Banking Market Structure and Heterogeneous Response of Bank Lending to Monetary Policy: Evidence from Uganda

Dorothy Nampewo

Working Paper 058-2026

CONSORTIUM POUR LA RECHERCHE ÉCONOMIQUE EN AFRIQUE

Bringing Rigour and Evidence to Economic Policy Making in Africa

BANKING MARKET STRUCTURE AND HETEROGENEOUS RESPONSE OF BANK LENDING TO MONETARY POLICY: EVIDENCE FROM UGANDA

By

Dorothy Nampewo
Bank of Uganda, Kampala

AERC Research Paper 058-2026
African Economic Research Consortium,
Nairobi March 2026

Published by: The African Economic Research Consortium

P.O. Box 62882 - City Square

Nairobi 00200, Kenya

Abstract

This paper investigates the heterogeneous response of bank lending following a monetary policy change. The study was conducted in the context of developing countries and is based on dynamic panel error correction methods using quarterly Ugandan bank-level data for the period 2011 - 2019. Results support the presence of heterogeneity in bank lending response to monetary policy changes by bank size and ownership type. Specifically, monetary policy pass-through is weaker in large foreign banks and stronger in smaller Pan-African banks. Moreover, bank lending response to monetary policy is asymmetric, with insignificant effects when the policy rate is falling. Risk, government borrowing, capital, and liquidity at the bank level, competition at the industry level, and inflation at the macro level are some of the factors that explain the response of bank lending to monetary policy.

Keywords: Bank lending, Heterogeneous response, monetary policy, dynamic panel data, Uganda

JEL Classifications: E42; E44, E52, E58, G21, G28

1. Introduction

The extent to which monetary policy can influence real economic activity through its impact on bank lending remains an important aspect for monetary policy transmission mechanism. As such, the role of the banking sector in the transmission of monetary policy to the real sector has received much attention in both theoretical and empirical literature (Bernanke and Gertler 1995). The bank lending channel theory stipulates that contractionary open market operations reduce banking sector reserves and deposits, forcing a reduction in lending volumes because banks are constrained in their ability to substitute lost deposits with alternative sources of finance (Bernanke & Blinder 1988).

The existing evidence shows that banks alter their lending behaviour in specific ways following a change in monetary policy (Gambacorta and Mistrulli 2014). This arises from heterogeneity in bank market structures and segmentation, which breeds information asymmetry (Bluedorn, Bowdler, and Koch 2017). The bank lending channel identifies incentive mechanisms that work through the capital structure of banks, their liquidity levels and their size and argues that these mechanisms may play an important role in altering bank lending decisions when there is a change in policy interest rate (Brissmis and Deli 2010).

In addition, structural factors such as bank ownership, risk exposure, limited financial market development, bank concentration, limited capacity to anchor inflation expectations, and poor institutional frameworks could result in asymmetric bank lending response to monetary policy changes (Loutskina 2011; Abuka et al. 2019). These factors play out quite well in developing and emerging market economies and are bound to hinder the effectiveness of the bank lending channel of monetary policy transmission compared to developed economies with much less structural impediments. Although the bank lending channel has been found to exist in many developing countries (Mishra and Montiel 2013), it is stronger in countries with better institutions, less concentrated banking systems, and with more developed financial markets (Mishra et al. 2014).

We investigate these issues on Uganda, a low income but fast-growing country in East Africa. Uganda's banking sector landscape has undergone rapid transformation with the introduction of financial innovations, particularly mobile money, leading to efficiencies in intermediation and potentially ameliorating the conduct of monetary

policy (Nampewo et al. 2016; Mawejje and Lakuma 2019). However, consistent with features of many low-income countries at similar levels of development, the industry remains small and concentrated, with shallow financial markets despite liberalization of the sector (Nampewo 2021). Consequently, access to finance continues to be a major binding constraint on firm growth (Mawejje and Sebudde 2019) and household welfare and resilience (Mawejje 2019).

In a bid to overcome these challenges and improve financial sector intermediation, the Central Bank adopted a forward-looking monetary policy framework with a transition to a new monetary policy framework—inflation targeting lite (Brownbridge and Kasekende 2018). Despite these developments, however, private sector credit growth has remained low over the past decade, growing only by about 13 percent of GDP by 2018, despite the accommodative monetary policy stance, which under normal circumstances would be expected to boost bank lending. These challenges are sustained by supply-side constraints brought about by the heterogeneous structure of the credit market (Nampewo et al. 2016).

An important feature of Uganda's banking sector relates to high levels of segmentation, with about 80 per cent of the commercial banks classified as small when using metrics such as the proportion of capital and assets in the overall banking system (Nampewo 2021). The market is dominated by foreign banks, which may be regional (Pan African Banks) or global (Non-Pan African Banks). Regional banks control 72% of the market share, with global banks accounting for 20% and indigenous banks 8%. This structure raises two important theoretical concerns for the transmission of monetary policy. First, is the possibility of differences in lending response to changes in monetary policy across bank categories. Second, is a possible weaker propagation of monetary policy to the real sector due to these differences (Bluedorn, Bowdler, and Koch 2017).

The main objectives of this study are twofold: first, we investigate the potential existence of heterogeneous responses of bank lending to monetary policy changes in Uganda's banking sector. Second, we investigate the factors behind this response, considering market structure dynamics differentiated by size and ownership. These issues have not received much attention in the literature investigating the heterogeneous response of bank lending to monetary policy changes in low-income countries. To

achieve these objectives, the study employed dynamic error correction methods using quarterly bank-level data for the period 2011-2019.

Our findings support the presence of heterogeneity in bank lending response to monetary policy in the different categories of banks. Overall, monetary policy pass-through to bank lending is weaker among large banks compared to small banks. In particular, the large foreign banks appear to respond less to monetary policy changes regardless of whether they are Pan-African banks or global banks. On the other hand, the stronger pass-through effect among the small banks is attributed to the Pan-African Banks. Moreover, bank lending response to monetary policy is asymmetric, with insignificant effects when the policy rate is falling. Risk, government borrowing, capital, and liquidity at the bank level, competition at the industry level, and inflation at the macro level are some of the factors that explain the response of bank lending to monetary policy.

These results suggest that measures to reduce credit risk and government borrowing from the financial sector will free up resources toward private sector lending, especially for the small banks. Although liberalization brought dynamism to the banking sector by opening competition, the sector is still highly concentrated and more can be done to address current challenges. Within this realm, supporting mostly the small and indigenous banks to compete and gain a large share of the market could improve bank competition and efficiency, enhancing the bank lending channel of monetary policy transmission.

The rest of the paper is organized as follows. Section two introduces the methodology. Data and sources are discussed in section three. Results are presented in section four. Section five concludes.

2. Econometric Model and Estimation Strategy

Following Kashyap and Stein (1995), our model specification allows for the assessment of three important aspects of this study. First, we assess the differences in the responses of bank lending for each category of banks with varying characteristics to monetary policy shocks by classifying the banks into two categories based on size and ownership type. Second, we account for heterogeneous effects by allowing for the inclusion of interaction terms for the monetary policy rate with the bank-specific characteristics,

which captures the effect of monetary policy changes on the loan supply. Third, we investigate pass-through effects and the speed of adjustments for the different specifications of banks, including all banks combined and the different categories. This enables us to assess the effect of heterogeneous response on the bank lending channel of the monetary transmission mechanism. The model is specified in Equation 1:

$$\Delta(\text{Log\_loans}) = \alpha_i + \sum_{k=1}^{2} \beta_k \Delta(\log L_{i,t-k}) + \sum_{k=0}^{n} \left(\gamma_k + \sum \gamma^*_k X_{i,t-k}\right) \Delta p_{t-k} + \sum_{i} \varsigma_i X_{i,t-k} + \sum \emptyset \bar{\omega}_{i,t} + \sum \phi \bar{Z}_{i,t} + \varepsilon_{i,t} \quad (1)$$

Where; $loans$ is the amount of lending for bank (i) at time (t); Δ is the difference operator that captures the change from the previous period; Δp_t is the change in the policy rate that captures changes in the monetary policy stance. $X_{i,t}$ is a vector of bank-specific characteristics for bank (i) and time t, which influence the loan levels and are independent of the policy rate variations; and $\bar{Z}_{i,t}$ is a vector of control variables including macroeconomic-related factors that influence the loan levels. We also assume that the macroeconomic control variables will affect changes in loans independently of changes in the policy rate. The differenced part of the equation is the short-run component of the model, and the long-run component constitutes the lagged explanatory variables, which may also be represented as the error correction term.

We include α_i, a constant term to capture the fixed effects that influence changes in the loan levels. β_k is the coefficient on the lagged dependent variable is included to account for potential endogeneity. The coefficients of the constant term $\gamma_k$capture the pass-through effect of changes in the policy rate to changes in the loan levels. We have also included interaction terms between the bank specific characteristic and changes in the policy rate to capture heterogeneity arising from bank-specific characteristics and the pass-through effect of policy rate variations to changes in the loan levels. This will be captured in the coefficients of the constant term γ^*_k in the model. ς_i is the coefficient on the error correction term that represents the speed of adjustment in changes in the loan levels as a result of changes in the policy rate. The coefficient,$\emptyset$, accounts for the banking industry's effect on changes in the loan levels. The coefficient,ϕ, accounts for the effect of the macroeconomic variables on changes in the loan levels.

Estimation strategy

The estimation strategy is done in three steps. First, we ascertain the statistical properties of the data by conducting panel unit root and cointegration tests. For panel unit root tests, we use both the Levin, Lin, and Chu (2002) and the Maddala and Wu (1999) tests. The null hypothesis for both tests is the same, that is, there is a unit root in all series. The alternative hypothesis for the Levin et al. (2002) test is that there is stationarity in all the series, and for the Maddala and Wu (1999) test is that there are unit roots in some (but not necessarily all) of the series.

The panel cointegration test was conducted using the Pedroni test (Pedroni, 2000). The strength of the Pedroni test is that it allows for heterogeneity in the panel, which accounts for separate hypothesised cointegration relationships for each group member of the panel and then pools the resulting residuals when conducting the test. Second, after ascertaining the order of integration and presence of cointegration, we estimated equation 1, using a generalized panel error-correction model in combination with GMM estimates, for each category of banks, separately. The advantage of using a panel error correction model is that it allows us to assess the speed of adjustment and the pass-through effect of monetary policy shocks on bank lending.

We used a standard two-step error correction procedure where we obtained the error correction term from a separate estimation of the long-run equilibrium in levels in the first step. We then included a lagged error correction term as our second step in the final regression that is estimated by difference GMM estimators developed by Arellano and Bond (1991). The strength of these estimators lies in their ability to apply all the lagged observations to instrument the lagged endogenous variables. This in turn avoids problems associated with biased estimates that may arise due to a possible correlation between the lagged endogenous variable and the error term, and results into a consistent and efficient GMM estimator. Third, we tested for robustness of the model using the Sargan test of over-identifying restrictions to test for the validity of the instruments. We also tested for serial correlation in the error terms and assessed whether the differenced error term is second-order serially correlated.

3 Data and sources

We used quarterly data for a sample of 17 commercial banks during the period 2011 Q3 to 2019 Q4, resulting in a balanced panel of 578 observations. The period of analysis is unique in three major ways. First, it coincides with heightened inflationary pressures due to food price shocks (Mawejje and Lwanga 2016; Mawejje 2016); second, it marked a moderation of credit aggregates and economic growth (Abuka et al. 2019); third, it is consistent with the introduction of the inflation targeting monetary policy framework (Brownbridge and Kasekende 2018).

The main source of the data is the Central Bank's commercial bank balance sheet databases. GDP and CPI data are from the Uganda Bureau of Statistics. The dependent variable is the change in the natural logarithms of loan levels for the individual commercial banks ($\Delta \text{Log\_loans}_{it}$). The independent variables include: the change in the policy rate, (Δp_t), the Central Bank Rate (CBR). We followed Zulkhibri (2013) to define the bank characteristics ($X_{i,t}$), including: liquidity, bank capital and risk. Liquidity (LIQUID) was defined as the ratio of liquid assets of the bank to total deposits of that bank. This was included to control for liquidity conditions of banks and their effect on the remission of loans by any given bank. Liquidity is expected to affect bank lending positively. The bank lending channel is stronger in more liquid banks compared to less liquid banks (Abuka et al., 2019).

Bank capital (BANKCAP) was computed as the ratio of total capital of the bank to total assets of that respective bank, and was included to assess the behaviour of well-capitalised and ill-capitalised banks. Banks with high capital structures react less to monetary policy changes compared to those with lower capital buffers (Bernanke 2007). We thus expect negative effects of high capital levels on bank loans.

Following Jiménez et al. (2014) we include risk (RISK), defined as the ratio of non-performing loans for each commercial bank to its total assets, to examine the effect of risk on individual bank lending. The higher this ratio, the more the bank is exposed to loan default risk, and banks would cut back on their lending. We controlled for government borrowing (GOVBOR), to capture the possible crowding-out effects on commercial bank loan levels. This was measured as the ratio of government securities of the individual bank to the total assets of the bank. Government borrowing through government securities leads to a reduction in bank lending. This implies that banks

prefer to invest in risk-free government securities rather than lending to the private sector, which is characterised by high loan default risk.

The macroeconomic–related factors, ($\bar{Z}_{i,t}$), as control variables include the inflation rate (INFL), measured as the annual change of the logarithm of the consumer price index (CPI) and the GDP growth rates. We expect that high economic activity results in a positive output gap and high inflation rates, which may lead to increased bank lending.

To account for the bank structure and market segmentation, we classified the individual banks into different categories, including size and ownership structure. The category of bank size (size) constitutes small and large banks, to capture the loan behaviour of small and large banks in response to changes in monetary policy. We expect that small banks, which are characterised by lower capital and liquidity levels, are more sensitive to monetary policy shocks compared to the large banks. Following Zulkhibri (2013), size was defined as the ratio of total assets of the bank to total assets in the banking system, as shown in the equation 2 below.

$$size_{it} = \log A_{it} - \frac{1}{N_t}\sum_i logA_t \qquad (2)$$

where;

$$largebank_{it} = Size_{it} > 0 \text{ and } smallbank_{it} = Size_{it} < 0$$

The ownership structure consists of foreign and domestic banks, where a bank is characterized as foreign if at least 50 percent of its capital is held by foreigners. To this end, we generated a dummy variable 1 for foreign banks and 0 for domestic banks. We further disaggregated the foreign banks into PABs and NPABs and generated dummy variables for the categories of banks. We disintegrate each of the categories into small and large banks. We expect large foreign banks to be less reactive to monetary policy changes than small foreign banks. We expect a similar pattern for the domestic banks. We also expect the NPABs to respond less to monetary policy than the PABs. The assumption is that foreign banks and the NPABs are better capitalised than their local and regional counterparts, mainly due to easier access to international financial markets.

The bank market structure ($\bar{\omega}_{i,t}$), was captured by a measure of bank competition. The literature suggests that, contrary to a concentrated banking sector, bank competition is

important in improving the transmission of monetary policy (Apergis and Polemis 2016). To assess the extent of competition in Uganda's banking sector, we computed competition scores for the banking industry using the Herfindahl - Hirschman Index (HHI). The HHI measure was preferred because it considers all banks in the industry and is sensitive to the entrance of new banks. The HHI is defined as the sum of squared market shares of the banks to total assets in the market; it ranges between 0 and 1; where 0 implies perfect competition, and 1 implies imperfect competition (perfect concentration). The results of the HHI index reveal an average score of 0.88, implying that the market is concentrated. We thus expect a negative effect of the bank competition score on bank loans.

Small banks constitute 70 per cent of the total banks in the sample, while large banks are only 30 per cent. Foreign banks consist of about 90 percent and only 1 per cent of the banks are domestic banks. The Pan African banks take up 70 per cent of the total sample, whereas only 30 percent are Non-Pan African banks. The competition score averages 0.9, indicating a high level of bank concentration.

4. Results

Panel unit test results presented in Appendix 1 reveal that most of the series are integrated of the first order. The results of the panel cointegration tests presented in Appendix 2, support cointegration among the variables. The estimation results of the model in equation 1 are presented in panels A, B; and C in Table 1. Panel A shows results for bank size (small and large) with interaction terms between the bank-specific control variables and changes in the policy rate. Panel B presents effects on bank loans after interacting the bank-specific characteristics with policy rate changes for foreign-owned banks. Panel C reveals results after interactions with domestic banks.

The results reveal that the coefficients of the interest rate variable in the loan equations are negative and statistically significant, as expected. This implies that a tight monetary policy leads to a decrease in the supply of bank loans. The results also reveal that overall, the pass-through coefficient of a change in monetary policy to bank loans is about 1.1 percent for all banks, per quarter, consistent with Abuka et al. (2019), who found that the pass-through effect ranges between 1 and 3 percent per quarter for all banks.

The results support the presence of heterogeneity in bank loans response to monetary policy across bank categories as depicted in differences in the pass-through coefficients. The pass-through effect for small and large banks is about 0.8 and 0.4 percent, respectively. The ownership structure reveals the same pattern, where large foreign banks appear to respond less to monetary policy changes than small foreign banks, with pass-through coefficients of 0.6 and 0.3 per cent, respectively. The domestic banks also depict a similar reaction to monetary policy changes with pass-through coefficients of 0.4 and 0.3 per cent, respectively.

Table 1: Determinants of Bank Loans (Foreign and Domestic Banks)

Dependent variable: Δ Log_loans									
	Panel A: All Banks			Panel B: Foreign Banks			Panel C: Domestic Banks		
	All Banks	Small Banks	Large Banks	All Banks	Small Banks	Large Banks	All Banks	Small Banks	Large Banks
ΔLR	-0.100**	-0.110***	-0.100*	-0.100**	-0.100**	-0.100*	-0.100*	-0.100*	-0.140***
ΔPR	-0.011**	-0.008***	-0.004**	-0.008**	-0.006**	-0.003**	-0.004**	-0.004**	-0.003**
ECT	-0.040***	-0.040***	-0.040**	-0.040**	-0.040**	-0.040**	-0.040**	-0.040**	-0.040**
All Banks*RISK*Δ PR	-0.003*	-0.001**	-0.003						
All Banks*CAPITAL*Δ PR	-0.002	-0.001	-0.001*						
All Banks*LIQUID*Δ PR	0.002***	0.003**	0.003						
All Banks*GOVBOR*Δ PR	-0.002**	-0.001**	-0.004**						
Foreign*RISK*Δ PR				-0.001*	-0.001**	-0.002			
Foreign *CAPITAL*Δ PR				-0.001	-0.001*	-0.001*			
Foreign *LIQUID*Δ PR				0.002**	0.002***	0.004			
Foreign *GOVBOR*Δ PR				-0.001**	-0.001**	- 0.001*			
Domestic*RISK*Δ PR							-0.002	-0.002*	-0.001
Domestic *CAPITAL*Δ PR							-0.001	-0.001	-0.001*
Domestic *LIQUID*Δ PR							0.001	0.002*	0.001
Domestic *GOVBOR*Δ PR							-0.002**	-0.001**	-0.001**
COMPETITION	-0.250***	-0.250***	-0.220***	-0.260***	-0.270***	-0.210***	-0.210***	-0.210***	-0.200***
INFLATION	0.003***	0.003**	0.003***	0.003***	0.003**	0.003***	0.003***	0.003***	0.003***
GDP	0.020	0.020	0.020	0.020	0.020	0.030	0.030	0.030	0.030
Number of observations	435	435	435	435	435	435	435	435	435
AR(1)	-0.800 [0.430]	-0.191 [0.850]	-1.510 [0.133]	-1.598 [0.114]	-1.321 [0.195]	-1.511 [0.132]	-0.381 [0.711]	0.542 [0.594]	0.444 [0.662]
AR(2)	1.442 [0.152]	0.841 [0.400]	0.581 [0.531]	-1.804 [0.100]	-1.717 [0.122]	0.591 [0.550]	-0.061 [0.953]	-0.677 [0.506]	0.251 [0.880]
Sargan over- identification test	418.5 [0.100]	385.3 [0.214]	261.8 [0.355]	408.3 [0.137]	380.2 [0.330]	161.7 [0.548]	408.4 [0.134]	301.9 [0.178]	145.9 [0.421]

Source: Author's computations

In addition, the test for differences in the pass-through coefficients for the bank categories confirms the presence of heterogeneity across the bank categories (see Appendix 3). This conforms to other findings in the literature that large banks are less responsive to monetary policy shocks compared to the small banks (Bluedorn, Bowdler, and Koch 2017). The results reveal that the pass-through coefficients become smaller as the banks are disaggregated by size and ownership. This indicates that heterogeneity in bank loans' response to monetary changes makes the bank lending channel of monetary policy transmission less effective. The results of the error correction terms reveal that the speed of adjustment is 4 per cent for all the bank categories.

A further disintegration of foreign banks into PABs and NPABs reveals that, as expected, PABs and NPABs respond less to monetary policy changes compared to all banks, as shown in the pass-through coefficients of 0.6 and 1 per cent, respectively (Table 2). Although the pass-through coefficient is the same for both PABs and NPABs at 0.6 per cent, differentiated patterns in response are revealed between small and large banks, particularly for the PABs. The pass-through coefficients for small and large PABs are 0.5 per cent and 0.3, respectively. We do not find a differentiated response among the NPABs, possibly because the banks have similar characteristics in terms of capital structures and access to international financial markets.

Moreover, the study discovered that among the factors, the credit risk and government borrowing have a significant negative impact on bank loans, as expected. This implies that credit risk and government borrowing decrease the pass-through effect of monetary policy changes on bank loans and hence weaken the bank lending channel of monetary policy transmission. This may be because higher risk discourages lending by the banks and instead, they resort to investing in more profitable and risk- free assets, which in this case are government securities. Indeed, the structure of the banks' balance sheets reveals high credit risk and a preference for investment in liquid and risk-free assets such as government securities. The share of interest payments in total domestic revenue has increased from 6 percent in 2010 to about 18 percent in 2019. This reflects both expanded government borrowing and the implied higher interest rates. The implication is that crowding out effects of lending to the private sector, which negatively affects economic growth. These findings are consistent with Altunbas, Gambacorta, and Marques-Ibanez (2012) and Alkhazaleh (2017), who argue that banks faced with lower default rates are associated with higher lending.

Table 2: Determinants of bank loans (PABs and NPABs)

Dependent variable: ΔLog_loans									
Panel A: All Banks				Panel B: Pan African Banks (PAB)			Panel C: Non Pan African Banks (NPAB)		
	All Banks	Small Banks	Large Banks	All Banks	Small Banks	Large Banks	All Banks	Small Banks	Large Banks
ΔLR_{t-1}	-0.100**	-0.110***	-0.100*	-0.100**	-0.110**	-0.140***	-0.100**	-0.100**	-0.100*
ΔPR_{t-3}	-0.011**	-0.008***	-0.004**	-0.006**	-0.005**	-0.003**	-0.006**	-0.003*	-0.003**
$ECT_{(-1)}$	-0.040***	-0.040***	-0.040**	-0.040**	-0.040**	-0.040**	-0.04**	-0.04**	-0.04**
All Banks*RISK*Δ PR	-0.003*	-0.001**	-0.003						
All Banks *CAPITAL*Δ PR	-0.002	-0.001	-0.001*						
All Banks *LIQUIDI*Δ PR	0.002***	0.003**	0.003						
All Banks *GOVBOR*Δ PR	-0.002**	-0.001**	-0.004**						
PAB*Risk*Δ PR				-0.001*	-0.001**	-0.001*			
PAB *CAPITAL*Δ PR				-0.001*	-0.002*	-0.002*			
PAB *LIQUID*Δ PR				0.003**	0.003***	0.002			
PAB *GOVBOR*Δ PR				-0.001**	-0.001**	- 0.002*			
NPAB*RISK*Δ PR							-0.001*	-0.002**	-0.003*
NPAB* CAPITAL *Δ PR							-0.001*	-0.001**	-0.001*
NPAB*LIQUID*Δ PR							0.003**	0.001**	0.001
NPAB*GOV*Δ PR							-0.001**	-0.003**	-0.001*
COMPETITION	-0.250***	-0.250***	-0.220***	-0.240***	-0.240***	-0.210***	-0.240***	-0.210***	-0.210***
INFLATION	0.003***	0.003**	0.003***	0.003***	0.003**	0.003***	0.003***	0.003***	0.003***
GDP	0.020	0.020	0.020	0.020	0.020	0.030	0.020	0.030	0.030
Number of observations	435	435	435	435	435	435	435	435	435
AR(1)	-0.800 [0.430]	-0.191 [0.850]	-1.510 [0.133]	-0.414 [0.161]	-1.452 [0.150]	-0.933 [0.355]	-1.410 [0.162]	-1.142 [0.256]	-0.636 [0.537]
AR(2)	1.442 [0.152]	0.841 [0.400]	0.581 [0.531]	-0.890 [0.372]	0.851 [0.394]	-0.288 [0.780]	-0.871 [0.366]	-1.090 [0.280]	-0.811 [0.421]
Sargan over- identification test	418.5 [0.100]	385.3 [0.214]	261.8 [0.355]	372.4 [0.122]	269.0 [0.154]	104.8 [0.383]	365.0 [0.110]	272.0 [0.120]	98.9 [0.400]

Source: Author's computations

Consistent with government borrowing and the possibility of the crowding out effect, the findings reveal positive and significant effects for liquidity levels, particularly for the small banks. This is in line with the literature that the bank lending channel is stronger in more liquid banks compared to less liquid banks (Abuka et al, 2019). Indeed, the results reveal a stronger pass-through effect for the small banks mainly on account of liquidity. The high holding of liquid assets may indicate a preference for government securities over lending activities.

We also find that monetary policy changes cause a very different response of bank lending on the basis of their capital structures. In particular, the results reveal significantly negative effects for the foreign well-capitalised banks. This indicates that the pass-through for well-capitalised banks is weaker, implying a low sensitivity of these banks to monetary policy shocks, consistent with other studies in developed countries (Bernanke 2007; Gambacorta and Mistrulli 2014; Abuka et al. 2019).

Competition in the banking industry, measured by the Herfindahl-Hirschmann Index (HHI), exhibits a significant negative effect, implying that the pass-through of monetary policy to bank loans decreases with industry concentration. This finding is consistent with the literature that the bank lending channel is less effective in more concentrated banking industries arising from uncompetitive market practices (Fungáčová, Solanko, and Weill 2014).

The control variables for the macroeconomic environment, that is, the inflation rate and growth rate, have a significant and insignificant positive impact on bank loans, respectively. The probable explanation for the positive effect could be that higher inflation is synonymous with increasing economic activity, which results in increased bank lending. These results are consistent with other studies that note that the pass-through is faster during periods of high inflation and increasing economic activity (Égert and MacDonald 2009)

4.2 Robustness

Model re-estimation using an alternative monetary policy rate (the 7-day interbank rate)

As a test for robustness of the results, we re-estimated the model using the 7-day interbank rate for the period 2011-2019. The results shown in Appendices 6 and 7 remain broadly similar to those that we estimated using the official policy rate (CBR), but we note that the pass-through effects are weaker for the large banks compared to the small banks, and for the foreign banks, especially the NPBs.

Accounting for the asymmetry of loans' reaction to changes in monetary policy

We account for asymmetry in the bank loans between the rise and fall of the policy rate. We introduced dummy variables, D_{rise} and D_{fall} in the model in equation 1 to capture the effect of asymmetry between rising and falling episodes of the policy rate on changes in bank loans. The coefficients on the two dummy variables were interpreted to show whether there exists asymmetry in loans reaction to changes in the

policy rates. The dummy variables were interacted with the policy rate and the bank-specific characteristics to assess the pass-through effect from changes in the policy rate.

The results presented in Table 3 indicate that although the coefficients on the interaction dummy variable,D_{fall}, is negative as expected, it is insignificant. This implies that bank loans do not increase as expected following a decrease in the policy rate, possibly due to the sticky behaviour of lending rates to policy changes, a policy challenge in Uganda's banking sector, which has resulted in continuous high lending rates and hence constraining credit growth (Nampewo 2021). The asymmetric behaviour of bank loans to monetary policy easing is mainly due to liquidity, capital and government borrowing for all the bank categories, and risk, though less significant for the large banks. Foreign banks and by extension, their categories of PABs and NPABs, especially the large banks, also contribute to the asymmetric behaviour of bank loans to monetary policy changes.

On the other hand, the interaction dummy variable,D_{rise}, shows negative significant effects for all bank categories. This implies that, during monetary policy tightening, bank loans decrease as expected and this is consistent with the theory of the bank lending channel. We also note from the results that the small banks are more sensitive to monetary policy shocks, compared to the large banks. The weaker pass-through effects during monetary policy tightening are mainly due to high liquidity conditions in the market. The results also indicate that bank loans are asymmetric to monetary policy, and this weakens the pass-through effect and the effectiveness of the bank lending channel.

In the model estimations, the lagged first difference of the dependent variable (ΔLog_loans) is negative and significant, confirming that the long-run equilibrium relation exists among the variables. The diagnostic tests show that the first-order AR (1) and second-order AR (2) autocorrelation tests have insignificant p-values, confirming the absence of serial autocorrelation in the error terms of the models. The Sargan test of over-identification gives high p-values, implying that there is no problem of over-identification

Table 3: Asymmetry of loans reaction to monetary policy changes

Dependent variable: ΔLog_loans									
Panel A: All Banks				Panel B: Interaction terms with dummy variable during policy fall			Panel B: Interaction terms wth dummy variable during policy rise		
	All Banks	Small Banks	Large Banks	All Banks	Small Banks	Large Banks	All Banks	Small Banks	Large Banks
ΔLR	-0.100**	-0.110***	-0.100*	-0.090**	-0.100**	-0.060*	-0.080**	-0.090**	-0.070*
ΔPR	-0.011**	-0.008***	-0.004**	-0.004**	-0.003***	-0.001	-0.009	-0.006***	-0.003*
ECT	-0.040***	-0.040***	-0.040**	-0.040***	-0.040***	-0.040**	0.040***	-0.040**	0.040**
D_fall*Δ PR				-0.003	-0.001	-0.001			
D_rise*Δ PR							-0.010***	-0.020**	-0.010*
D_fall*RISK*Δ PR				-0.001*	-0.002**	-0.002*			
D_fall*CAPITAL*Δ PR				-0.001*	-0.001*	-0.001*			
D_fall*LIQUID*Δ PR				0.003**	0.001**	0.001***			
D_fall*GOVBOR*Δ PR				-0.002*	-0.002**	- 0.003*			
D_fall*FOREIGN*Δ PR				-0.001*	-0.001	-0.003*			
D_fall*DOMESTIC*Δ PR				0.001	0.004	0.004			
D_fall*PAB*Δ PR				-0.001**	-0.002*	-0.002*			
D_fall*NPAB*Δ PR				-0.003**	-0.001*	-0.001**			
D_rise*RISK*Δ PR							0.005	0.003	0.003
D_rise*CAPITAL*Δ PR							-0.004	-0.001	0.001
D_rise*LIQUID*Δ PR							0.001***	0.001*	0.004**
D_rise*GOVBOR*Δ PR							0.002	0.001	0.002
D_rise*FOREIGN*Δ PR							0. 003	0.004	0.002
D_rise*DOMESTIC*Δ PR							0.004	0.002	0.002
D_rise*PAB*Δ PR							0.001	0.001	0.002
D_rise*NPAB*Δ PR							0.002	0.003	0.005
COMPETITION	-0.060	-0.000	-0.004	-0.050	-0.020	-0.050	-0.010	-0.010	-0.003
INFLATION	0.001***	0.002***	0.001	0.002***	0.002***	0.003*	0.001** 0.004*	0.002***	
GDP	0.040	0.030	0.010	0.040	0.030	0.020	0.040	0.040	0.010
Number of observations	435	435	435	435	435	435	435	435	435
AR(1)	-0.800 [0.430]	-0.190 [0.851]	-1.510 [0.132]	0.155 [0.881]	-1.220 [0.141]	-1.570 [0.151]	-0.877 [0.388]	-0.474 [0.185]	-0.876 [0.381]
AR(2)	1.441 [0.155]	0.841 [0.403]	0.582 [0.531]	-0.321 [0.752]	-1.422 [0.110]	0.616 [0.220]	0.134 [0.900]	0.199 [0.820]	0.211 [0.630]
Sargan over- identification test	411.0 [0.100]	485.3 [0.202]	250.1 [0.115]	401.0 [0.141]	468.0 [0.188]	122.4 [0.441]	421.1 [0.168]	326.0 [0.281]	122.0 [0.331]

Source: Author's computations

5. Conclusion and Policy implications

This paper contributes to the empirical literature on the heterogeneous response of banks in terms of their lending decisions following a monetary policy change. The study was conducted in the context of developing countries, taking the case of Uganda. Exploiting the error correction techniques used within dynamic panel estimates, this paper investigated the factors that might explain the heterogeneous response of bank lending to monetary policy changes over the period 2011 to 2019. The results support the presence of heterogeneity in bank loans' response to monetary policy across the different categories of banks. Overall, the large banks depict a weaker pass-through of monetary to bank lending compared to the small banks. A similar pattern is shown among the foreign banks where; large foreign banks appear to respond less to monetary policy changes regardless of whether they are Pan African banks or not. On the other hand, the small Pan-African Banks depict a stronger pass-through of monetary policy to bank loans compared to the large Pan-African Banks. In addition, bank lending is shown to be asymmetric to monetary policy changes, especially during a loosening monetary policy. The asymmetric behaviour of bank loans weakens the pass-through effect of monetary policy to bank loans.

A combination of bank, industry and macroeconomic level factors explains the heterogeneous response of bank loans to monetary policy. The bank level factors include risk and government borrowing, in which case, higher risk discourages lending by the banks and instead they resort to investing in more profitable and risk- free government securities, potentially leading to crowding out effects of lending to the private sector. The capital structure of banks is another important factor which negatively affects bank lending. This is especially evident among the foreign banks with stronger capital positions than their local counterparts. These factors have contributed to a weaker pass-through of monetary policy shocks to bank loans. On the other hand, liquidity has contributed to stronger pass-through of monetary policy to bank loans, particularly for the small banks. The results reveal that the banking industry is concentrated and this has weakened the effectiveness of the bank lending channel. The inflation rate is positively related to bank loans. This is due to the fact that higher inflation is associated with increasing economic activity, which results in increased bank lending.

These results suggest that measures to reduce credit risk, such as continued support of the credit reference bureau and enhancing domestic revenue mobilisation, would support bank lending to the private sector, especially for the small banks. Although the banking sector was liberalised and opened up to competition, the sector is still highly concentrated, and more can be done, especially in terms of breaking market concentration. Within this realm, supporting mostly the small and indigenous banks to compete and penetrate the market could improve bank competition and banking efficiency and thus enhance the bank lending channel of monetary policy transmission.

Data Availability Statement

The data that support the findings of this study are from the Bank of Uganda and are available upon reasonable request from the corresponding author. The data are not publicly available due to privacy/ethical restrictions.

Funding

This work was supported by the African Economic Research Consortium under Research Grant No. RT19528.

6. References

Abuka, C., Alinda, R.K., Minoiu, C., Peydró, J.L. & Presbitero, A.F. 2019. Monetary policy and bank lending in developing countries: Loan applications, rates, and real effects, Journal of Development Economics, 139, 185-202.

Alkhazaleh, A.M.K. 2017. Does banking sector performance promote economic growth? Case study of Jordanian commercial banks, Problems and Perspectives in Management, 15(2), 55-66

Altunbas, Y., Gambacorta, L. & Marques-Ibanez, D. 2012. Do bank characteristics influence the effect of monetary policy on bank risk? Economics Letters, 117(1), 220-222

Apergis, N., & Polemis, M. L. 2016. Competition and efficiency in the MENA banking region: a non-structural DEA approach. Applied Economics, 48(54), 5276-5291.

Arellano, M. & Bond, S. 1991. Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations, the review of economic studies, 58(2), 277-297

Bernanke, B.S. & Blinder, A.S. 1988. Is it money or credit, or both, or neither, American Economic Review, 78(2), 435-439

Bernanke, B.S. and Gertler, M. 1995. Inside the black box: the credit channel of monetary policy transmission, Journal of Economic perspectives, 9(4), 27-48

Bernanke, B.S. 2007. The financial accelerator and the credit channel, speech at The Credit Channel of Monetary Policy in the Twenty-First Century Conference, Federal Reserve Bank of Atlanta, Atlanta, Georgia.

Bluedorn, J.C., Bowdler, C. & Koch, C. 2017. Heterogeneous bank lending responses to monetary policy: new evidence from a real-time identification, International Journal of Central Banking, 13(1), 95-149

Brissimis, S.N. & Delis, M.D. 2010. Bank Heterogeneity and Monetary Policy Transmission. ECB Working Paper Series No. 1233, European Central Bank: Frankfurt

Brownbridge, M. & Kasekende, L. 2018. Inflation Targeting in Uganda: What Lessons Can We Learn from Five Years of Experience? In Berg, A. and R. Portillo (eds), Monetary Policy in Sub Saharan Africa: Oxford University Press.

Égert, B., & MacDonald, R. 2009. Monetary transmission mechanism in Central and Eastern Europe: Surveying the surveyable. Journal of Economic Surveys, 23(2), 277-327.

Fungáčová, Z., Solanko, L., & Weill, L. 2014. Does competition influence the bank lending channel in the euro area?. Journal of Banking & Finance, 49, 356-366.

Gambacorta, L. & Mistrulli, P.E. 2014. Bank heterogeneity and interest rate setting: What lessons have we learned since Lehman Brothers? Journal of Money, Credit and Banking, 46(4),753-778

Jiménez, G., Ongena, S., Peydró, J.L. & Saurina, J. 2014. Hazardous Times for Monetary Policy: What Do Twenty-Three Million Bank Loans Say About the Effects of Monetary Policy on Credit Risk Taking? Econometrica, 82(2), 463-505

Kashyap, A.K. and Stein, J.C., 1995. The impact of monetary policy on bank balance sheets. In Carnegie-Rochester Conference Series on public policy (Vol. 42, pp. 151-195).

Kashyap, A.K. & Stein, J.C. 2000. What do a million observations on banks say about the transmission of monetary policy? American Economic Review, 90(3), 407-428

Levin, A., Lin, C. F., & Chu, C. S. J. 2002. Unit root tests in panel data: asymptotic and finite-sample properties. Journal of econometrics, 108(1), 1-24.

Loutskina, E. 2011. The role of securitization in bank liquidity and funding management, Journal of Financial Economics, 100(3), 663-684.

Maddala, G. S., & Wu, S. 1999. A comparative study of unit root tests with panel data and a new simple test. Oxford Bulletin of Economics and statistics, 61(S1), 631-652.

Mawejje, J. 2016. Food prices, energy, and climate shocks in Uganda. Agricultural and Food Economics, 4, 4, doi: https://doi.org/10.1186/s40100-016-0049-6

Mawejje, J., & Lakuma, P. 2019. Macroeconomic effects of Mobile money: evidence from Uganda. Financial Innovation, 5, 23, doi: https://doi.org/10.1186/s40854-019-0141-5

Mawejje, J. 2019. Financial inclusion, shocks, and coping strategies: survey evidence from Uganda. African Journal of Economic and Management Studies, 10(3), 286-298.

Mawejje, J. and Lwanga, M.M. 2016. Inflation dynamics and agricultural supply shocks in Uganda. African Journal of Economic and Management Studies, Vol. 7 No. 4, pp. 547-567

Mawejje, J. and Sebudde, R.K. 2019. Constraints or complaints? Business climate and firm performance perceptions in Uganda. The Journal of Development Studies, 55(12), 2513-2525

Mishra, P., & Montiel, P. 2013. How effective is monetary transmission in low-income countries? A survey of the empirical evidence, Economic Systems, 37(2), 187-216

Mishra, P., Montiel, P., Pedroni, P., & Spilimbergo, A. 2014. Monetary policy and bank lending rates in low-income countries: Heterogeneous panel estimates. Journal of Development Economics, 111, 117-131

Nampewo, D. 2021. Why are Lending Rates Sticky? Investigating the asymmetrical adjustment of bank lending rates in Uganda. Journal of African Business, 22(1), 126-151

Nampewo, D., Tinyinondi, G. A., Kawooya, D. R., & Ssonko, G. W. 2016. Determinants of private sector credit in Uganda: the role of mobile money. Financial Innovation, 2, 13, https://doi.org/10.1186/s40854-016-0033-x

Pedroni, P., 2000. Fully modified OLS for heterogeneous cointegrated panels. Advances in Econometrics, 15, pp.93-130.

Zulkhibri, M. 2013. Bank-characteristics, lending channel and monetary policy in emerging markets: bank-level evidence from Malaysia. Applied Financial Economics, 23(5), 347-362.

Appendix 1: Panel unit root tests

H0: Variables are non-stationary			
Variables	**Levin et al.**	**Maddala et al**	**Decision**
LOANS	-0.51 [0.30]	-1.28 [0.90]	Do not reject H0
TB-RATE	-0.66 [0.75]	-1.23 [0.89]	Do not reject H0
7-DAY RATE	-0.40 [0.66]	-1.07 [0.86]	Do not reject H0
CBR	-0.04[0.48]	-0.09[0.54]	Do not reject H0
LIQUID	-3.34 [0.00] ***	-3.82 [0.00] ***	Reject H0
RISK	-0.14 [0.56]	-0.14 [0.56]	Do not reject H0
BANKCAP	-2.58 [0.00] ***	-3.86 [0.00] ***	Reject H0
INFLATION	-0.39 [0.65]	-1.59 [0.95]	Do not reject H0
GOVBOR	-1.18 [0.12]	-0.83 [0.20]	Do not reject H0
GDP	-7.99 [0.00] ***	-12.28 [0.00] ***	Reject H0
COMPETITION	----------	-2.67 [0.00] ***	Reject H0

Note: 1) The coefficients are tabulated; p-values are in parentheses. 2) Significance levels: *** =significant at the 1% level, ** =significant at the 5% level, *=significant at the 10% level, [] are p-values. All trends include fixed effects and trends

Source: Author's computations

Appendix 2: Panel Cointegration Tests

Variables	**ADF**	**Decision**	**Conclusion**
Residuals	- 9.88 [0.00] ***	Reject H0	I(0)

Note: 1) The coefficients are tabulated; p-values are in parentheses. 2) Significance levels: *** =significant at the 1% level, ** =significant at the 5% level, *=significant at the 10% level, [] are p-values

Source: Author's computations

Appendix 3:Test for differences in the pass-through coefficients (heterogeneity)

Bank category	**Test statistic**	**Decision**	**Conclusion**
Small vs Large	2.760 [0.050] **	Reject H0	Coefficients are different (Heterogeneous)
Foreign Vs Domestic	3.850 [0.085] *	Reject H0	Coefficients are different (Heterogeneous)
PAB vs NPAB	7.060 [0.008] ***	Reject H0	Coefficients are different (Heterogeneous)

Note: 1) The coefficients are tabulated; p-values are in parentheses. 2) Significance levels: *** =significant at the 1% level, ** =significant at the 5% level, *=significant at the 10% level, [] are p-values

Source: Author's computations

Appendix 6: Determinants of bank loans using the 7-day rate (Foreign Banks and Domestic Banks)

Dependent variable: ΔLog_loans									
	Panel A: All Banks			Panel B: Foreign Banks			Panel C: Domestic Banks		
	All Banks	Small Banks	Large Banks	All Banks	Small Banks	Large Banks	All Banks	Small Banks	Large Banks
ΔLR_{t-1}	-0.100**	-0.110***	-0.100*	-0.100**	-0.100**	-0.100*	-0.100*	-0.104*	-0.141***
ΔPR_{t-1}	-0.010**	-0.007***	-0.002**	-0.007**	-0.005**	-0.001**	-0.003**	-0.003**	-0.001**
$ECT_{(-1)}$	-0.040***	-0.040***	-0.040**	-0.040***	-0.040***	-0.040**	-0.040**	-0.040**	-0.040**
All Banks*RISK*Δ PR	-0.003*	-0.001**	-0.003						
All Banks *BANKCAP*Δ PR	-0.002	-0.001	-0.001*						
All Banks *LIQUID*Δ PR	0.002***	0.003**	0.003						
All Banks *GOVBOR*Δ PR	-0.002**	-0.001**	-0.004*						
Foreign*RISK*Δ PR				-0.003*	-0.004*	-0.002			
Foreign *BANKCAP*Δ PR				-0.001	-0.001*	-0.001*			
Foreign *LIQUID*Δ PR				0.002***	0.002***	0.004			
Foreign *GOVBOR*Δ PR				-0.002**	-0.001**	- 0.001*			
Domestic*RISK*Δ PR							-0.002*	-0.002	-0.001
Domestic *BANKCAP*Δ PR							-0.001	-0.001	-0.001
Domestic *LIQUID*Δ PR							0.001	0.002*	0.001
Domestic *GOVBOR*Δ PR							-0.002**	-0.001**	-0.001
COMPETITION	-0.200***	-0.210***	-0.190***	-0.21***	-0.21***	-0.19***	-0.19***	-0.17***	-0.19***
INFLATION	0.001*	0.001*	0.002*	0.002**	0.001*	0.001*	0.001*	0.002*	0.002*
GDP	0.030*	0.030*	0.030*	0.030*	0.030*	0.030*	0.030*	0.030*	0.030*
Number of observations	435	435	435	435	435	435	435	435	435
AR(1)	-1.641 [0.101]	-1.425 [0.150]	-0.421 [0.672]	-0.560 [0.571]	-1.955 [0.054]	-0.197 [0.856]	-0.144 [0.891]	0.122 [0.901]	-0.482 [0.633]
AR(2)	1.110 [0.270]	0.782 [0.440]	-1.691 [0.105]	-0.211 [0.841]	0.884 [0.380]	-0.760 [0.451]	-0.200 [0.814]	-0.219 [0.707]	0.313 [0.724]
Sargan over- identification test	375.8 [0.150]	318.1 [0.211]	161.9 [0.205]	404.0 [0.110]	380.1 [0.222]	166.6 [0.441]	308.3 [0.108]	411.0 [0.167]	345.8 [0.118]

Source: Author's computations

Appendix 7: Determinants of bank loans using the 7-day interbank rate (Pan African Banks and Non Pan African Banks)

Dependent variable: ΔLog_loans									
Panel A: All Banks				Panel B: Pan African Banks (PABs)			Panel C: Non Pan African Banks (NPABs)		
	All Banks	Small Banks	Large Banks	All Banks	Small Banks	Large Banks	All Banks	Small Banks	Large Banks
ΔLR	-0.100**	-0.110***	-0.100*	-0.100*	-0.100*	-0.100*	-0.100**	-0.100**	-0.100*
ΔPR	-0.010**	-0.007***	-0.004**	-0.007**	-0.005**	-0.003**	-0.007**	-0.003*	-0.003**
ECT	-0.040***	-0.040***	-0.040**	-0.040***	-0.040**	-0.040**	-0.040***	-0.040**	-0.040**
All Banks*RISK*Δ PR	-0.003*	-0.001**	-0.003						
All Banks *BANKCAP*Δ PR	-0.002	-0.001	-0.001*						
All Banks *LIQUID*Δ PR	0.002***	0.003**	0.003						
All Banks *GOVBOR*Δ PR	-0.002**	-0.001**	-0.004*						
PAB*RISK*Δ PR				-0.001*	-0.003*	-0.002			
PAB *CAPITAL*Δ PR				-0.003**	-0.003*	-0.002*			
PAB *LIQUID*Δ PR				0.003***	0.003***	0.003			
PAB *GOVBOR*Δ PR				-0.002**	-0.001**	- 0.001*			
NPAB*RISK*Δ PR							-0.002*	-0.001*	-0.003
NPAB* BANKCAP *Δ PR							-0.002*	-0.003*	-0.001*
NPAB*LIQUID*Δ PR							0.003***	0.001*	0.001
NPAB*GOVBOR*Δ PR							-0.002**	-0.003*	-0.001*
COMPETITION	-0.200***	-0.210***	-0.190***	-0.200***	-0.200***	-0.180*	-0.200***	-0.200***	-0.190***
INFLATION	0.001*	0.001*	0.002*	0.001*	0.001*	0.001*	0.001*	0.001*	0.002*
GDP	0.030*	0.030*	0.030*	0.030*	0.03*	0.03*	0.030*	0.030*	0.030*
Number of observations	435	435	435	435	435	435	435	435	435
AR(1)	-1.641 [0.101]	-1.425 [0.150]	-0.421 [0.672]	-1.541 [0.129]	-1.564 [0.127]	-0.473 [0.644]	-1.331 [0.122]	-1.311 [0.150]	-0.334 [0.772]
AR(2)	1.110 [0.270]	0.782 [0.440]	-1.691 [0.105]	0.931 [0.35]	0.702 [0.155]	-0.402 [0.335]	0.720 [0.65]	0.922 [0.356]	-0.600 [0.551]
Sargan over- identification test	375.8 [0.150]	318.1 [0.211]	161.9 [0.205]	370.4 [0.111]	251.000 [0.154]	121.881 [0.311]	211.1 [0.891]	299.0 [0.171]	188.2 [0.412]

Source: Author's computations