balanced (Juodis et al., 2021; Lopez & Weber, 2017).

Empirical results

The summary statistics are presented in Table 2, the average sectoral GDP across the sample period was UGX 2,588 billion, with substantial variation between sectors (*between SD* = 2,259) and over time (*within SD* = 1,359). This reflects structural heterogeneity in sectoral output contributions. Commercial bank credit (CBC) averaged UGX 3.71 trillion, with a wide dispersion across sectors and years (max = UGX 16 trillion). Credit institutions (CI) and micro-deposit taking institutions (MDTIs) reported much lower mean credits of UGX 86 billion and UGX 87 billion, respectively, underscoring their limited scale relative to commercial banks. The within-sector standard deviations for CI and MDTI credit suggest notable temporal fluctuations in credit disbursement. Macroeconomic variables show moderate variability: the average lending rate was 21%, with inflation averaging 6% and the exchange rate at UGX 3,263 per USD. These variables provide critical macroeconomic context for assessing the impact of financial credit on sectoral GDP growth.

Considering the overall relation between the GDP and combined ODCs' credit, Figure 2 presents a scatterplot depicting this relationship between Uganda's overall quarterly GDP and total ODCs' credit for the financial years 2010/11 to 2023/24. The trend line indicates a strong positive linear relationship between the two variables. This suggests that financial credit is a critical driver of economic activity over the observed period.

Additionally, Figure 3 illustrates the logarithmic trends of credit amounts provided by commercial banks, credit institutions and micro-deposit taking institutions. Credit from commercial banks (CB) displays a steady upward trajectory, reflecting their dominant role in credit provision. In contrast, credit from micro-deposit taking institutions $(ln(MDTIs))$ exhibits moderate growth suggesting stable but less aggressive expansion compared to *CB* while credit institutions' credit (CIs) shows an initial rise followed

Table 2. Summary statistics of the study variable.

Variable		Mean	Std. dev.	Minimum	Maximum
Sectoral GDP	Overall	2,588	2,539	49	17,314
	Between		2,259	237	7,280
	Within		1,359	−1,135	17,115
CB Credit	Overall	3,705,362	3,297,520	49,406	16,000,000
	Between		2,884,013	159,792	8,082,381
	Within		1,836,974	−1,736,370	12,400,000
CI Credit	Overall	86,433	122,909	84	675,356
	Between		95,521	4,927	292,653
	Within		82,947	−125,004	489,602
MDTIs' Credit	Overall	87,264	148,914	0	688,523
	Between		143,607	909	453,941
	Within		59,847	−166,821	358,791
LR	Overall	21	3	17	27
INF	Overall	6	5	2	24
XRATE	Overall	3,263	540	2,247	3,858

Note: Sectoral GDP is in Billion Ugandan Shillings; Credit amount is in million Ugandan shillings.

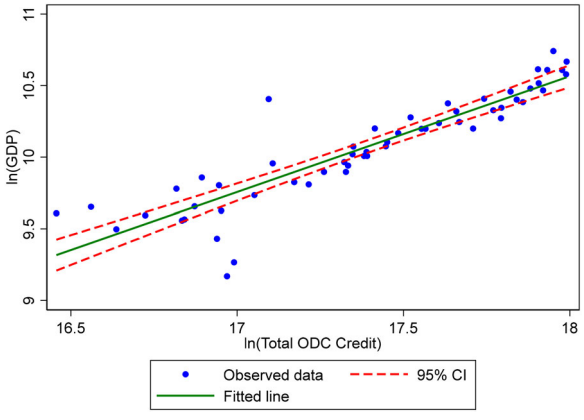

Figure 2. Overall Quarterly GDP Vs ODCs' Credit (2010/11–2023/24).

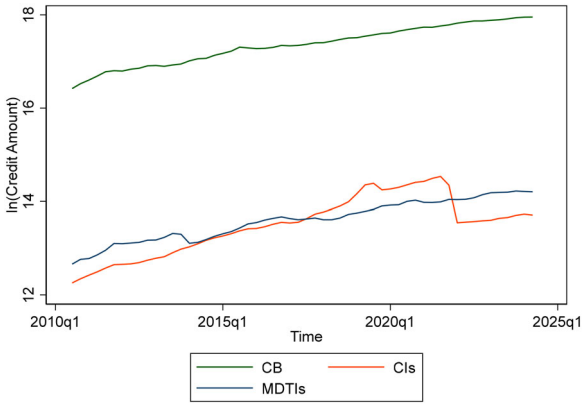

Figure 3. Trends OF ODCs' Credit Amount (2010/11–2023/24).

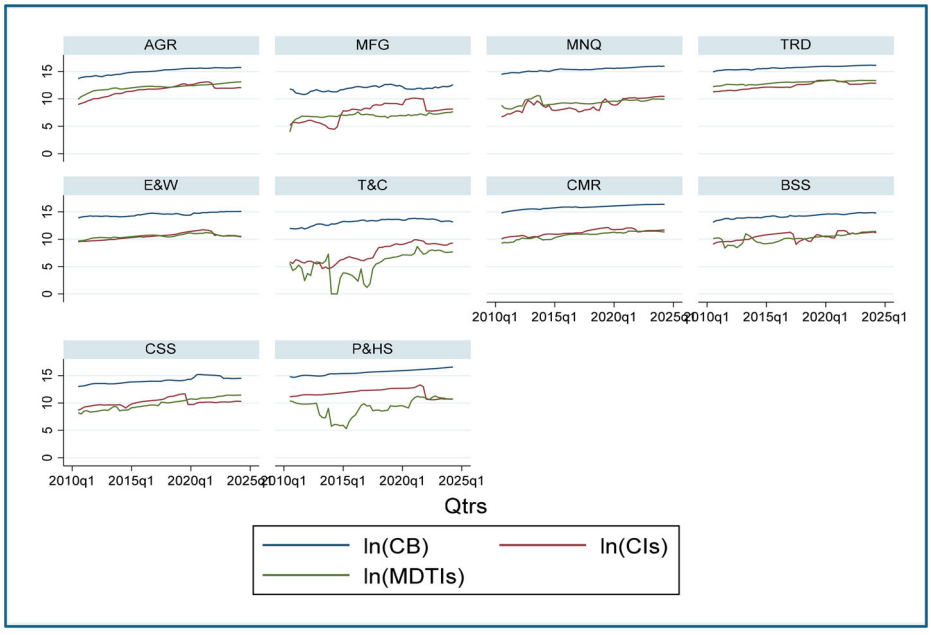

Figure 4. ODCs' credit movements across economic sectors.

by a notable decline after 2020/21probbly due to COVID-19, operational challenges, or shifts in policy focus.

Figure 4 plots credit from ODCs by sector. Across all sectors, CB credit dominates and exhibits a smooth, persistent upward drift. CIs and MDTIs track CB closely, rising over time but at lower levels than CB credit, indicating pronounced co-movement. Heterogeneity is evident, in MFG, T&C and P&HS, MDTIs display mid-period volatility followed by recovery while CIs rise steadily, narrowing gaps in MNQ, TRD, CMR and BSS. By contrast, Agriculture and E&W show persistent source gaps (CB $>$ CIs $\approx$ MDTIs), with E&W flattening toward the end of the study period. CSS and CMR record the most uniform, monotonic growth across all ODCs. Overall, these patterns suggest sector-specific short-run dynamics overlaid on a shared long-run upward trend in credit supply. The visual evidence of common movements motivates the use of cross-sectional dependence test and a dynamic panel model framework that allows heterogeneous short-run adjustments while testing for long-run relationships that are common across sectors.

Furthermore, Figure 5 illustrates the growth trends of sectoral GDP contributions, highlighting varying sectoral performance over time. Key sectors, such as Agriculture (AGR), Building, Mortgage, Construction and Real Estate (CMR), Trade (TRD) and Mining and Quarrying (MNQ), exhibit strong and consistent growth, with steep upward trajectories, likely indicating their dominant role in driving Uganda's economic growth. Other sectors, such as Community & Social services (CSS), Electricity & Water and

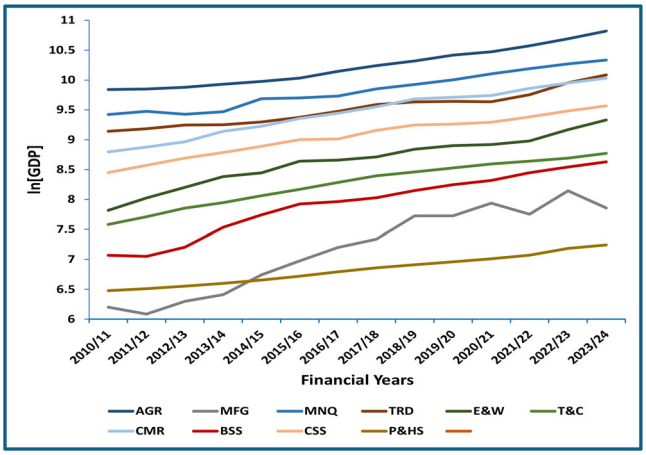

Figure 5. Growth trends in sectoral GDP (2010/2011–2023/24).

Table 3. Correlation matrix for the study variables.

	lnGDP	*lnCBC*	*lnCIS*	*lnMFI*	*LR*	*INF*	*lnXRATE*
lnGDP	1						
lnCBC	0.524***	1					
lnCIS	0.348***	0.760***	1				
lnMFI	0.563***	0.696***	0.786***	1			
LR	−0.222***	−0.215***	−0.242***	−0.192***	1		
INF	−0.153***	−0.153***	−0.200***	−0.086**	0.453***	1	
lnXRATE	0.282***	0.310***	0.363***	0.221***	−0.556***	−0.40***	1

*,**,***Significance at 10%, 5% and 1% levels, respectively.

Transport & Communication, show moderate growth, reflecting steady contributions to GDP but at a slower pace compared to high-performing sectors. Meanwhile, manufacturing (MNG) reveals fluctuating growth, with periods of slower performance. Lower-performing sectors, like Business services (BSS) and Personal and Household activities (P&HS), display gradual but minimal growth, suggesting challenges in scaling up their contributions to GDP.

The results of Pearson correlation in Table 3 indicate a significant positive correlation between sectoral GDP (*lnGDP*) and all three ODCs. These associations suggest that increases in the respective ODCs' credit is associated with higher sectoral output. Among the credit variables, strong inter-correlations are observed, between *lnCIS* and *lnMDTI* and between *lnCBC* and *lnCIS*, indicating potential complementarities in credit access across ODCs. As expected, lending rates and inflation exhibit negative and significant correlations with sectoral GDP and credit variables, reflecting the inhibitory role of macroeconomic instability and high borrowing costs on credit uptake and economic activity. Conversely, the exchange rate shows a positive correlation with *lnGDP* and credit variables, suggesting a possible link between currency depreciation and the expansion of credit sector output. While these correlations provide preliminary insights, they do not imply causality. Further econometric modelling is employed to account for dynamic relationships.

The cross-sectional dependence test alongside second generation CIPS panel unit-root tests results are presented in Table 4. Cross-sectional dependence is evident in the study's key variables confirming the presence of pervasive common shocks across sectors. The CIPS results reveal mixed order of integration among sectoral GDP and ODCs' credit both with and without a deterministic trend specification. However, the CIPS fails to handle the macroeconomic covariates (lending rates, inflation and exchange rate) since they are repeated across panels. This outcome reflects their common nature across panels, which weakens the power of CIPS. To address this limitation, we complement the second-generation results with first-generation unit-root tests (IPS and LLC), which are better suited for testing variables that do not vary across cross-sections. This dual approach ensures a consistent classification of integration orders. Results from the Im, Pesaran and Shin (IPS) and Levin, Lin and Chu (LLC) methods, conducted with and without individual linear trends are presented in Table 5. Like CIPS, results regarding key variables such as GDP, CBC, CIS and MDTIs reveal mixed order of integration. Regarding

Table 4. Cross-sectional dependence and second-generation unit root testing.

		CIPS (second-generation unit roots)					
		No trend			Trend		
Variable	CSD test	Level	Difference	Order	Level	Difference	Order
ln(*GDP*)	40.52**	−3.730***	−6.100***	*I*(0)	−3.905***	−6.315***	*I*(0)
ln(*CBC*)	42.90***	−2.115	−5.813***	*I*(1)	−3.040***	−5.981***	*I*(0)
ln(*CIS*)	31.06***	−1.623	−5.703***	*I*(1)	−2.035	−5.887***	*I*(1)
ln(*MDTIs*)	29.88***	−2.796***	−5.793***	*I*(0)	−3.426***	−5.948***	*I*(0)
LR	*50.20***	2.61	2.61	–	1.7	1.7	–
INF	*50.20***	2.61	2.61	–	1.7	1.7	–
ln(*XRATE*)	*50.20***	2.61	2.61	–	1.7	1.7	–

*,**, *** Significance at 10%, 5% and 1% levels, respectively.

Table 5. Results of first-generation unit root testing with and without trend.

	IPS test					LLC test				
	Level		1st difference			Level		1st difference		
Variable	No trend	Trend	No trend	Trend	Order	No trend	Trend	No trend	Trend	Order
ln(*GDP*)	1.44	−7.68***	−23.30***	−22.9***	*I*(1)	−0.24	−6.55***	−21.3***	−20.6***	*I*(1)
ln(*CBC*)	−0.33	−2.95***	−15.46***	−15.2***	*I*(1)	−4.05***	−2.78***	−13.6***	−13.5***	*I*(0)
ln(*CIS*)	−1.47*	0.89	−12.65***	−11.6***	*I*(1)	−2.79***	−0.57	−12.1***	−11.8***	*I*(1)
ln(*MDTIs*)	−1.34*	−3.78***	−14.75***	−13.7***	*I*(0)	−2.39***	−2.33***	−10.7***	−10.3***	*I*(0)
LR	−0.09	−6.13***	−9.88***	−9.55***	*I*(1)	−1.48*	−6.9***	−9.08***	−9.36***	*I*(0)
INF	−9.86***	−16.0***	−16.78***	−13.5***	*I*(0)	−13.78***	−9.73***	−17.9***	−14.6***	*I*(0)
ln(*XRATE*)	−1.10*	1.73	−13.39***	−12.5***	*I*(1)	−4.44***	−1.22	−12.9***	−12.5***	*I*(1)

*,**,*** Significance at 10%, 5% and 1% levels, respectively.

Table 6. Pedroni, Kao and Westerlund cointegration test results.

Pedroni test			Kao test		Westerlund	
	Value		Statistic	Value	Statistic	Value
Statistic	No trend	Trend	Modified Dickey–Fuller t	−21.470***	Gt	−4.916***
Modified Phillips-Perron t	−1.964***	−1.689**	Dickey-Fuller t	−9.878***	Ga	−26.168***
Phillips–Perron t	−7.119***	−10.73***	Augmented Dickey–Fuller t	−6.917***	Pt	−16.294***
Augmented Dickey–Fuller t	−7.477***	−10.30***	Unadjusted modified Dickey–Fuller	−21.470***	Pa	−35.434***
			Unadjusted Dickey–Fuller t	−9.878***		

,*Significance at 5% and 1% levels, respectively.

macroeconomic controls, the lending rate (LR) and exchange rate (*lnXRATE*) are non-stationary at level and become stationary at first difference, hence are $I(1)$. Inflation (INF) is stationary at level under LLC but $I(1)$ under IPS, again indicating mixed order of integration. Overall, the presence of both $I(0)$ and $I(1)$ among variables justify the use of the Panel ARDL model, which accommodates such mixed integration orders.

The Pedroni, Kao and Westerlund panel cointegration tests examining the existence of a long-run equilibrium relationship between sectoral GDP and the ODCs' credit as well as macroeconomic controls are presented in Table 6. The Pedroni test, reported under both no-trend and trend specifications, reveals strong evidence of cointegration. The Modified Phillips-Perron t-statistic, Phillips–Perron t-statistic, and Augmented Dickey-Fuller (ADF) t-statistic are all significant at the 1% level in both specifications. Similarly, the Modified Phillips-Perron t-statistic also confirms significance at the 5% level. The Phillips-Perron and ADF statistics yield even stronger significance. The Kao test, which complemented the Pedroni test using a single-equation residual-based approach, further confirms cointegration. All reported test statistics, Modified Dickey-Fuller, Dickey-Fuller, and Augmented Dickey-Fuller t-tests, are highly significant at the 1% level. For robustness, Westerlund, a second generation, similarly reveals that all four test statistics Gt, Ga, Pt and Pa are highly significant at the 1% level, providing strong evidence to reject the null hypothesis of no cointegration. Together, these results provide evidence of panel cointegration, justifying the estimation of a Panel ARDL model to explore both short-run and long-run dynamics in the credit-sectoral growth relationship.

Table 7. Optimal lag selection for model.

	ARDL (p, q, q, q, q, q, q)						
Economic sectors	*lnGDP*	*lnCBC*	*lnCIS*	*lnMFI*	*LR*	*INF*	*lnXRATE*
Agriculture	4	3	0	4	1	2	4
Mining and Quarrying	1	0	0	0	3	0	0
Manufacturing	1	0	0	0	1	0	0
Trade	4	0	1	0	0	0	0
Transport and Communication	1	1	0	0	1	0	0
Electricity and Water	4	0	0	1	0	2	0
Mortgage, Construction and Real Estate	2	0	4	0	0	2	0
Business Services	2	0	0	1	0	0	0
Community, Social & Other Services	1	0	0	0	0	0	0
Personal and Household	3	3	4	4	1	1	0
Overall	***1***	***0***	***0***	***0***	***0***	***0***	***0***

Table 8. Selection of the appropriate estimator using the Hausman test.

	lnGDP (dependent variable)		
	MG	PMG	DFE
Long-run coefficients			
lnCBC	0.314* (0.176)	0.380*** (0.072)	0.139* (0.095)
lnCIS	0.050 (0.050)	−0.008 (0.026)	0.088*** (0.029)
lnMDTIs	0.143* (0.076)	0.123*** (0.038)	−0.025 (0.025)
LR	−0.289** (0.013)	−0.052*** (0.007)	−0.061*** (0.014)
INF	−0.064 (0.006)	0.004* (0.003)	0.005 (0.006)
lnXRATE	0.439 (0.483)	0.396*** (0.125)	0.772*** (0.241)
Short-run coefficients			
ECT	−0.579*** (0.117)	−0.301*** (0.088)	−0.456*** (0.037)
ΔlnCBC	−0.019 (0.075)	−0.031 (0.069)	−0.088 (0.101)
ΔlnCIS	−0.014 (0.033)	0.029 (0.025)	−0.049 (0.032)
ΔlnMFI	0.158 (0.154)	0.168 (0.162)	0.010 (0.018)
ΔLR	0.009 (0.006)	0.010*** (0.003)	0.008 (0.011)
ΔINF	−0.019** (0.008)	−0.018** (0.007)	−0.021*** (0.005)
ΔlnXRATE	0.149 (0.224)	0.191 (0.179)	−0.010 (0.295)
Constant	−0.152 (2.797)	−0.307*** (0.074)	−0.142 (0.679)
Hausman Test	$\chi^2 = 1.500$ (0.9596)		$\chi^2 = 0.25$ (0.9997)

*,**,***Significance at 10%, 5%, 1% levels and standard errors in parenthesis.

To determine the optimal lag structure for the panel ARDL model, separate ARDL estimations were conducted for each economic sector. Table 7 presents the selected lag orders under the $ARDL(p, q1, ..., q6)$ framework was based on Bayesian Information Criterion (BIC), where p denotes the number of lags for sectoral GDP and q_1 to q_6 correspond to the explanatory variables. The results reveal considerable heterogeneity across sectors. For example, agriculture and personal services required longer lags (up to four quarters), indicating delayed credit transmission effects. In contrast, sectors such as manufacturing, trade, and mining exhibit shorter lag structures, often zero or one, implying faster responsiveness to credit and macroeconomic variables. The overall panel model favored an $ARDL(1, 0, 0, 0, 0, 0, 0)$ structure, chosen based on the most frequent lag order across sectors, consistent with the approach of Zardoub (2023).

The long-run (LR) and short-run estimates for the three estimators are presented in Table 8. The Hausman test between the MG and PMG estimators suggests that we fail to reject the null hypothesis, implying that the PMG estimator is preferred over the MG estimator due to efficiency since the p-value is greater than the 5% significance level. The test result between PMG and DFE yields a similar conclusion thus the PMG model estimator is preferred over the DFE model estimator.

For long run effects, the PMG estimation results in Table 9 reveals evidence of long-run effect of ODCs' credit on sectoral GDP growth in Uganda. Commercial bank credit exerts a significant positive effect on sectoral GDP, that is, a 1% increase in credit by commercial banks is associated with an estimated 0.38% increase in sectoral GDP contributions, underscoring the critical role of commercial banking in sustaining long-term economic expansion, this is consistent with the findings of Duc (2024). Similarly, credit from micro-deposit taking institutions has a significant positive long-run effect, though the effect-size is less than that of commercial bank credit, that is to say, a 1% rise in micro-deposit taking institutions' credit leads to a 0.123% increase in sectoral GDP, highlighting the

Table 9. Long-run and short-run results using PMG estimator.

Main analysis (all sectors)			
Long-run estimates		Short-run estimates	
Variable	Coefficient (SE)	Variable	Coefficient (SE)
lnCBC	0.380*** (0.072)	Δ*lnCBC*	−0.031 (0.069)
lnCIS	−0.008 (0.026)	Δ*lnCIS*	0.029 (0.025)
lnMDTIs	0.123*** (0.038)	Δ*lnMDTIs*	0.168 (0.162)
LR	−0.052*** (0.007)	Δ*LR*	0.010*** (0.003)
INF	0.004* (0.003)	Δ*INF*	−0.018** (0.007)
lnXRATE	0.396*** (0.125)	Δ*lnXRATE*	0.191 (0.179)
ECT	−0.301*** (0.088)	*Constant*	−0.307*** (0.074)

*,**,***Significance at 10%, 5% & 1% levels and standard errors (SE) in parenthesis.

Table 10. Robustness checks using ARDL-PMG (sample of sectors) and PCSE approaches.

Robustness				
	Panel ARDL-PMG (7 sectors)		PCSEs	
	Long-run estimates	Short-run estimates	Common $AR(1)$, $\rho = 0.91$	Panel-specific $AR(1)$, $\rho = (0.81 - 0.97)$
Variables	Coefficient (SE)	Coefficient (SE)	Coefficient (SE)	Coefficient (SE)
lnCBC	0.367*** (0.076)	−0.042 (0.091)	0.273*** (0.087)	0.322*** (0.086)
lnCIS	−0.020 (0.028)	0.034 (0.035)	0.011 (0.038)	0.047 (0.035)
lnMDTIs	0.149*** (0.043)	0.143 (0.219)	0.042*** (0.013)	0.027** (0.012)
LR	−0.054*** (0.007)	0.012*** (0.003)	0.413 (0.301)	0.293 (0.292)
INF	0.005* (0.003)	−0.017** (0.008)	−0.008* (0.005)	−0.007 (0.005)
lnXRATE	0.365*** (0.132)	0.184 (0.257)	0.010 (0.011)	0.010 (0.011)
Constant		−0.208*** (0.070)	−0.675 (2.378)	−0.362 (2.389)
ECT		−0.331*** (0.120)		
R^2			0.564	0.859
Wald $\chi^2(6)$			39.08***	95.61***

*,**,***Significance at 10%, 5% & 1% levels and standard errors (SE) in parenthesis.

importance of inclusive financial systems in supporting smaller and medium economic segments thus consistent with (Olawale & Shiloh, 2024) findings. Conversely, credit from credit institutions shows no statistically significant effect on sectoral GDP in the long run. The overall short-run effects of the credit from Other Depository Corporations are all insignificant at 5% level of significance, indicating that credit's overall influence on sectoral output is not immediate but rather realized over time as Fawaier and Al-Tal (2025) put it. However, the error correction term's coefficient is negative and significant, confirming a stable long-run relationship among the variables that is, approximately 30.1% of deviations from the equilibrium are corrected in each quarter.

Furthermore, as indicated in Table 9, among the control variables, lending rates are negatively associated with sectoral growth at 1% level of significance, this indicates that a 1 percentage point increase in the lending rate reduces sectoral GDP by approximately 5.2% in the long run, which is consistent with (Buabeng et al., 2021; Okisai et al., 2022) thus emphasizing the growth-suppressing nature of higher borrowing costs. The exchange rate has a positive and significant effect in the long-run, implying that currency depreciation boosts GDP by 0.4% for every 1% change, likely by enhancing export competitiveness, this finding is consistent with the one of Kogid et al. (2012). Inflation displays a marginally significant positive effect at 10% level of significance, suggesting that modest inflation may have a small stimulative effect on growth, though the effect size is minimal (0.004% increase in GDP per 1% increase in inflation) thus further supported by the findings of Taderera et al. (2021). Among the macroeconomic variables in the short run, inflation has a negative and significant effect, meaning a 1% rise in inflation reduces GDP by approximately 1.8%, reflecting inflation's contractionary short-run influence on sectoral economic performance, this is contrary to the findings of Dinh (2020) where inflation had a positive effect on growth in the short run. Interestingly, lending rates in the short run have an overall positive and significant effect which is similar to the findings of Mohamed (2019), implying that short-run increases in interest rates, possibly indicating improved financial sector conditions, may be positively associated with sectoral growth. The short-run exchange rate effect remains insignificant, suggesting that currency movements do not influence sectoral output immediately but may do so in the long run.

Table 11. Dumitrescu & Hurlin Granger causality test results.

Variable	Lag (BIC)	W-bar	Z-bar	*p*-value (Z)*	Critical value (Z)	Z-bar tilde	*p*-value (Z-bar tilde)*	Critical value (Z-bar tilde)	Decision	Conclusion
lnCBC	1	5.32	9.66	0.002	6.131	8.930	0.002	5.636	Reject H_0 at 1% level	Strong Granger-Causality
lnCIS	1	2.36	3.05	0.150	4.617	2.757	0.150	4.224	Fail to Reject H_0 at 5%	No Granger-Causality
lnMDTIs	1	2.95	4.36	0.037	4.072	3.979	0.037	3.715	Reject H_0 at 5% level	Granger-Causality

Source: Author's computation.

To validate the baseline findings, robustness tests presented in Table 10 were conducted using the ARDL-PMG estimator on a reduced panel of seven sectors excluding Business services, community & social services and Personal & Household services sectors identified as the least contributors to GDP for the observed period and alternative estimation via Prais-Winsten regressions with panel-corrected standard errors (PCSE) were employed to account explicitly for cross-sectional dependence, using both common and panel-specific AR(1) error structures. Results indicate that across specifications, the long-run positive contributions of commercial bank credit and MDTI credit to sectoral GDP remain stable and statistically significant, while credit institutions continue to exhibit no significant effect. Although lending rates, inflation, and exchange rate retain significance in the PMG models, their effects weaken or turn insignificant once cross-sectional dependence (CSD) is addressed under PCSE. These results confirm that the credit-growth relationship in Uganda is primarily driven by commercial banks and MDTIs, with macroeconomic variables exerting less robust influence.

To compliment and ascertain the results of the panel-ARDL in Table 9, we establish the Granger-causal relationship between credit from ODCs and sectoral GDP growth using the Dumitrescu and Hurlin (2012) Granger non-causality test. The test utilized bootstrapped *p*-values (1,000 replications) and the optimal lag length was selected based on the Bayesian Information Criterion (BIC). The null hypothesis that the predictor variable (credit) does not Granger-cause sectoral GDP was tested for each Other Depository Corporation (ODC). Results were evaluated using Z-bar and $\tilde{Z}-$ bar statistics, alongside their corresponding p-values and critical values as summarized in Table 11. The findings provided insights into the causal dynamics of financial credit allocation on sectoral economic growth.

For Credit from Commercial Banks, the null hypothesis that commercial bank credit does not Granger-cause sectoral GDP was rejected at the 1% level of significance. Both Z-bar and $\tilde{Z}-$ bar statistics exceed their respective critical values; this indicates strong evidence of causality. For Credit from Credit Institutions, the null hypothesis couldn't be rejected at the 5% level. Both Z-bar and $\tilde{Z}-$ bar statistics are below the respective critical values; thus, no significant causality is detected. For Credit from Micro-deposit taking Institutions, the null hypothesis can be rejected at the 5% level, the statistics exceed the critical values at the 5% threshold, suggesting causality. These findings are in-line with the long run results of the panel ARDL-PMG model results above in Table 9.

Discussion of findings

The estimated long-run elasticities, although significant, appear relatively inelastic at 0.38% for commercial bank credit and 0.12% for micro-deposit-taking institutions (MDTIs). Within the Ugandan credit environment, however, these effects are economically meaningful. The country's financial system is characterized by high lending rates, stringent collateral requirements and limited access to affordable long-term credit, particularly for productive sectors such as agriculture and manufacturing (BOU, 2023; UBOS, 2023). In such a constrained environment, even modest percentage increases in sectoral GDP reflect substantial real gains in employment creation, household incomes and productivity. This aligns with findings from Olawale and Shiloh (2024), who emphasize the importance of inclusive financial systems in supporting sectoral expansion, and Duc (2024), who highlights the long-run role of private credit in sustaining growth. The results therefore suggest that credit, though limited in scale, remains a critical driver of sectoral growth and that improvements in credit allocation efficiency could magnify these effects (King & Levine, 1993; Patrick, 1966).

The insignificance of credit from credit institutions in both the short and long run may reflect their limited engagement with high-risk, informal, and rural sectors. Credit institutions typically operate under tighter risk management frameworks and face higher funding costs, which restrict lending to sectors with weak collateralization such as agriculture and small-scale services. This supports the view that Uganda's sectoral credit allocation reflects not only financial capacity but also perceived sectoral risk and formality levels, consistent with Stiglitz and Weiss (1981). Moreover, these are relatively small in scale compared to commercial banks, with limmited capital. For example three Banks (ABC Capital Bank (U) Limited, Guaranty Trust Bank (U) Limited and Opportunity Bank) transitioned from Tier I (commercial banks) to Tier II (Credit institutions) license due capital requirements effective from July 2024 (BOU, 2024). Additionally, these often target niche markets such as consumer loans and short-term financing. Their operations are typically characterized by higher interest spreads and shorter repayment horizons, which may not align with the financing needs of growth-enhancing sectors like agriculture and industry that require long-term investment capital (Florence & Nathan, 2020). Moreover, issues of borrower quality, weak targeting mechanisms and limited outreach reduce the ability of credit institutions to generate measurable macroeconomic effects (Brixiová et al., 2020). These structural and institutional constraints likely explain why their credit appears statistically insignificant in driving sectoral GDP growth, consistent with similar findings in other Sub-Saharan African economies where small-scale lenders have limited influence on aggregate output (Fawaier & Al-Tal, 2025; Njoku et al., 2023).

Conclusion and policy recommendations

The findings reveal that credit from commercial banks and MDTIs significantly enhances sectoral GDP in the long-run but not in the short-run, while credit from credit institutions does not. Additionally, although Commercial Banks' credit and MDTIs' credit showed significant positive effect on sectoral growth in the long run, this relationship is inelastic, thus indicating the need to streamline the credit allocation mechanism that forefronts productive sectors such as agriculture, manufacturing, among others. These results further underscore the need for targeted credit policies that prioritize financial channels with demonstrated sectoral growth effect, in support of Uganda's inclusive growth and financial development goals.

On policy recommendations, while maintaining low interest rates would ease borrowing constraints, it may not be feasible in Uganda's current fiscal and inflationary environment. Instead through government and development agencies partnering with commercial banks and MDTIs, more practical policy options lie in targeted interventions that expand access to affordable credit without compromising macroeconomic stability. These may include concessional lending schemes directed at high-potential but credit-constrained sectors such as agriculture and manufacturing, credit guarantee facilities that reduce the perceived risks faced by financial institutions, and sector-specific subsidies designed to lower the effective cost of borrowing. Such mechanisms would align credit policy with national development priorities while avoiding the broad fiscal pressures associated with generalized interest rate reductions. Policy makers should also consider a review of the structure and operations credit institutions. By focusing on targeted and risk-sharing approaches, policymakers can improve credit allocation efficiency, stimulate sectoral growth, and advance inclusive development.

Limitations and future research directions

The omission of sector-specific factors such as government policies, foreign direct investment, and global commodity price fluctuations due to data limitations, which may influence sectoral GDP and potentially bias the results.

The sectoral GDP contributions data are only available on a quarterly basis from 2010/11Q1 to 2023/24Q4 financial years, which, while appropriate, may not fully reflect the long-term effects of credit especially for large infrastructure projects and long-horizon agricultural investments which often require longer time frames for their growth impacts to materialize. Future research should therefore employ extended time series to provide a more comprehensive picture of the credit-growth relationship.

There is also lack of detailed data on Uganda's informal sector, which is not well profiled by sector over the study period in official statistics. Since sectors such as Agriculture, Trade and Business services are heavily characterized by informality, the analysis may not fully capture the representativeness of firms that are unable to access credit from ODCs. Future research should incorporate datasets that explicitly measure informal sector activity or develop proxies to better account for its role in sectoral growth.

Notes

1. ODCs' Credit Data and Sector categorization by used in this dissertation are based on BOU's economic sector categorization found here https://bou.or.ug/bouwebsite/bouwebsitecontent/statistics/MonetaryStatistics/Credit-By-Sector.xls
2. Data on sectoral GDP Contributions was sourced here: https://www.ubos.org/explore-statistics/9/.

Author contributions

CRediT: **Steven Katende**: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Software, Visualization, Writing – original draft, Writing – review & editing; **James Wokadala**: Formal analysis, Methodology, Supervision, Validation, Writing – review & editing; **John Bosco Asiimwe**: Formal analysis, Methodology, Supervision, Validation, Writing – review & editing.

Disclosure statement

No potential conflict of interest was reported by the authors.

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Data availability statement

The data that support the findings of this study are available from the corresponding author Steven Katende (katendesteven591970@gmail.com or skatende@eprcug.org) upon reasonable request.

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