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Quantile Regression Analysis of the Economic Impact of Business and Household Credit in Lesotho

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Abstract

What role does credit allocation play in shaping economic performance in small, developing countries? While prior research shows that business credit tends to support growth and household credit may lead to instability, most studies focus on larger economies. Using quarterly data from Lesotho between 2009 and 2020, this study applies quantile regression to examine how credit to businesses and households affects real economic output across different performance levels. Business credit significantly enhances output, especially in lower-performing periods, while household credit consistently has a negative effect. These results are robust across estimation methods. The findings suggest that business credit supports investment and productivity, whereas household credit may fuel consumption-driven debt. This highlights the need for targeted credit policies to promote productive lending and financial stability in developing economies.

Keywords

Credit Allocation, Economic Performance, Quantile Regression, Household Credit, Business Credit

1. Introduction

The role of credit in economic development has been extensively researched, with particular emphasis on how credit to business enterprises and households influences economic performance such as the growth in gross domestic product (GDP). This study aims to examine the effects of credit to business enterprises and households on economic performance in Lesotho, utilizing quantile regression tech-

niques to capture the heterogeneous impacts across different levels of economic performance.

Credit to business enterprises is often posited to have a positive effect on economic growth by facilitating investment in productive activities, enhancing capital formation, and fostering innovation. Empirical evidence from various countries supports this view, indicating that business credit is positively associated with economic performance (Beck et al., 2012b; Sassi & Gasmi, 2014). For instance, in their study on the effects of business and household credit on economic performance in Malaysia, Law et al. (2021) found that business credit significantly boosts economic growth, especially when supported by strong institutional quality.

Conversely, the impact of household credit on economic performance is more nuanced. While household credit can stimulate consumption and improve living standards, excessive household debt may lead to financial instability and lower economic growth. Studies have shown mixed results, with some indicating that household credit has an insignificant or even negative effect on economic performance in the medium term (Law et al., 2021; Mian et al., 2017; Tunc & Kilinc, 2022; Arcand et al., 2015).

The remainder of the paper is organized as follows: Section 2 provides a comprehensive review of the literature. Section 3 describes the methodology and data used in the study. Section 4 presents the study results, offering a thorough analysis and discussion. Finally, Section 5 concludes the paper with key findings, policy recommendations and areas for future study.

2. Literature Review

The relationship between bank credit and economic performance has long been a central theme in development economics. This section synthesizes key contributions from the literature, emphasizing the dual role of credit in fostering growth and inducing volatility, and highlighting the importance of credit composition and institutional context.

A substantial body of research affirms that credit to the private sector—particularly to businesses—can stimulate economic growth by enhancing productivity, investment, and innovation. Studies such as Beck et al. (2005), Levine et al. (2000), Hassan et al. (2011), Kar et al. (2011), and Rahaman (2011) consistently demonstrate that access to credit is positively associated with firm-level and macroeconomic performance, especially in economies with robust financial systems and inclusive financial institutions.

In contrast, household credit presents a more complex picture. While it can support consumption and improve welfare in the short term, excessive household borrowing may lead to macroeconomic instability. Research by Barrail (2020), Bahadir & Valev (2017), and Sim & Lee (2020) shows that household credit expansion can amplify consumption volatility and undermine long-term growth, particularly in emerging and transition economies.

The structure and institutional quality of credit markets also play a decisive role.

Laeven (2002) and Ma et al. (2019) highlight that easing financing constraints for SMEs through targeted reforms can significantly boost entrepreneurship and economic dynamism. Similarly, Bezemer and Zhang (2019) and Ekinci and Omay (2020) caution against imbalanced credit growth—especially when household credit outpaces business credit—linking such trends to post-crisis growth losses and external imbalances.

A growing strand of literature underscores the nonlinear and threshold effects of credit. Cecchetti and Kharroubi (2012) and Arcand et al. (2015) argue that beyond certain levels, credit expansion may hinder growth due to resource misallocation. Hung (2009) and Beck et al. (2012a) further distinguish between productive and non-productive credit, emphasizing that the composition of credit—whether directed toward investment or consumption—critically shapes its economic impact.

Overall, the literature reveals a nuanced and context-dependent relationship between credit and growth. While access to credit is widely recognized as a catalyst for development, its effectiveness depends on the type of credit, the institutional environment, and macroeconomic conditions. These insights underscore the need for differentiated credit policies and sound financial regulation to maximize the developmental benefits of credit while mitigating associated risks.

3. Country Context

Lesotho, a small, landlocked country in Southern Africa, presents a unique context for examining the finance-growth nexus. Figure 1 illustrates the quarterly trends in private sector credit by banks to businesses and households from 2009: Q1 to 2020: Q4. The graph reveals that the percentage share of credit allocated to the business sector generally fluctuates but shows a slight upward trend over the period. In contrast, the household sector credit exhibits a more stable trend with occasional increases, maintaining a significant share throughout.

Figure 2 illustrates the quarterly seasonally adjusted GDP trend from 2009 Q1 to 2020 Q4. The figure reflects a highly volatile economic landscape. The average GDP growth rate over this period was 0.3632, with a significant standard deviation of 4.0209, indicating substantial fluctuations. The data reveals several periods of economic downturn, most notably in 2009 Q2, 2015 Q4, and a dramatic decline in 2020 Q2, which can be attributed to the global impact of the COVID-19 pandemic. Conversely, there were notable recovery phases, such as in 2016 Q1 and 2020 Q3, where GDP growth rebounded strongly.

The connection between Figure 1 and Figure 2 lies in examining how changes in credit allocation might influence or correlate with economic performance. For instance, increased household credit could lead to higher consumer spending, potentially impacting GDP growth. The steady increase in household credit suggests improved access to finance for consumers, which can boost economic activity through higher consumption. On the other hand, the stagnant trend in business credit indicates potential challenges for businesses in accessing finance, which could hinder investment and growth.
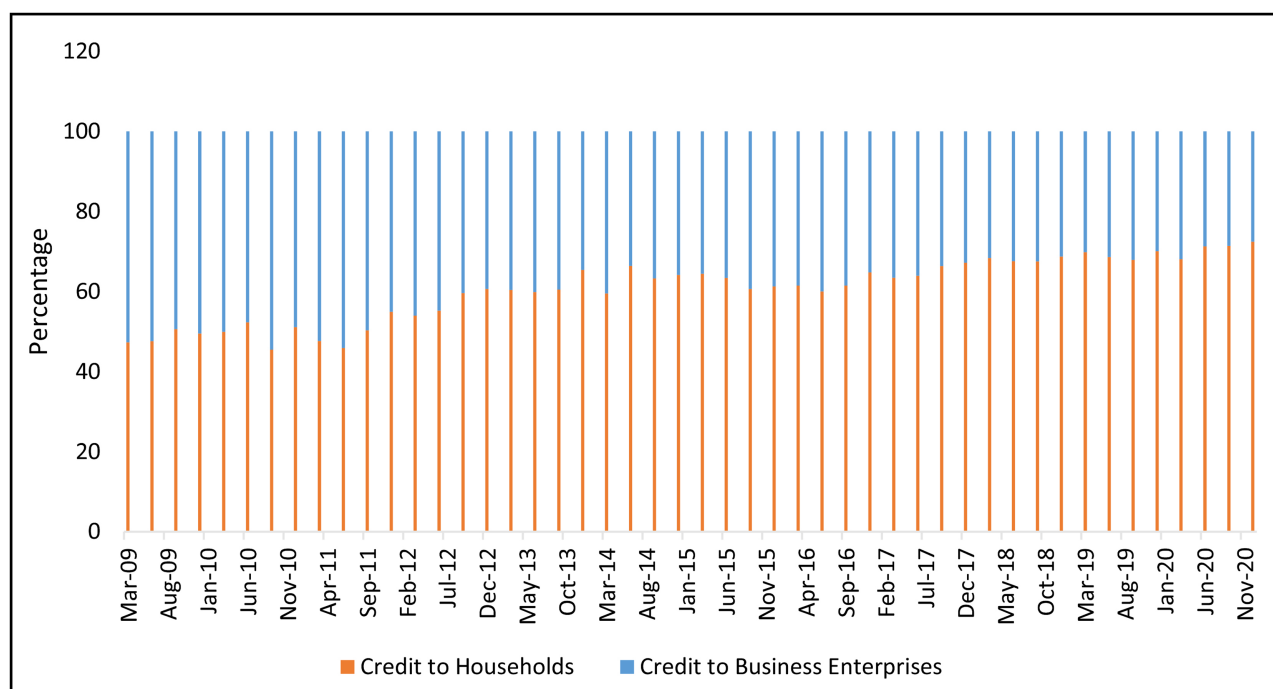
Source: Central Bank of Lesotho.

Figure 1. Private sector credit trends from 2009: Q1 to 2020: Q4.
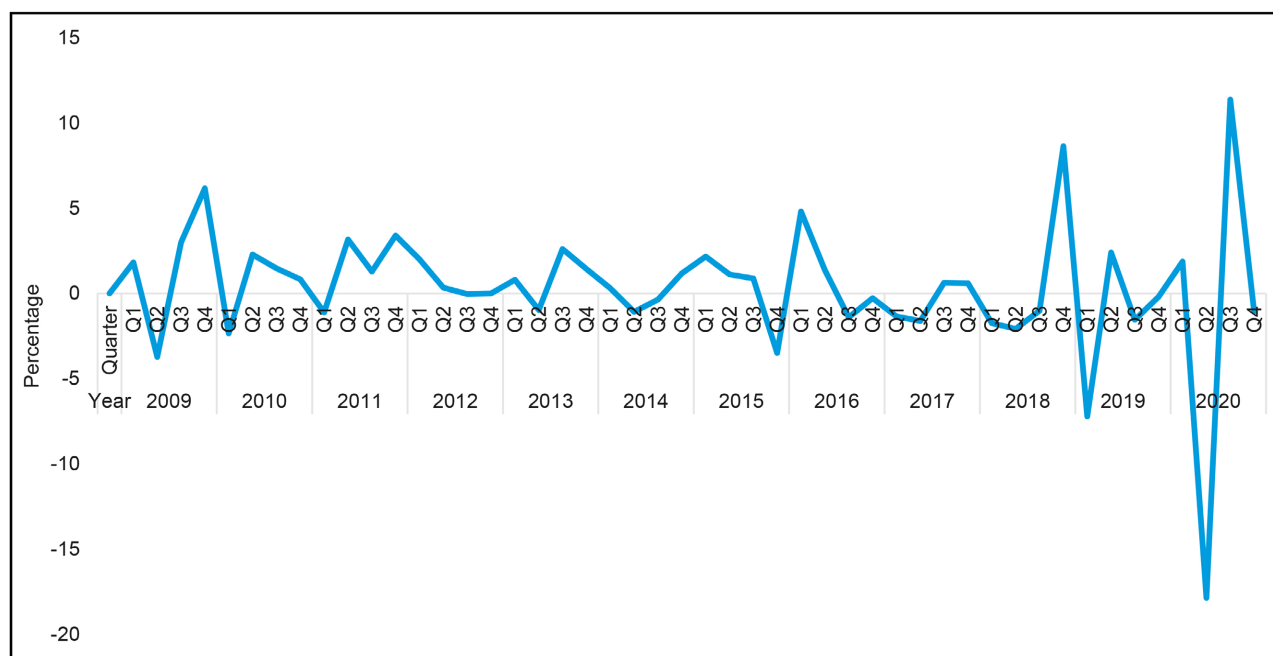
Source: Lesotho Bureau of Statistics.

Figure 2. Economic performance trends from 2009: Q1 to 2020: Q4.

The high volatility in GDP growth underscores the sensitivity of Lesotho's economy to external shocks and internal factors. These developments, as illustrated in **Figure 1** and **Figure 2**, make Lesotho an interesting case study for understanding

the finance-growth nexus. By analysing the interplay between credit allocation and economic performance, this study can provide valuable insights into the dynamics of economic growth in a small, developing country.

Recent studies highlight the importance of financial development, including bank credit, in promoting economic growth in Lesotho. These studies use various econometric techniques, mostly focusing on the conditional mean.

Amadasun and Mutezo (2022) find that access to finance, including financial information, bank support services, and collateral requirements, significantly impacts the competitive growth of SMEs. Improving access to finance through targeted policies could enhance SME growth. Motelle (2011) shows that remittances positively affect financial development by increasing demand for financial services and providing alternative financing, thus supporting economic growth.

Sekantsi and Kalebe (2015) find that savings drive capital accumulation, contributing to economic growth. Investment-led growth is crucial for sustainable development. Molapo and Damane (2017) identify a positive relationship between private sector credit and bank deposits, while net foreign assets and interest rates negatively impact credit supply. They recommend expanding access to finance through the Financial Sector Development Strategy.

Against this background, this study makes significant contributions to the existing literature on credit dynamics and economic performance. Firstly, by employing heterogeneous impact analysis, it examines the effects of credit on business enterprises and households across different levels of economic performance. This method offers a nuanced understanding of how these effects vary across the economic spectrum, addressing a notable gap in the literature that predominantly relies on mean regression techniques.

Secondly, the study offers context-specific insights by focusing on Lesotho, a small, developing country with unique economic and financial characteristics. Much of the existing research tends to concentrate on larger economies, thereby overlooking the distinct dynamics present in smaller, developing nations. By examining Lesotho, this study enriches the global understanding of credit dynamics in diverse economic settings.

Thirdly, the study conducts a comparative analysis by simultaneously investigating the impacts of both business and household credit. This dual examination highlights the differential roles these types of credit play in economic performance, providing a more comprehensive view of the credit-growth nexus that is often missing in the literature.

Lastly, the study presents policy-relevant findings that are expected to inform the broader debate on the optimal allocation of credit in developing economies. By identifying the conditions under which business and household credit are most beneficial, the study contributes to the formulation of more effective financial policies.

The insights from this study have several implications for policy making, particularly in the context of Lesotho and similar economies. Firstly, the study offers

guidance on informed credit allocation. By understanding the differential impacts of business and household credit, policymakers can design credit policies that maximize economic benefits, thereby allocating resources more efficiently to stimulate growth. Secondly, the study's findings on the potential risks associated with excessive household credit can aid in risk management. These insights can guide the development of regulatory frameworks aimed at maintaining financial stability, which is crucial for preventing financial crises that may arise from unsustainable debt levels.

Thirdly, the use of quantile regression allows for the identification of specific economic segments that benefit most from credit expansion. This enables targeted interventions, ensuring that credit reaches the sectors and households that can leverage it for maximum economic impact. Lastly, by providing empirical evidence on the effects of credit in a developing country context, the study supports evidence-based policy making. It offers concrete data and analysis that can be used to justify and refine financial policies, making them more responsive to the actual needs and conditions of the economy.

In summary, this study not only advances academic understanding of the credit-growth relationship but also provides practical insights that can help shape more effective and sustainable financial policies in Lesotho and other developing economies. By addressing gaps in the literature and offering policy-relevant findings, the study makes a valuable contribution to both academic research and practical policy making.

4. Empirical Model, Econometric Methodology and Data

4.1. Empirical Model

To evaluate the effects of banks' credit to households and businesses on economic performance in Lesotho, we employ an empirical model like those used by Sassi and Gasmi (2014) and Law et al. (2021). The general model is presented as follows:

$$RGDP_t = \alpha + \beta_1 BC_t + \beta_1 HC_t + \beta_i X_t + \varepsilon_t \tag{1}$$

where RGDP is real seasonally adjusted GDP, BC and HC represent credit to businesses and households, respectively, and (X) is a vector of control variables which comprise government expenditure and interest rates. ε_t is the error term.

Government expenditure is another vital control variable. Fiscal policy, through government spending, plays a significant role in stimulating economic activity. During economic downturns, increased government expenditure can boost demand for goods and services, directly contributing to GDP growth. Additionally, public investments in infrastructure, education, and healthcare can enhance productivity and foster long-term economic growth. In Lesotho, where government spending can be a substantial part of the economy, controlling for this variable ensures that the analysis accurately reflects the independent effects of bank credit on economic performance. This differentiation between growth driven by fiscal policy and that driven by credit expansion is essential (Barro, 1990; Easterly

& Rebelo, 1993).

Interest rates are a primary tool of monetary policy and a crucial determinant of economic activity. They influence borrowing costs for households and businesses, affecting consumption and investment decisions. Lower interest rates typically encourage borrowing and spending, while higher rates can restrain these activities. In this study, interest rates directly impact the effectiveness of credit provided by banks. Including interest rates as a control variable allows the study to account for the broader monetary policy environment and its influence on economic performance. This inclusion helps ensure that the observed effects of bank credit on GDP are not confounded by changes in borrowing costs (Bernanke & Blinder, 1992; Mishkin, 1996).

4.2. Estimation Method

Quantile regression techniques, introduced by Koenker & Bassett (1978), provide crucial insights into the impact of bank credit across different levels of economic performance. This method reveals how credit influences growth under varying conditions, offering a more detailed analysis than mean-focused approaches (Yu, Lu, & Stander, 2003). Insights from these techniques could guide targeted financial interventions to foster inclusive growth (Buchinsky, 1998). These approaches enhance the robustness of the estimates by reducing sensitivity to outliers and capturing heterogeneity across the distribution of economic performance, thereby providing more reliable and context-specific insights.

Incorporating quantile regression would enrich existing studies in Lesotho, which have primarily used cointegration and focused on the conditional mean. This approach would validate findings from other methods and offer fresh perspectives. Additionally, quantile regression is less sensitive to outliers compared to ordinary least squares regression, improving robustness. Applying this method to study the impact of bank credit on Lesotho's economic performance would yield a deeper understanding of the financial sector's role. It would reveal differential impacts across various economic conditions and segments, providing essential insights for researchers and policymakers.

To evaluate the effects of banks' credit to households and businesses on economic performance in Lesotho, this study employs the robust Simultaneous Quantile Regression (SQR) method advanced by Tokdar and Kadane (2011). This technique uses a semiparametric Bayesian framework to simultaneously analyse linear quantile regression models, addressing the computational challenges of maintaining monotonicity in quantile curves. Building on the foundational work of Koenker and Bassett (1978) and Koenker (2005), SQR allows for the estimation of multiple conditional quantiles of a response variable at once, ensuring non-crossing quantile functions. This provides a comprehensive understanding of the relationship between predictors and the response variable across different points of the conditional distribution. SQR is particularly suited for this analysis as it captures the varying impacts of credit across different levels of economic perfor-

mance, offering a detailed view beyond the mean effects. While the study does not employ instrumental variables or exploit policy reforms for causal identification, the primary objective is to uncover distributional patterns and associations between credit types and economic performance. The quantile regression framework is well-suited for this purpose, offering robust insights into heterogeneity across the GDP distribution without requiring strong assumptions about exogeneity. By examining how credit impacts real GDP at different quantiles, SQR reveals how credit influences both lower and higher levels of economic performance.

The linear quantile regression model in our study can be expressed as:

$$q_\tau\left(RGDP_t \mid I_t\right) = \alpha_t + \beta_t C_t + \varepsilon_t \qquad (2)$$

where $q_\tau\left(RGDP_t \mid I_t\right)$ denotes the conditional quantile function of the real GDP ($RGDP_t$) at quantile (τ), given the information set (I_t). Essentially, it represents the value below which a proportion (τ) of the data falls, conditional on (I_t). α_t is the intercept term for the (τ)-th quantile. It varies with (τ), indicating that different quantiles can have different intercepts. (β_t) is the slope coefficient for the (τ)-th quantile, associated with the covariate (C_t). Like the intercept, it varies with (τ), showing that the effect of (C_t) on ($RGDP_t$) can differ across different quantiles of the distribution. (C_t): This is the covariate or predictor variable at time (t). It could represent any factor that is believed to influence ($RGDP_t$). ε_t is the error term, capturing the deviation of the observed ($RGDP_t$) from the predicted quantile.

4.3. Data

This study utilizes quarterly time series datasets covering the period from 2009: Q1 to 2020: Q4. The chosen timeline is justified by the availability of reliable quarterly data and the relevance of this period in capturing critical economic dynamics in Lesotho. Table 1 presents the study data, detailing various economic variables, their descriptors, transformations applied, and sources. Real GDP is represented as quarterly GDP, seasonally adjusted, deflated by the Consumer Price Index (CPI), and converted to natural logarithms, sourced from the Lesotho Bureau of Statistics. Business credit includes loans extended by banks to business enterprises across multiple sectors, also deflated by CPI and converted to natural logs, with data from the Central Bank of Lesotho. To mitigate the influence of long-run trends and ensure stationarity, all time series variables were tested for unit roots and transformed accordingly. Specifically, real GDP and credit variables were seasonally adjusted, deflated, and log-transformed to remove deterministic trends and stabilize variance.

Household credit encompasses loans extended by banks to households, such as mortgages and personal loans, similarly deflated by CPI and converted to natural logs, sourced from the Central Bank of Lesotho. Government expenditure measures the central government's spending on goods and services, deflated by CPI and converted to natural logs, sourced from the Ministry of Finance and Development

Planning. Lastly, Interest rates are represented by the prime lending rate, with data from the Central Bank of Lesotho, and no transformation applied.

Table 1. Study data.

Name of Variable	Notation	Descriptor	Transformation	Source
Real GDP	realgdp	Quarterly GDP seasonally adjusted	Deflated by CPI and converted to natural logs	Lesotho Bureau of Statistics
Business Credit	business_credit	Loans extended by banks to business enterprises across multiple sectors of production	Deflated by CPI and converted to natural logs	Central Bank of Lesotho
Household Credit	household_credit	Loans extended by banks to households in the form of mortgage and personal loans	Deflated by CPI and converted to natural logs	Central Bank of Lesotho
Government Expenditure	g_exp	Expenditure by central government on goods and services	Deflated by CPI and converted to natural logs	Ministry of Finance and Development Planning
Interest Rates	r	Prime lending rate		Central Bank of Lesotho

Table 2 reports the descriptive statistics of the study variables in their original units of measurement. Real GDP shows substantial growth variability, underscoring the dynamic economic activity in the country. Business credit and household credit exhibit steady increases and significant fluctuations, respectively, suggesting varying access to credit for businesses and households. Stable interest rates suggest a consistent monetary policy environment. These trends underscore the critical economic dynamics of Lesotho and provide a foundation for analyzing the impact of bank credit on the economy.

Table 2. Descriptive statistics.

Variable	Obs.	Units of measurement	Mean	Std. Dev.	Min	Max
realgdp	48	Maloti (million)	767277.18	96033.895	507167.91	872574.81
business_credit	48	Maloti (million)	246074.56	41003.076	148228.03	309707.44
household_credit	48	Maloti (million)	413087.35	152858.21	133085.66	606153.56
g_exp	48	Maloti (million)	115162.12	43277.64	59620.645	276025.44
r	48	percent	10.81	1.06	8.187	14.5

Source: Authors' calculation.

The pairwise correlations presented in Table 3 reveal significant relationships between the study variables. Real GDP shows a notable negative correlation with business credit (-0.317, $p = 0.028$) and household credit (-0.791, $p = 0.000$), indicating that as real GDP increases, these variables tend to decrease. Business credit is strongly positively correlated with household credit (0.757, $p = 0.000$),

suggesting that increases in business credit are associated with increases in household credit. Government expenditure shows weaker correlations, with a non-significant negative correlation with Real GDP (-0.171, $p = 0.247$). Interest rates have a positive correlation with Real GDP (0.250, $p = 0.086$) and government expenditure (0.213, $p = 0.147$), though these are not statistically significant, and a negative correlation with business credit (-0.205, $p = 0.163$) and household credit (-0.285, $p = 0.050$). These correlations underscore the interconnectedness of economic variables in Lesotho, highlighting how changes in credit availability and government expenditure can significantly impact economic performance.

However, the negative pairwise correlations between real GDP and the credit variables, particularly business credit, may reflect the influence of confounding factors such as interest rates or government expenditure. These bivariate relationships do not account for such controls, which are explicitly addressed in the multivariate quantile regression models presented later. This helps explain why the regression results reveal more nuanced and economically intuitive effects.

Table 3. Pairwise correlations.

Variables	(1)	(2)	(3)	(4)	(5)
(1) realgdp	1.000				
(2) business_credit	−0.317 (0.028)	1.000			
(3) household_credit	−0.791 (0.000)	0.757 (0.000)	1.000		
(4) g_exp	−0.171 (0.247)	0.239 (0.102)	0.216 (0.141)	1.000	
(5) r	0.250 (0.086)	−0.205 (0.163)	−0.285 (0.050)	0.213 (0.147)	1.000

Source: Authors' calculation.

5. Empirical Results

5.1. Quantile Regression Results

In our estimation of the effect of business credit and household credit on the different conditional quantiles of real GDP in Lesotho, we employ the Simultaneous Quantile Regression (SQR) method advanced by Tokdar and Kadane (2011). This technique enables the estimation of conditional quantile functions, providing a more comprehensive analysis of the impact across the distribution of real GDP. Table 4 presents the quantile regression results with bootstrapped standard errors at the 10th, 20th, 30th, 40th, 50th, 60th, 70th, 80th, and 90th quantiles. For comparison, it also includes the ordinary least squares (OLS) regression results. This comparative analysis highlights how the effects of business and household credit vary across different points in the real GDP distribution, not just at the mean.

Table 4. Result of quantile regression and OLS regression.

Variables	(1) Q10	(2) Q20	(3) Q30	(4) Q40	(5) Q50	(6) Q60	(7) Q70	(8) Q80	(9) Q90	OLS
business_credit	0.667***	0.62***	0.689***	0.727***	0.702**	0.399	0.363	0.099	0.03	0.671***
	(0.207)	(0.209)	(0.205)	(0.254)	(0.266)	(0.289)	(0.259)	(0.19)	(0.237)	(0.111)
household_credit	−0.38***	−0.378***	−0.421***	−0.475***	−0.458***	−0.317**	−0.304**	−0.165*	−0.137	−0.405***
	(0.093)	(0.081)	(0.092)	(0.108)	(0.114)	(0.124)	(0.123)	(0.094)	(0.115)	(0.046)
g_exp	−0.008	0.005	−0.006	−0.004	−0.017	−0.017	−0.014	0.002	0.015	−0.042
	(0.055)	(0.054)	(0.055)	(0.041)	(0.032)	(0.035)	(0.026)	(0.027)	(0.021)	(0.037)
r	0.036	0.024	0.017	−0.004	−0.014	−0.03	−0.038**	−0.033***	−0.028*	0.01
	(0.024)	(0.03)	(0.04)	(0.032)	(0.029)	(0.027)	(0.018)	(0.011)	(0.015)	(0.012)
cons	9.762***	10.321***	10.244***	10.706***	11.088***	13.221***	13.564***	14.839***	15.127***	10.809***
	(1.744)	(2.002)	(1.964)	(2.037)	(1.99)	(2.034)	(1.625)	(1.243)	(1.467)	(0.997)
Pseudo R^2	0.6367	0.6006	0.5447	0.4842	0.4367	0.4221	0.3879	0.3581	0.3418	0.6848
Observations	48	48	48	48	48	48	48	48	48	48

Source: Authors' calculation; **Note:** The dependent variable for the quantile and OLS regressions is realgdp. Figures in parentheses are standard errors. ***, ** and *denote significance at 1%, 5% and 10% levels, respectively. The Adjusted R^2 is reported in the case of the OLS regression.

The results from the quantile regression and OLS regression analyses reveal significant insights into the impact of banks' credit to businesses and households on Lesotho's economic performance, as proxied by real GDP. Across most quantiles, business credit consistently shows a positive and significant effect on real GDP, with coefficients ranging from 0.667 at the 10th quantile to 0.727 at the 40th quantile. This positive impact diminishes at higher quantiles, becoming insignificant at the 80th and 90th quantiles. The OLS regression confirms this positive relationship with a coefficient of 0.671, significant at the 1% level.

Conversely, household credit exhibits a consistently negative and significant impact on real GDP across all quantiles, with coefficients ranging from −0.38 at the 10th quantile to −0.475 at the 40th quantile. This negative effect also diminishes at higher quantiles, becoming insignificant at the 90th quantile. The OLS regression supports this finding, with a coefficient of −0.405, significant at the 1% level.

These findings have important implications for Lesotho's economic policy. The positive impact of business credit on real GDP suggests that policies aimed at increasing access to credit for businesses could stimulate economic growth. This aligns with findings from other studies, such as Delis et al. (2021), who found that access to credit significantly boosts income and economic performance for small businesses. Similarly, Were, Nzomoi and Rutto (2012) observed that private sector credit positively impacts economic performance in Kenya.

On the other hand, the negative impact of household credit on real GDP indicates that increasing household debt may hinder economic growth. This could be due to households using credit for consumption rather than investment, which

does not contribute to productive economic activities. This finding is consistent with the Federal Reserve Board (2021) observations that high levels of household debt can pose risks to economic stability.

Overall, the results suggest that targeted credit policies that prioritize business credit over household credit could enhance economic growth in Lesotho. Policymakers should consider measures to improve access to credit for businesses, such as reducing borrowing costs and providing guarantees for business loans. At the same time, they should be cautious about expanding household credit without ensuring that it is used for productive purposes.

Figure 3 presents the relationship between business credit and economic performance (proxied by the real GDP) across different quantiles. The horizontal axis represents quantiles ranging from 0 to 1, while the vertical axis shows the coefficients, ranging from −0.5 to 1.5. The dashed blue line with markers represents the quantile regression (qreg) estimates, the solid red line represents the ordinary Least Squares (OLS) estimate, and the shaded area indicates the 95% pointwise confidence interval for the qreg estimates.
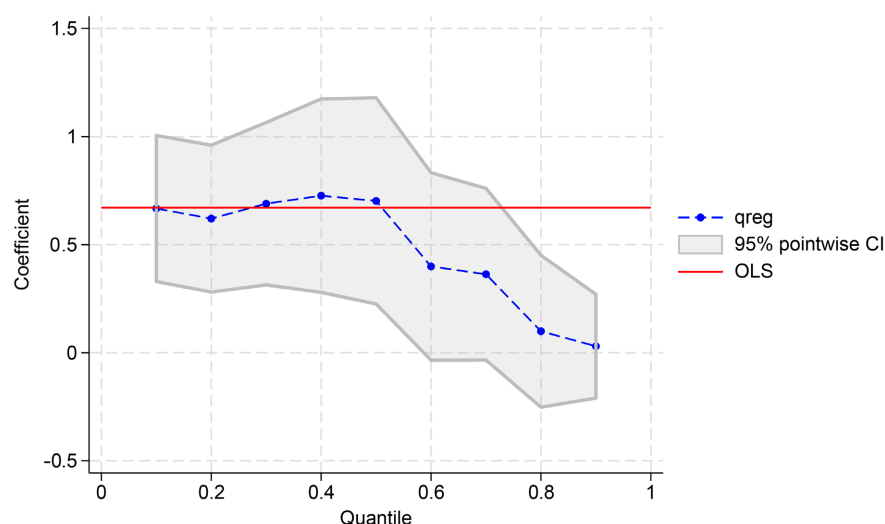
Source: Authors' calculation.

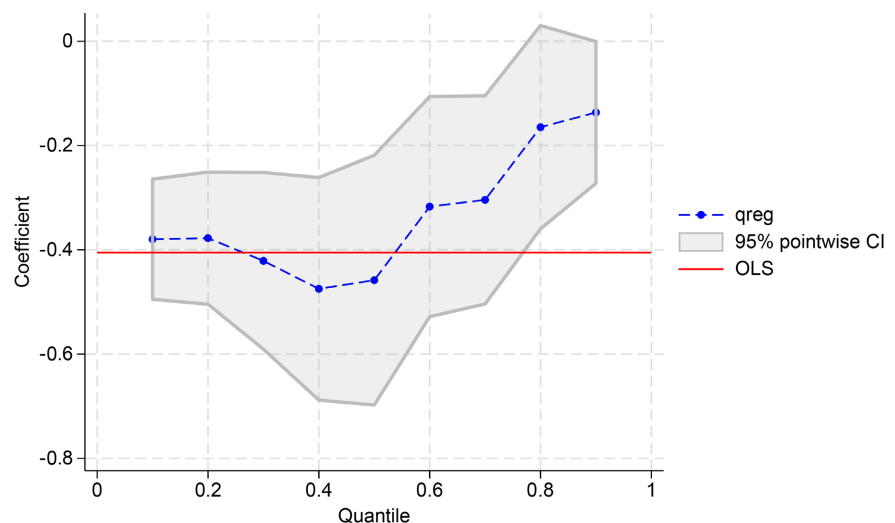**Figure 3.** Coefficient plot of impact of business credit on economic performance.

At lower quantiles, the dashed blue line starts above zero, indicating a positive association between business credit and economic performance. This positive relationship is statistically significant, as shown by the confidence intervals not crossing zero. As we move towards higher quantiles, the dashed blue line dips below zero, suggesting that the impact of business credit on economic performance becomes negative. This shift indicates that while business credit positively influences economic performance at lower levels, its effect diminishes and even turns negative at higher levels of economic performance.

In contrast, the solid red line representing the OLS estimate remains constant slightly above zero across all quantiles. This suggests that the OLS model captures

a small, positive, and constant effect of business credit on economic performance, regardless of the quantile. However, this constant effect masks the varying impact observed in the quantile regression analysis.

Overall, the graph highlights the importance of considering different quantiles when analysing the impact of business credit on economic performance. The quantile regression reveals a nuanced relationship that the OLS model fails to capture, showing that business credit's effect is positive at lower economic performance levels but diminishes and turns negative at higher levels.

Figure 4 illustrates the relationship between household credit and economic performance, measured by the log of real GDP, across different quantiles. The analysis reveals that at lower quantiles, household credit has a significant negative impact on economic performance, which intensifies in the middle quantiles. However, this negative effect diminishes as we move towards the higher quantiles, approaching zero. In contrast, the OLS estimate, represented by a solid red line, shows a small, constant negative effect across all quantiles, failing to capture the varying impacts observed in the quantile regression analysis. This highlights the importance of using quantile regression to understand the nuanced effects of household credit on economic performance, which is crucial for policymakers and economists in designing effective credit policies and evaluating their implications for economic growth.

Source: Authors' calculation.

Figure 4. Coefficient plot of impact of household credit on economic performance.

In the previous analysis, we utilized quantile regression to explore how banks' credit to businesses and households influenced economic performance in Lesotho. This provided valuable insights into the differentiated impacts across various economic performance levels.

Building on this foundation, the follow-up analysis will employ quantile regression to examine the impact of banks' total credit to the private sector on economic

performance. This approach is particularly valuable as it allows us to capture the comprehensive effect of credit allocation within the private sector, encompassing both businesses and households. By doing so, we can gain a more holistic understanding of how financial intermediation by banks influences economic outcomes across different quantiles of economic performance. This broader perspective is crucial for formulating effective financial policies and strategies aimed at fostering sustainable economic growth in Lesotho.

Table 5 displays the quantile regression results on the impact of banks' total private sector credit on Lesotho's economic performance, with bootstrapped standard errors at the 10th, 20th, 30th, 40th, 50th, 60th, 70th, 80th, and 90th quantiles.

Table 5. Result of quantile regression—impact of total private sector credit.

Variables	(1) Q10	(2) Q20	(3) Q30	(4) Q40	(5) Q50	(6) Q60	(7) Q70	(8) Q80	(9) Q90
total_privatesector_credit	−0.2**	−0.194**	−0.238***	−0.228***	−0.202***	−0.159***	−0.161***	−0.157***	−0.146***
	(0.075)	(0.089)	(0.07)	(0.07)	(0.038)	(0.032)	(0.019)	(0.023)	(0.026)
g_exp	0.003	−0.094	−0.029	−0.027	0.025	−0.021	0.008	0.006	−0.005
	(0.12)	(0.119)	(0.077)	(0.073)	(0.052)	(0.051)	(0.035)	(0.027)	(0.012)
r	0.049**	0.053	−0.015	−0.029	−0.059**	−0.034*	−0.033*	−0.028**	−0.024**
	(0.023)	(0.056)	(0.058)	(0.048)	(0.025)	(0.02)	(0.019)	(0.012)	(0.009)
cons	15.51***	16.517***	17.206***	17.222***	16.626***	16.325***	16.026***	15.95***	15.897***
	(1.438)	(1.388)	(1.247)	(1.017)	(0.701)	(0.68)	(0.345)	(0.341)	(0.412)
Pseudo R^2	0.3685	0.309	0.298	0.3031	0.291	0.3032	0.3188	0.3257	0.3314
Observations	48	48	48	48	48	48	48	48	48

Source: Authors' calculation; **Note:** The dependent variable for the quantile regression is realgdp. Figures in parentheses are standard errors. ***, ** and *denote significance at 1%, 5% and 10% levels, respectively.

The quantile regression results in Table 5 reveal a consistently negative and significant impact of banks' total credit to the private sector on Lesotho's economic performance, proxied by real GDP, across all quantiles (Q10 to Q90). This suggests that an increase in banks' credit to the private sector is associated with a decrease in real GDP, regardless of the economic performance level. This counterintuitive finding may indicate inefficiencies in credit allocation or structural issues within the private sector that hinder economic growth.

In comparison, when private sector credit is disaggregated into business credit and household credit, respectively (i.e. Table 3), we observe that business credit, consistently shows a positive and significant effect on real GDP across most quantiles, with the strongest impact at lower quantiles and diminishing at higher quantiles. This indicates that business credit effectively stimulates economic performance, particularly in lower-performing segments. Conversely, household credit has a consistently negative and significant impact on real GDP across all quantiles, with the effect also diminishing at higher quantiles. This suggests that household

credit may not be as productive in driving economic growth and could potentially lead to inefficiencies or increased financial burdens.

The stark contrast between the Impacts of business credit and household credit highlights the importance of targeted credit allocation. While business credit appears to be a valuable driver of economic performance, household credit seems to have a detrimental effect. The negative impact of total private sector credit, which encompasses both business and household credit, underscores the need for a more nuanced approach to credit distribution.

Figure 5 illustrates the relationship between banks total credit to the private sector and economic performance, measured by the log of real GDP, across different quantiles and comparing it with Ordinary Least Squares (OLS) results. The quantile regression line (dashed blue) consistently shows negative coefficients across all quantiles, indicating that banks' total credit to the private sector has a negative impact on real GDP at different points in the economic performance distribution. This aligns with the findings from Table 5, suggesting inefficiencies in credit allocation or structural issues within the private sector. The OLS line (solid red) provides an average effect of banks' total credit on real GDP, which is also negative, but less variable compared to the quantile regression results, suggesting a uniform negative impact across the entire distribution.
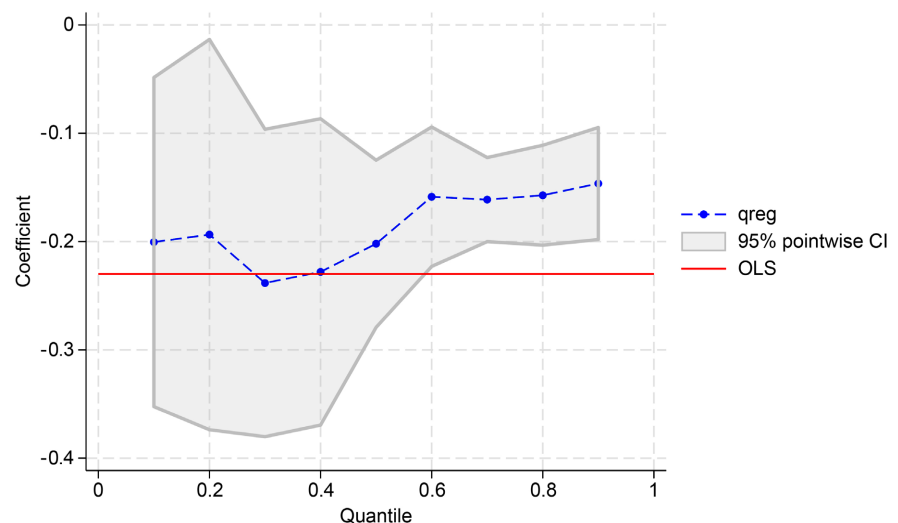
Source: Authors' calculation.

Figure 5. Coefficient plot of impact of total private sector credit on economic performance.

5.2. Interquartile Range Results

Generating results for the interquartile range (IQR) in quantile regression models is advisable for several reasons. Firstly, the IQR, typically between the 25th and 75th percentiles, is less sensitive to outliers compared to the mean or even the median. This makes it a robust measure of central tendency and variability, providing a clearer picture of the data's central distribution without being skewed by extreme values (Koenker, 2005). Additionally, examining the IQR allows for a better un-

derstanding of the distribution of the dependent variable. It helps in identifying the spread and skewness of the data, which can be crucial for making informed decisions. For instance, Yu and Moyeed (2001) highlight that the IQR can reveal important characteristics of the data that might be missed when only focusing on the mean or median.

Quantile regression also provides insights into heteroscedasticity, or non-constant variance, in the data. By exploring how the relationship between the independent and dependent variables changes across different points in the distribution, the IQR can highlight variations in this relationship (Koenker & Hallock, 2001). For policymakers and decision-makers, understanding the effects at different quantiles can be more informative than just looking at the mean effect. For example, in the case of our study, the impact of a policy might vary for periods of low-economic performance versus those of high-economic performance, and the IQR can provide insights into these differential impacts (Buchinsky, 1998). This nuanced understanding can lead to more effective and targeted policy interventions. Lastly, generating results for the IQR can serve as a validation tool for the model. If the model performs well within the IQR, it suggests that the model is capturing the central tendency of the data accurately, which is often the primary area of interest (Koenker, 2005). This validation is crucial for ensuring the reliability and applicability of the model's results.

Table 6 presents the results of the 25th, 50th and 75th quantiles and uses bootstrap resampling to estimate the standard errors and confidence intervals. With bootstrap resampling, we are able to assess the stability of our estimates across different samples.

Table 6. Quantile regression results at the 25th, 50th and 75th quantiles.

Variables	(1) Q25	(2) Q50	(3) Q75
business_credit	0.618*** (0.174)	0.702*** (0.244)	0.121 (0.276)
household_credit	−0.379*** (0.075)	−0.458*** (0.108)	−0.172 (0.124)
g_exp	−0.004 (0.047)	−0.017 (0.05)	−0.01 (0.032)
r	0.024 (0.026)	−0.014 (0.03)	−0.034* (0.02)
cons	10.473*** (1.737)	11.088*** (1.89)	14.796*** (1.792)
Pseudo R²	0.5708	0.4367	0.3656
Observations	48	48	48

Source: Authors' Calculation; **Note:** The dependent variable for the quantile regression is realgdp. Figures in parentheses are standard errors. ***, ** and * denote significance at 1%, 5% and 10% levels, respectively.

The quantile regression results at the 25th, 50th, and 75th quantiles reveal distinct impacts of business and household credit on economic performance. At the 25th and 50th quantiles, business credit significantly boosts economic performance, with coefficients of 0.618 and 0.702, respectively, both statistically significant at the 1% level. However, at the 75th quantile, the effect of business credit diminishes and is not statistically significant. Conversely, household credit consistently shows a negative impact on economic performance across all quantiles, with coefficients of −0.379 and −0.458 at the 25th and 50th quantiles, respectively, both significant at the 1% level, and −0.172 at the 75th quantile, which is not significant. The pseudo-R-squared values suggest that the model explains a substantial portion of the variance at the 25th quantile (0.5708), with decreasing explanatory power at the 50th (0.4367) and 75th (0.3656) quantiles.

We perform a series of hypothesis tests. First, we evaluate whether the effects of business credit on economic performance are the same on the 25th and 75th quantiles. That is:

Null Hypothesis (H_0): The effect of business credit on economic performance is the same at the 25th quantile (q25) and the 75th quantile (q75). Mathematically, this is expressed as: (H_0): [q25]log(business_credit) − [q75]log(business_credit) = 0

Alternative Hypothesis (H_1): The effect of business credit on economic performance is different at the 25th quantile and the 75th quantile.

F-statistic: 3.22.

Degrees of Freedom: 1 (numerator), 43 (denominator).

p-value: 0.0797.

Since the p-value (0.0797) is greater than 0.05, we fail to reject the null hypothesis at the 5% significance level. This means there is not enough evidence to conclude that the effects of business credit on economic performance are different at the 25th and 75th quantiles.

Table 7 shows the confidence interval for the difference between the effect of business credit at the 25th and 75th quantiles, respectively, at the null hypothesis: (H_0): [q25]log(business_credit) − [q75]log(business_credit) = 0.

Table 7. Confidence interval for business credit impact at 25th vs. 75th quantiles.

realgdp	Coef.	Std. err	t	P > t	[95% conf. interval]	
(H_0)	0.497	0.277	1.790	0.080	−0.062	1.056

Source: Authors' calculation.

Coefficient (0.497): This suggests that the effect of business credit on real GDP is positive. Specifically, a 1% increase in business credit is associated with a 0.497% increase in real GDP, holding other factors constant. The p-value of 0.080 suggests that there is not enough evidence to reject the null hypothesis at the 5% significance level. This means we cannot conclude that the effect of business credit on economic performance is different at the 25th and 75th quantiles. The confidence

interval also supports this, as it includes zero, indicating that the effect might not be statistically significant. It is also important to note that the failure to reject the null hypothesis may be influenced by the relatively small sample size (N = 48), which limits the statistical power of the test. As such, the absence of statistical significance should be interpreted with caution, as it does not necessarily imply the absence of a meaningful difference between quantile-specific effects.

Second, we evaluate whether the effects of household credit, respectively on economic performance are the same on the 25th and 75th quantiles. That is:

Null Hypothesis (H_0): The effect of household credit on economic performance is the same at the 25th quantile (q25) and the 75th quantile (q75). Mathematically, this is expressed as: (H_0): [q25]log(household_credit) – [q75]log(household_credit) = 0.

Alternative Hypothesis (H_1): The effect of household credit on economic performance is different at the 25th quantile and the 75th quantile.

F-statistic: 2.68.

Degrees of Freedom: 1 (numerator), 43 (denominator).

p-value: 0.1092.

Since the p-value (0.1092) is greater than 0.05, we fail to reject the null hypothesis at the 5% significance level. This means there is not enough evidence to conclude that the effects of household credit on economic performance are different at the 25th and 75th quantiles.

Table 8 shows the confidence interval for the difference between the effect of household credit at the 25th and 75th quantiles, respectively, at the null hypothesis: (H_0): [q25]log(household_credit) – [q75]log(household_credit) = 0.

Table 8. Confidence interval for household credit impact at 25th vs. 75th quantiles.

realgdp	Coef.	Std. err	t	P > t	[95% conf. interval]	
(H_0)	−0.207	0.127	−1.640	0.109	−0.463	0.048

Source: Authors' calculation.

Coefficient (−0.207): This suggests that the effect of household credit on real GDP is negative. Specifically, a 1% increase in household credit is associated with a 0.207% decrease in real GDP, holding other factors constant. The p-value of 0.109 suggests that there is not enough evidence to reject the null hypothesis at the 5% significance level. This means we cannot conclude that the effect of household credit on economic performance is different at the 25th and 75th quantiles. The confidence interval also supports this, as it includes zero, indicating that the effect might not be statistically significant.

Table 9 shows results of the impact of business credit and household credit on economic performance within the interquartile range (i.e., between the 25th and 75th percentiles). The interquartile range regression results reveal nuanced impacts of various predictors on economic performance. The coefficient for business

credit is −0.497, suggesting a negative relationship with real GDP, but this effect is not statistically significant (p-value = 0.122). Similarly, household credit shows a positive coefficient of 0.207, yet this effect is also not significant (p-value = 0.137). The coefficient for the interest rate has a significant negative impact on real GDP, with a coefficient of −0.057 (p-value = 0.048). Overall, while business and household credit do not show significant effects on economic performance in the Interquartile range, the interest rate emerges as a significant negative factor influencing real GDP.

Table 9. Results of the interquartile range.

realgdp	Coef.	Std.err.	t	P > t	[95% Conf Interval]		Sig
business_credit	−0.497	0.316	−1.58	0.122	−1.134	0.139	
household_credit	0.207	0.137	1.52	0.137	−0.068	0.483	
g_exp	−0.006	0.05	−0.12	0.903	−0.108	0.095	
r	−0.057	0.028	−2.04	0.048	−0.114	−0.001	**
Cons	4.323	2.265	1.91	0.063	−0.244	8.89	*

Source: Authors' calculation; **Note:** ***, ** and *denote significance at 1%, 5% and 10% levels, respectively.

The interquartile range (IQR) regression presented in Table 9 was estimated using a pooled quantile regression approach, aggregating effects across the 25th to 75th percentiles. This method captures the average impact of credit variables within the central band of economic performance. The observed insignificance of business and household credit in the IQR model does not contradict the significant findings at the 25th and 50th quantiles (Table 6); rather, it reflects the dilution of strong effects at lower quantiles by weaker or statistically insignificant effects at the 75th quantile. The IQR regression serves as a robustness check, offering a broader view of central tendencies. It complements the quantile-specific results by highlighting that credit effects are more pronounced in lower-performing segments of the economy and taper off toward the upper-middle range. This reinforces the importance of targeted credit policies that prioritize interventions where they are most impactful.

When both business and household credit have an insignificant impact on economic performance within the interquartile range in Lesotho, it suggests that when the economy is performing at an average level, borrowing by both sectors neither significantly boosts nor hinders economic performance. This can be attributed to several factors. First, businesses and households in Lesotho might exhibit balanced financial practices, where borrowing and spending are managed prudently, avoiding both over-leverage and under-utilization of credit (Delis, Fringuellotti, & Ongena, 2021). Additionally, stable economic conditions with moderate growth and inflation can mean that credit does not have a pronounced effect, as both borrowing, and repayment are manageable (Schweitzer & Meyer,

2022).

Effective financial regulation in Lesotho might also play a role. For instance, during the study period, Lesotho benefited from technical assistance and capacity development under the IMF's Financial Sector Stability Fund (FSSF), which supported reforms aimed at strengthening financial supervision, enhancing macroprudential oversight, and improving crisis preparedness. These efforts included the development of recovery and resolution frameworks and the enhancement of regulatory tools to mitigate systemic risks. Such initiatives may have contributed to a more stable credit environment, particularly in the mid-range of economic performance, where neither business nor household credit showed statistically significant effects (IMF, 2024).

Regulations that prevent excessive borrowing and ensure productive use of credit can mitigate potential negative impacts (Goodhart, 2005). Furthermore, economies in the interquartile range often have a diversified economic base, where credit is just one of many factors influencing economic performance. This diversification can dilute the impact of both business and household credit (Bernanke, 2018). Lastly, both businesses and households might be using credit to smooth investment and consumption over time, borrowing during low-income or low-revenue periods and repaying during high-income or high-revenue periods. This behavior can lead to a neutral overall impact on economic performance (Alem & Townsend, 2014).

5.3. Robustness Checks

Robustness checks using the Method of Moments Quantile Regression are presented in **Appendix A**.

6. Conclusions and Policy Recommendations

This study examines the impact of credit to businesses and households on economic performance in Lesotho, a small, landlocked country in Southern Africa. Lesotho's financial sector has undergone significant reforms to improve access to credit for both businesses and households. Using quarterly time series data from 2009: Q1 to 2020: Q4 and employing quantile regression approaches, the analysis reveals several key insights. Business credit consistently shows a positive and significant effect on real GDP across most quantiles, with the strongest impact at lower quantiles, diminishing at higher quantiles. Conversely, household credit exhibits a consistently negative and significant impact on real GDP across all quantiles, with the effect also diminishing at higher quantiles. These findings are supported by OLS regression results and robustness checks from the method of moments quantile regression. The positive impact of business credit suggests that increasing access to credit for businesses can stimulate economic growth, especially at lower quantiles. On the other hand, the negative impact of household credit indicates that increasing household debt may hinder economic growth, likely due to credit being used for consumption rather than investment. When both business

and household credit have an insignificant impact within the interquartile range, it suggests that during average economic performance, borrowing by both sectors neither significantly boosts nor hinders economic performance. This could be due to balanced financial practices, stable economic conditions, effective financial regulation, and a diversified economic base.

6.1. Policy Recommendations

To enhance the positive impact of business credit on economic growth while mitigating the negative effects of household credit, the following policy recommendations are advanced:

- Improve access to credit for businesses through interest rate subsidies, credit guarantees, and regulatory incentives (Central Bank of Lesotho, Ministry of Finance).
- Regulate household credit to prioritize productive borrowing through financial education and stricter lending criteria (Central Bank, financial institutions, educational bodies).
- Strengthen financial regulation to prevent excessive borrowing and ensure productive credit use (Central Bank, financial regulatory authorities).
- Promote economic diversification through sector-specific development programs and SME incentives (Ministry of Trade and Industry).
- Support balanced financial practices through financial literacy programs and incentives (Ministry of Education, NGOs, financial institutions).

6.2. Areas for Future Study

While this study provides valuable insights into the impact of business and household credit on Lesotho's economic performance, it has several limitations. First, the analysis is constrained by the availability and quality of data, which may not capture all relevant economic variables or account for informal financial activities prevalent in Lesotho. Second, the study focuses solely on quantile regression and OLS approaches, potentially overlooking other econometric methods that could offer additional perspectives. Third, the research does not differentiate between short-term and long-term credit impacts, which could provide a more nuanced understanding of credit dynamics. Lastly, the study's findings are specific to Lesotho and may not be generalizable to other countries with different economic structures and financial systems.

Future research could address these limitations by incorporating more comprehensive data sets, including informal sector activities, and exploring alternative econometric techniques. Additionally, examining the differential impacts of short-term versus long-term credit and conducting comparative studies across multiple countries could provide deeper insights into the relationship between credit and economic performance. Investigating the role of other financial instruments and policies in conjunction with credit could also enhance our understanding of how to foster sustainable economic growth.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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Appendix A: Robustness Checks

To ensure the reliability and robustness of our findings, we employ the method of moments quantile regression (MMQR) as proposed by Machado and Santos Silva (2019). This method offers several significant advantages, making it an excellent robustness check for the simultaneous quantile regression used in our main results. This approach is particularly beneficial for complex models, such as models with endogenous explanatory variables, as it allows the use of methods valid for estimating conditional means. Additionally, the MMQR ensures that the estimated regression quantiles do not cross, addressing a crucial requirement often overlooked in empirical applications. This feature enhances the reliability and interpretability of the results. Furthermore, this method offers flexibility, making it applicable in settings where traditional quantile regression might be challenging to implement. By combining estimates of location and scale functions identified by conditional expectations, it enhances the estimation of regression quantiles, providing a robust tool for econometric analysis.

Table 10 presents the results of the Method of Moments Quantile Regression (MMQR). The results align closely with the findings from the main Simultaneous Quantile Regression (SQR) model, reinforcing the robustness of the analysis. Both models indicate that business credit has a consistently positive and significant effect on real GDP across all quantiles. In the MMQR, the coefficients for business credit range from 0.707 at the 10th quantile to 0.644 at the 90th quantile, demonstrating a strong positive impact that slightly diminishes at higher quantiles. This pattern is consistent with the SQR results, where the strongest impact of business credit is observed at lower quantiles, gradually decreasing at higher quantiles.

Table 10. Result of method of moments quantile regression.

Variables	(1) Q10	(2) Q20	(3) Q30	(4) Q40	(5) Q50	(6) Q60	(7) Q70	(8) Q80	(9) Q90
business_credit	0.707***	0.695***	0.688***	0.677***	0.668***	0.661***	0.657***	0.651***	0.644***
	(0.197)	(0.168)	(0.151)	(0.128)	(0.113)	(0.107)	(0.104)	(0.103)	(0.107)
household_credit	−0.418***	−0.414***	−0.411***	−0.407***	−0.404***	−0.402***	−0.401***	−0.398***	−0.396***
	(0.077)	(0.066)	(0.059)	(0.050)	(0.045)	(0.042)	(0.041)	(0.041)	(0.042)
g_exp	−0.024	−0.030	−0.034	−0.039	−0.044	−0.047*	−0.049*	−0.052*	−0.055**
	(0.051)	(0.043)	(0.039)	(0.033)	(0.029)	(0.027)	(0.027)	(0.027)	(0.027)
r	0.045**	0.034*	0.027	0.016	0.007	0.001	−0.003	−0.009	−0.016
	(0.021)	(0.019)	(0.018)	(0.016)	(0.014)	(0.013)	(0.012)	(0.013)	(0.013)
cons	9.843***	10.152***	10.344***	10.649***	10.893***	11.065***	11.175***	11.337***	11.528***
	(1.645)	(1.414)	(1.286)	(1.091)	(0.972)	(0.911)	(0.879)	(0.887)	(0.915)
Observations	48	48	48	48	48	48	48	48	48

Source: Authors' Calculation; **Note:** The dependent variable for the method of moments quantile regression is realgdp. Figures in parentheses are standard errors. ***, ** and *denote significance at 1%, 5% and 10% levels, respectively.

Similarly, household credit shows a consistently negative and significant effect on real GDP in both models. The MMQR results indicate coefficients ranging from −0.418 at the 10th quantile to −0.396 at the 90th quantile, suggesting a diminishing negative impact at higher quantiles. This is in line with the SQR findings, where the negative effect of household credit on real GDP is also observed to diminish as quantiles increase.

The consistency between the MMQR and SQR results underscores the reliability of the findings. Both models highlight the crucial role of business credit in driving economic performance in Lesotho, while also pointing to the potential adverse effects of household credit on economic growth. The diminishing impact of both business and household credit at higher quantiles suggests that their influence on economic performance may be more pronounced at lower levels of economic activity.

Overall, the MMQR serves as a robust check, confirming the main conclusions drawn from the SQR model. The alignment of results across different quantile regression methods, as well as their support from OLS regression results, provides strong evidence for the significant roles of business and household credit in influencing economic performance in Lesotho.