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Original Research Article

Determinants of interest rate spread in Rwanda: Empirical evidence

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This paper examines the determinants of interest rate spread in Rwanda by using Arellano-Bond dynamic panel data Generalized Method of Moments (GMM) estimation. The study shows that credit risks, operating cost and inflation positively influence interest rate spread in Rwanda, though the effect of the latter is quite small. Panel data fixed effects and random effect estimation also confirmed these results. The findings above imply that banks need to adopt consolidation and cost minimization strategies alongside strengthening of their credit management mechanisms to help reduce credit risk.

Key words: Credit risk, economic efficiency, financial system, interest rate, macroeconomics

INTRODUCTION

It is believed that financial sector development plays an important role in economic growth and development, and commercial banks are important in the development of the financial sector because they promote economic efficiency through financial intermediation particularly in developing countries where banks remain the main source of financing economic activities (Njuguna et al., 2000).

One of the indicators used to measure the efficiency of banks is interest rate spread. Its high value is often associated with the presence of inefficiencies in the banking system, due to the fact that costs incurred as a result of the inefficiency are transferred to bank customers by charging high interest rates (Randall, 1998; Barajas et al., 1999).

High intermediation costs reflect low level of banking sector efficiency resulting from the absence of competition in the sector, inadequate banking regulations and high asymmetric information (Randall, 1998; Barajas et al., 1999). In 2007, the study by Kigabo and Barebereho concluded that interest rate spreads were high in Rwanda as a result of bank specific characteristics and market structure. Factors such as low competition among banks, bank size and the volume of non-performing loans as well as risk aversion of banks were found to play a major role in determining interest rate spread differentials across banks. They recommended that increasing market transparency and reducing information asymmetries would help reduce spreads.

The financial system stability assessment on Rwanda conducted by the IMF in 2011 acknowledged positive developments in Rwanda's banking industry such as increased entry of new banks, growing competition as well as the decline in profit margins and effective spreads for Rwanda's banks. This was due to a number of reforms introduced by the Government of Rwanda since March 1995 which led to noticeable development in financial intermediation. However, the interest rate spread in

Rwanda has remained quite volatile and relatively higher.

This study builds on the aforementioned studies to track the recent developments in interest rate spread and the determinants thereof. The rest of the paper is organized as follow: The second section presents a summary of literature review on the determinants of interest rate spread[1]. In the section III, we analyze in the case of Rwanda, some key factors which are known as drivers of interest rate spread. We focus on macroeconomic and political stability, the development in the banking competition as well as the legal environment. The methodology is presented in the section IV, empirical results in section V before concluding the paper.

Literature review

Empirical literature classifies determinants of interest rate spread into three categories, namely: bank-specific, bank-industry or market structure and macroeconomic factors (Ngugi, 2001; Chirwa and Mlachila, 2002). Bank-specific determinants include non-performing loans (NPLs), overhead costs, and excess liquidity; make share and ownership of bank.

In developing countries, foreign owned banks tend to have wider interest rate spreads compared to domestically owned banks (Demirgüc-Kuntand Huizinga, 1998). However, foreign ownership of a bank was found to be not important in 14 Latin American Countries (Gelos, 2006). Perez (2011) found that market share and NPLs are the major determinants of interest rate spread in Belize and that excess liquidity tended to widen the interest rate spread. In Bangladesh and in the Eastern Caribbean Currency Union, overhead costs, operating costs and NPLs were positively correlated with high interest rate spreads (Grenade, 2007).

In Africa, Ngugi (2001) points out that, ownership structure and control of banks, policy regime (whether interest rates are controlled or not), the market share of individual banks, and diversity of financial assets contribute to high interest rate spreads in Kenya. In addition, monetary policy tightening and increasing treasury bills rate widened the interest spread. A recent study by Rebei (2014) shows that operating expenses and credit risk have a positive effect on interest rate spread.

Chirwa and Mlachila (2002) found that high interest rate spreads were associated with market power, high discount rates, high reserve requirements and high inflation rates in Malawi. These results were also confirmed in the case of English-speaking African countries (Crowley, 2007). Macroeconomics variables were found to be important factors explaining interest rate spread in Namibia (Eita, 2012). In addition, inflation rate, bank rate and the treasury bills rate increase whilst the size of the economy and financial deepening decrease the interest rate spread.

In Sub-Saharan Africa, Ahokpossi (2013) found that market concentration is positively related to interest margins, while bank specific factors such as credit risk, liquidity risk and bank equity are important determinants of interest margins.

Interest rate spread in Rwanda

From the foregoing, international experience shows that interest rate spread are mainly explained by bank specific characteristics (such as size of the bank, credit risks, liquidity risks, overhead costs and deposits strengths), macroeconomic conditions (such as GDP growth, inflation, money markets rates, etc.), the legal environment (creditor rights, the quality of the legal framework, availability of information on borrowers, etc.), the market structure of the banking system (the degree of market competition and market concentration) and political stability. Before conducting empirical analysis, we assess the developments in key factors which are expected to influence the path of the interest rate spread in the Rwandan context.

Macroeconomic stability

Stable macroeconomic environment is conducive for business and can reduce banks risk aversion and the price mark up. The macroeconomic environment in Rwanda has been healthy, stable and sound since year 2000 with high real economic growth of 8% on average, low and stable inflation (4.1% in the last 5 years) and stable exchange rate (depreciation of 3.9% against the US dollar for the last 5 years). In addition, inflation and depreciation were less volatile in Rwanda than in other EAC countries as illustrated in next charts (Figure 1 and Figure 2).

Political stability

Political stability can affect the whole economic environment, banks' investments, assets and profitability. Hence, it definitely affects banks pricing behavior. Rwanda is favorably ranked by the World Bank in terms of good governance, according to the Worldwide Governance Indicator (WGI). In terms of corruption perceptions, Rwanda was ranked the second less corrupted country in Africa after Botswana in 2012 and in 2013. At global level, Rwanda was ranked 50th and 40th respectively in 2012 and 2013 out of 177 countries (Figure 3). In 2015, Rwanda was ranked the 2nd easiest place to business in Africa with the most efficient Government in Africa (World Bank report doing business report 2015) and 7th most efficient globally (Global competitiveness report 2015).

Competition in the banking sector

Development in concentration indicators such as share of number of big banks in deposits, loans and assets of the entire sector and the Herfindahl Hirschmann Index (HHI) shows that the competition in the banking sector in

[1] Interest rate spread is defined in this paper as the difference in the lending and deposit rate

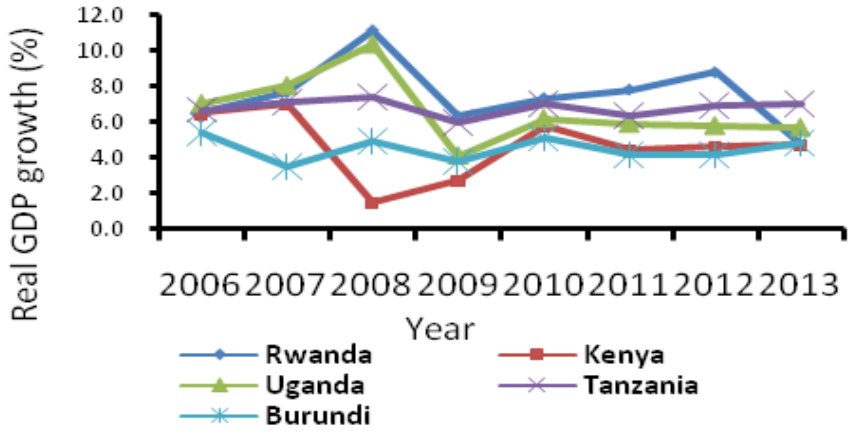

Figure 1: Real GDP growth in percentage
Source: EAC and EAC central banks websites

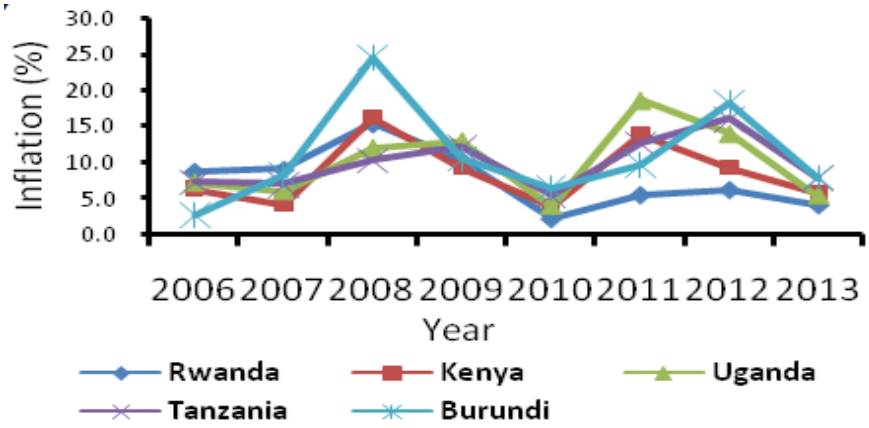

Figure 2: Inflation rate in percentage
Source: EAC and EAC central banks websites.

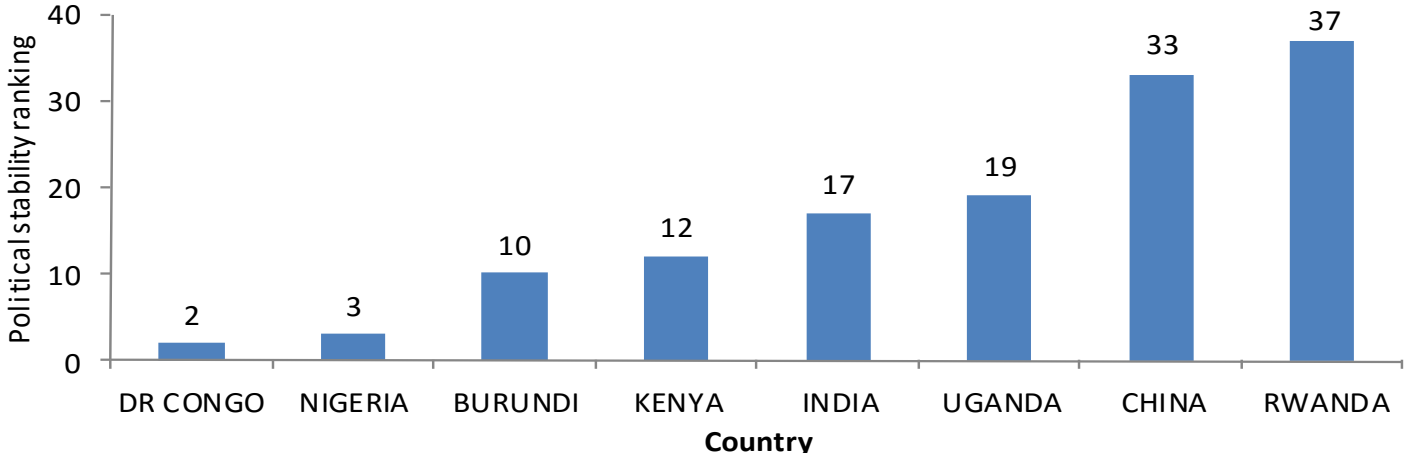

Figure 3: Political stability
Source: World Bank data.

Rwanda has been significantly improving since 2009 due to the entry of new banks in the sector and the development of banking network across the country. The share of three big banks in assets, deposits and loans has significantly

Table 1. Evolution in strength of legal rights index in Rwanda (0=weak to 12=strong).

Index	2010	2011	2012	2013	2014
Strength of legal rights index (0=weak to 12=strong)	7	7	7	9	11

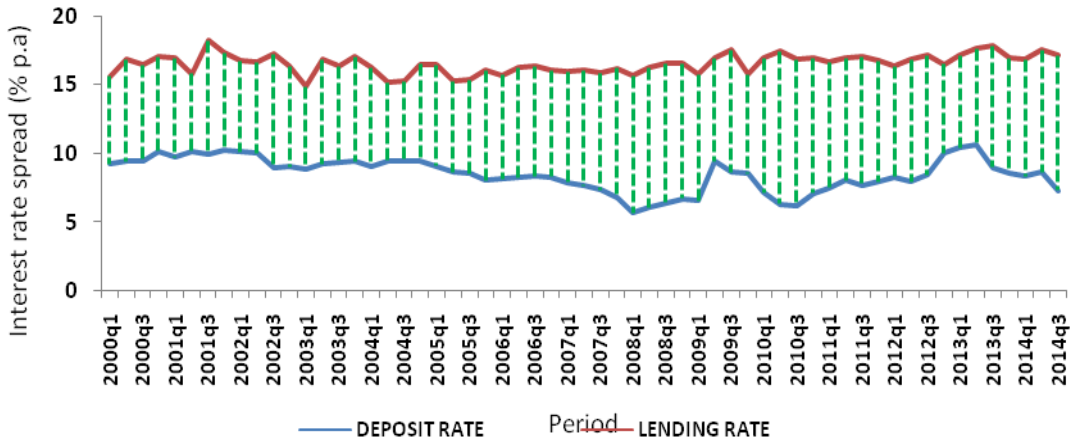

Figure 4: The trend of interest rate spread in Rwanda.
Source: BNR, Monetary Policy and Research Department

reduced from 62.7, 70.4 and 64.3% in 2006 to 48.7, 48.5 and 50.3%, respectively in 2013. During the same period, HHI in assets, deposits and loans declined to 0.12, 0.13 and 0.12 in 2014 from 0.18, 0.21 and 0.18 in 2006, respectively.

A recent study by Kigabo and Nyalihama (2015) using different indicators of competition established that competition in the banking sector in Rwanda has significantly improved. Lerner index reduced from 0.48 in 2006 to 0.29 in 2013 while the panzer Rose H increased from 0.24 to 0.65 in the same period.

Despite this substantial improvement, this has not been translated into a reduction in lending rate as expected due to other factors such as high operating cost but also low level of innovation in the banking sector.

Legal environment

The legal right index as measured by the World Bank has also been strengthening since 2010, reflecting ongoing improvement in that area. Normally, this should reduce the loans risks and subsequently, the lending rate (Table 1).

Interest rate spread development and variability

Deposit rates in Rwanda tend to fluctuate more than lending rates. The latter are particularly high given some structural problems such as high operational costs. While deposit rates have fluctuated at around 9% since 2000, lending rates have remained high, standing at around 17%, and thus keeping the interest rate spread high. However, compared to other EAC countries, interest rate spread is low in Rwanda than in Uganda and Kenya (Figure 4).

Using the coefficient of variation as a measure of variability, we found that variability is high across banks than across time implying that there is heterogeneity in terms of bank-specific characteristics. This supports the use of panel data to determine the key determinants of interest rate spreads in Rwanda (Figure 5).

Considering the spread by size of banks we found that in larger banks (the three biggest banks in terms of asset share) average spread is 7.9% compared to 8.2% for the other banks. Smaller banks tend to incur higher operational costs which they recover by earning higher profit margins while bigger banks tend to benefit from economies of scale without necessarily raising interest rates. In addition, the total operating costs as a percentage of total assets was on average standing at 7.8% for big banks and 8.4% for small banks between 2008Q1 and 2014Q3(Figure 6).

METHODOLOGY

Panel data regression

In this paper, we apply the model developed by Martinez Peria and Mody (2004) which is widely used in empirical studies on determinants of interest rate spread:

$$SP_{it} = b_0 + b_1 CR_{it} + b_2 \log oc_{it} + b_3 size_{it} + b_4 MS_{it} + b_5 \pi_t + e_{it} \quad (1)$$

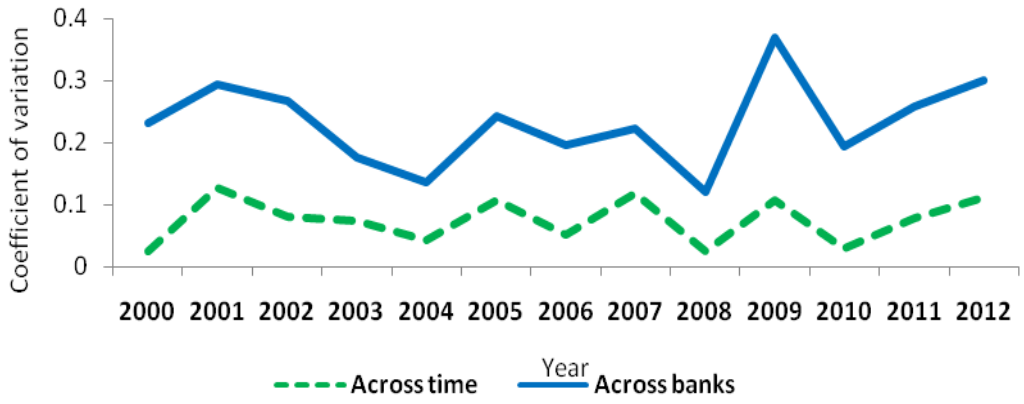

Figure 5: Coefficient of variation for the interest rate spread over time and across banks
Source: Authors' calculations.

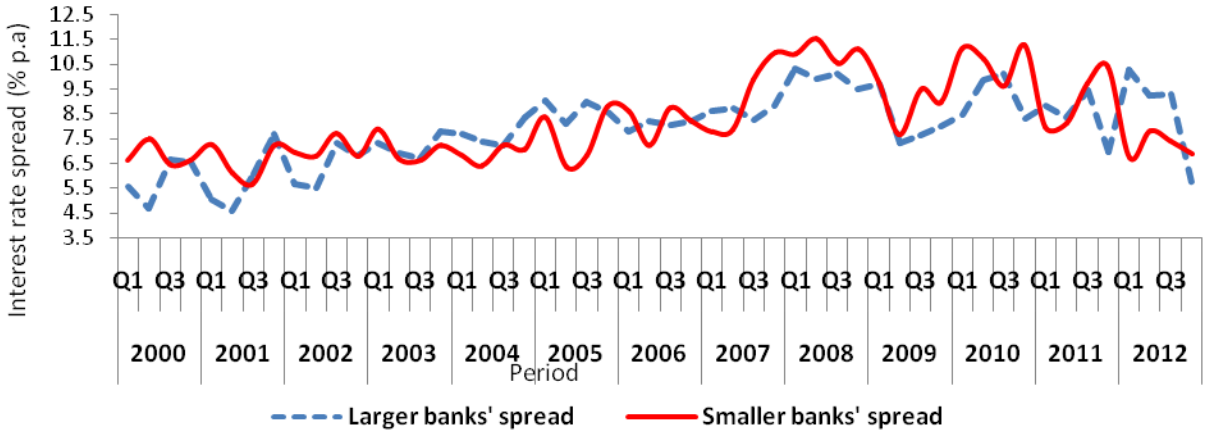

Figure 6: Interest rate spread by category of banks
Source: Own calculations

Where: i= 1… 6 (number of banks); t= from first quarter of 2006 to the first quarter of 2012.

ε is the white noise error term, capturing all other factors that might influence interest rate spread but not included in the model.

logoc is the logarithm of the ratio of operating costs to total assets. Operating costs for Rwandan commercial banks include interest expenses, loan loss provisions, salaries, wages staff costs, premises, depreciation and transport, other interest expenses and any other expenses. Since higher operating costs imply higher marginal costs leading to the upward adjustments in the lending rate, logoc is expected to have a positive effect on interest rate spread (Lerner, 1981).

Size is the logarithm of the share of each bank's assets in total assets of commercial banks. Bank size is used as a proxy for the average size of operations of a particular bank (Ayesha and Nawazish, 2010). Since banks can enjoy economies of scale or face diseconomies of scale, bank size can have either positive or negative effects on interest rate spread.

Credit risks (CR) is measured as the logarithm of the ratio of net loans to total assets. Once the net loans ratio is rising, there is a large likelihood for loan defaults and non-performing loans to increase. As a result banks tend to reserve more loan loss provisions to mitigate any emerging risks. These buffers are often built by increasing the profitability of banks, done through increasing lending rates, hence leading to the widening of the interest rate spread (Wong, 1997).

Market power is measured as the logarithm of the bank's market share in the deposits market ($msh\_deposits$). Higher market power implies that the banking sector is dominated by a few banks, which may collude to set higher lending rates to fetch higher profits and thus leading to higher interest rate spreads (Norris and Floerkemeier, 2007).

Another important determinant of interest rate spread is inflation, which is often considered as a measure of macroeconomic stability. Higher inflation leads to declining value of money and increasing risk exposure of banks in terms of higher solvency (Beck and Hesse, 2006). According

Table 2. Parameters estimated in the interest rate spread model.

Parameter	Description
b_0	The intercept
b_1	Elasticity for credit risk
b_2	Elasticity for operating costs
b_3	Elasticity for the size of banks
b_4	Elasticity for the bank's deposit market share
b_5	Semi-elasticity for inflation

to the Fischer hypothesis, nominal interest rate is a sum of the real interest and inflation. This implies that any increase in inflation is factored into the nominal interest rate, thus, a positive relationship between interest rate spread and inflation is expected. The parameters used in equation 1 are defined in Table 2.

Three sets of model were estimated and compared in order to choose the one that best captures the realities of interest rate spreads among Rwanda's commercial banks.

First, we assume individual random effects and specify the random effects model as:

$$\text{spread}_{it} = \beta X_{it} + u_{it} \quad (2)$$

Where: $u_{it} = \alpha_i + \varepsilon_{it}$, X_{it} stands for a set of bank characteristics, market/industry as well as macroeconomic variables. u_{it} is the between-entity error while ε_{it} is the within-entity indicator.

For $i = 1, N$; $t = 1, T$; $E(\alpha_i) = E(\varepsilon_{it}) = 0$, $Var(\alpha_i) = \delta_\alpha^2$, $Var(\varepsilon_{it}) = \delta_\varepsilon^2$ and $E(\alpha_i, \varepsilon_{it}) = 0$ (3)

The presence of α_i leads to serial correlation in the u_{it}, $E(u_{it}, u_{is}) = \delta_\alpha^2$ for $t \neq s$; thus, failure to account for α_i leads, at a minimum, to incorrect standard errors and inefficient estimation. If α_i is correlated with X_{it}, failure to account for α_i leads to heterogeneity (omitted variables) bias in the estimate of β. The presence of random effects is tested using the Breusch-Pagan LM test (whose statistic follows the chi-square distribution with one degree of freedom) stated as:

$$LM = \frac{NT}{2(T-1)}\left[\frac{\sum_N\left(\sum_T \varepsilon_{it}\right)^2}{\sum_N\sum_T \varepsilon_{it}^2}\right]^2 \quad (4)$$

Secondly, we assumed the fixed effects model mainly to remove the effects of bank specific characteristics that do not vary over time but rather across banks. The fixed effects model is stated as:

$$\text{spread}_{it} = \beta_1 X_{it} + \alpha_i + u_{it} \quad (5)$$

Where: X_{it} stands for a set of bank characteristics, market/industry variables as well as macroeconomic variables. u_{it} is the between-entity error, α_i represents coefficients on a set of dummy variables indicating membership in cross-sectional unit i. To test for the presence of fixed effects, the F test is used to test joint significance of the included dummy variables. In effect, we have 6 cross-sections for which we test for fixed effects by testing the hypothesis that $\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = \alpha_6$ which is simply a joint significance test of individual characteristics.

Lastly, the pooled model assumes that there is perfect homogeneity between all six commercial banks (intercepts and slopes are similar). All banks are assumed to have similar coefficients (slopes and intercepts) such that observations for each bank are stacked together. The pooled model is as stated below:

$$\text{spread}_t = \beta_1 X_t + \alpha + u_t \quad (6)$$

Where: X_t stands for a set of bank characteristics, market/industry variables as well as macroeconomic variables. u_t is the between-entity error. To test for poolability, a comparison of the pooled model (the restricted model) and either the random effects model or fixed effects model (the unrestricted model) can be made using the restricted F test.

To choose between the fixed effects model and the random effects model, the Hausman test (H) is used.

Given that GMM estimates are more efficient and mindful of the persistence of higher interest rate spreads during the sample period, we compare the results of the fixed effects model with those of the dynamic panel data regression (Arellano-Bond estimation). The latter enables the use of the lagged dependent variable as one of the explanatory variables to account for persistence.

Table 3. Estimation results

Variable	Random effect	Fixed effect	GMM: Arellano-Bond
Logoc	0.67***	0.78***	0.52***
Credit risk	2.52**	1.89	2.08*
Inflation	0.12***	0.12***	0.12***
msh_deposits	0.02	-0.04	0.40**
Intercept	-2.76	3.71*	-2.92
Spread(lag)			0.36***

*, **, *** Imply significance at 10%, 5% and 1% respectively

RESULTS

Based on the findings presented in the Table 3, we reject the null hypothesis of both random and fixed effects, thus we estimate both models and compare results. In addition, we then compare results from the two models with the GMM results (Arellano-Bond linear dynamic panel-data estimation).

These results indicate that as credit risk increases, commercial banks raise their interest rate spreads as a hedge against such risks. Other factors influencing spread in Rwanda operating costs are market power, measured by the market of deposits and the lagged term of interest rate spread. The latter implies that it takes time for commercial banks to sort out structural problems, such as higher operating costs, in order to reduce interest rates.

The moderate effect of inflation on interest rate spread is due to the fact that inflation in Rwanda has for a long time been maintained at moderate levels and therefore less influential in the formation of expectations by economic agents.

Conclusions and policy implications

This paper builds on a study by Kigabo and Barebereho (2007) who hypothesized that interest rate spread in Rwanda depends on non-performing loans, provisions for doubtful debts, over-head costs, bank size (measured by bank assets), deposit market share, deposit market concentration and inflation. Using bank level quarterly data, our findings confirm that risks associated with lending out funds affect the interest rate spread. Both operating costs and credit risk significantly and positively affect interest rate spreads in Rwanda's commercial banks. Other variable found to be responsible for pushing up spreads in Rwanda is inflation, although its effect is moderate.

This may indicates that by achieving low and stable inflation in recent years, BNR's monetary policy has become more credible and effective, thereby making inflation less influential in the formation of expectations by economic agents and banks pricing less prone to inflation movement. The insignificance of market power is an indication that price-based competition has improved over time among Rwanda's commercial banks.

The significant positive effect of credit risk, operating cost and inflation on interest rate spread implies that strategies to reduce costs and exposure to loan default risks need to be strengthened if the efficiency of banks is to be improved. In addition, banks should devise mechanisms to screen out potential defaulters and strengthen their credit management strategies to help reduce credit risk. A strong credit reference bureau, used and accessed by all banks, is a valuable tool to provide information about potential borrowers as it would help reduce information asymmetry in the commercial banking industry.

Finally, appropriate monetary and fiscal policy measures should also be sustained in order to maintain stability in prices and the general macroeconomic environment. In the wake of rising inflation, coordination of monetary and fiscal policy as well as other policies can be pursued to help attain the low and stable inflation objective.

Competing interests

The authors declare that they have no competing interests

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