Factors explaining high interest rates in Mongolia: A Markov Regime-Switching approach

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Abstract

This paper examines the dynamics of bank lending, deposit rates and interest rate spread in Mongolia using both accounting framework and Markov Regime-Switching approach. The empirical analysis suggests that the high lending rate in Mongolia is compatible with underdeveloped stock market, low savings ratio, inefficient operating costs of banks, high credit risk, high interbank market rate driven by unstable inflation, strong competition in deposit market and concentration in the loan market. Important findings stand out: (i) the accounting framework suggests that bank lending rate is high because of high deposit rate, while high interest rate spread mainly reflects operating costs and provision for loan losses; (ii) the results obtained from Markow Regime-Switching approach support the view that permitting asymmetry and non-linearity in responses of interest rate to changes in explaining factors are important in the interest rate analysis; (iii) effects of non-performing loan, inter-bank market rate and growth of money supply on the interest rate spread, bank lending and deposit rates differ depending on the regime, while structure of loan and deposit markets, business cycle fluctuations, budget expenditure and stock market capitalization significantly affect both bank lending rate and interest rate spread regardless of the regime; and (iv) market structure, risks associated with lending operations (credit risk, interest rate risk, the interaction between the risks and inflation) and industrial product affect the lending rate transmitting through the interest rate spread, whereas the growth of M2 money and financial sector development influence the lending rate channeling through the deposit rate.

Keywords: Lending rate, deposit rate, interest rate spread, Markov Regime-Switching model.

JEL classification: C22, C51, D40, E43, L11.

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1. Introduction

The banking sector plays a key role in the economy as it channels funds from lenders to borrowers. Bank lending rate can be decomposed as sum of bank deposit rate and the interest rate spread (lending rate minus deposit rate). It is important that the financial intermediation by banks is performed with the low possible interest rate spread to achieve greater social welfare. Interest rate spread for all group of countries has declined over the last two decades. However, there is high diversity in interest rate spread across countries. According to the World Bank database, as of 2017, the interest rate spread is 5.9% for the World, 7.1% for lower middle-income countries, 3.9% for South Asian countries and below 3% for OECD countries. For the resource dependent[2] low-and lower-middle-income countries, the interest rate spread has declined from 12.8% to 7.7% during the period 2007-2017, however it is still high compared to those in other groups of countries. The existing literature (i.e., Ho and Saunders 1981, Maudos and Guevare 2004, Hannan and Berger 1989, 1991 and De Bondt 2005) suggests that interest rate spread and deposit rate depend on the degree of market competition, risks to which banks are exposed (interest rate risk, credit risk), and operating costs of banking sector, development of financial system, macroeconomic stability, legal environment and economic policies. However, factors explaining lending and deposit rates can vary across countries reflecting characteristics of the economy such as how the economy is dependent on resource sector. As resource abundant countries are highly vulnerable to external shocks such as commodity demand, commodity price and foreign direct investment (FDI) shocks, factors reflecting the fact may play a vital role in explaining interest rates in the countries. Thus, it is important to empirically analyze the determinants of interest rate spread, lending and deposit rates for resource abundant economies.

This paper seeks to explain interest rate spread, lending rate and deposit rate in Mongolia-one of the most resource dependent countries, which are persistently high by comparison with other small and middle income countries, using both accounting framework and Markov Regime-Switching approach. As of 2017, bank lending and deposit rates in Mongolia are 20% and 13%, respectively. This level of bank lending rate is 5 percentage points higher than the average of the middle-income countries, and about 10 percentage points higher compared to East Asia and Pacific countries[3]. This paper contributes to the literature in two ways. First, use of Markov Regime-Switching approach to examine determinants of bank lending rate, deposit rate and interest rate spread in a resource abundant country is its novelty in the literature. It is one of the first attempts to examine the regimes of lending rate, deposit rate and interest rate spread. Second, since the study uses a large data set including banks' income statements, balance sheets (used for lending rate decomposition based on accounting framework), and aggregate macroeconomic and financial variables, it provides comprehensive analysis examining effects of

[2] A distinction is made between 'resource dependent' and 'resource abundant' countries in the paper. The natural abundance is measured by natural resource rents and natural resource dependence is represented by as a share of gross domestic product (Shahbaz et al. 2019).

[3] According to the World Bank database, the interest rate spread (about 7 percent) is 1 percentage points higher compared to the average of the middle-income countries, and about 3 percentage points higher over East Asia and Pacific countries.

potential factors explaining lending and deposit rates in a commodity exporting economy. As far as we are aware, empirical studies on the same topic for resource abundant countries are rare in the literature.

Existing studies have concentrated on analyzing factors determining the interest rate spread rather than lending rates. The theoretical and empirical literature on the interest rate spread is rich and mostly covers the euro area where banks play an important role in the financial sector. The dealership model proposed by Ho and Saunders (1981) shows that the degree of market competition and interest rate risk are key factors determining the interest rate spread. Allen (1988) applies her analysis to the model with two types of loans. Saunders and Schumacher (2000) apply the original model of Ho and Saunders (1981) to analyze the determinants of the interest margin by following a two-step process and find that macro policies consistent with reduced interest-rate volatility (i.e., low inflation policies) could have a positive effect in reducing bank margins. Demirgüç-Kunt (1999) shows that differences in interest margins reflect a variety of determinants such as bank characteristics, macroeconomic conditions, explicit and implicit bank taxation, deposit insurance regulation, overall financial structure, and underlying legal and institutional indicators. Maudos and Guevare (2004) extend the Ho and Saunders (1981) model by introducing (i) the influence of operating costs, (ii) credit risks, (iii) competitive structure of both lending and deposit markets, (iv) positive relationship between the interest rate spread and the size of banking operations, (v) opportunity cost of keeping reserves, and (vi) quality of management into the modelling of the interest margin. By applying the Ho and Saunders (1981) model to a multi-output framework, Valverde and Fernández (2007) find that (i) the relationship between bank margins and market power varies significantly across bank specializations, and (ii) the market power increases as output becomes more diversified towards non-traditional activities in the European banking sector.

The literature suggests two opposing hypothesis about the impact of concentration on the pricing behavior of banks: ‘structure performance hypothesis’- banks will collude and use market power to extract rents from their customers and ‘efficiency structure hypothesis’- concentration would increase the overall efficiency of the sector. Hannen and Berger (1989) model bank deposit prices as a function of local concentration and find strong evidence in favor of structure performance hypothesis for the US banking market. Rhoades (1993) provides evidence against the efficiency structure hypothesis. Slovin and Sushka (1983) find that commercial banks operate in a market characterized by imperfect competition and they explicitly set loan rates. Using a simple Cournot model of bank pricing originally proposed by Jappelli (1993), Corvoisier and Gropp (2002) find that for loan and demand deposits, increasing concentration may have resulted in less competitive pricing by banks as expected by the model, whereas for savings and time deposits, the model is rejected. Hannen and Berger (1991) find that (i) deposit rates exhibit significantly more rigidity in concentrated markets and (2) deposit rates are significantly more rigid when the stimulus for the deposit rate change is upward. The presence of switching costs, market structure and regulatory restrictions are sources of market power, which lead banks to

quote lower rates on deposits and higher rates on loans (Berger et al. 2004, Demirgüç-Kunt et al. 2004).

In this paper, the factors explaining the interest rate spread, bank lending and deposit rates are examined using Markow Regime-Switching approach developed by Quandt (1972) and Goldfeld and Quandt (1973). Markov Regime-Switching model is particularly useful in examining the interest rates since factors affecting interest rates and their effects can vary over time depending on the state of the economy. More generally, changes in business cycle conditions and monetary policy may affect real rates and expected inflation and cause interest rates to behave quite differently in different time periods. For instance, Ang and Bekaert (2002) show that regimes in interest rates correspond reasonably well with the US business cycle. Permitting asymmetry and non-linearity in responses of interest rate to changes in explaining factors are crucial in the interest rate analysis. Regime-switching models constitute an attractive class of models to capture these changes in the behaviour of interest rates. In economic analysis, Hamilton (1989) extends Markov-Switching regressions for AR processes and provided a nonlinear filter for estimation and shows that the modelling technique is useful in capturing the asymmetrical behaviour observed over expansions and recessions in the US business cycle. This technique has been used for analysing time-series properties and pass-through of interest rate (Garcia and Perron 1996, Ang and Bekaert 2002, Blagov et al. 2015) and exchange rate (Engel and Hamilton 1990), however has not been employed in analysing factors explaining the interest rate spread and interest rates.

The reminder of the paper is structured as follows. Section 2 provides the background on the banking sector, dynamics of bank interest rates and decomposition of the lending rate based on an accounting framework in Mongolia. Section 3 describes theoretical and empirical modelling of the interest rate spread and deposit rate and discuss es Markov-Switching dynamic regression as the econometric methodology used in the empirical analysis. Section 4 describes the data employed and provides empirical results. Finally, section 5 concludes the paper with some policy implications and directions for future research.

2. The country background and dynamics of bank interest rates

2.1 Overview of the Mongolian banking sector

Mongolia is one of the most resource dependent countries as the commodity exports (coal, copper, mineral fuels, iron ore and gold) of the economy account for around 90% of its total exports, which is about 40% of its total GDP. Mongolia has a relatively closed, bank-based financial system. Currently, 13 registered commercial banks account for 96% of total financial system asset, and the ratio of total bank loans to GDP is about 50%. Banks therefore play a vital role in the creation of money supply and in the transmission of monetary policy. Foreign banks are not present in Mongolia, however overseas financial institutions hold certain shares of domestic bank equities. Currently, banks rely more heavily on domestic deposits to finance their

loans, and only a few banks have access to international capital markets. The current level of dollarization in the bank balance sheets exposes the sector to risks. About a third of deposits and a fourth of loans are denominated in foreign currency. Banks' foreign currency lending to unhedged borrowers renders the banking sector vulnerable to foreign exchange induced credit risk. Banking sector lending is highly concentrated in mining, construction, trading, and household sectors, as there are few investment opportunities available domestically. The Mongolian banking sector is characterized by extremely short maturities on financial liabilities, and therefore, the business loan term is relatively short (less than two years). Volatile capital flows and dollarization of domestic liability lead to exchange rate risk on banks or their customers, due to underdeveloped market tools for foreign exchange hedging. Furthermore, banks have relatively low capital compared to assets and are highly leveraged, making them more vulnerable to liquidity problems.

Prior to July 2007, the Bank of Mongolia (BOM) had announced operating targets for monetary aggregates. During that period, monetary policy operated through a mixture of open-market operations and direct controls on bank interest rates, reserve requirements and various other balance sheet restrictions. The BOM managed the money market rate by operating in the market for settlement funds to achieve its operational targets, which meant that there was considerable volatility in the market rates. In July 2007, the BOM began announcing the policy rate (i.e., the desired level for the money market rate) as a new operational target of monetary policy. Since then, the BOM has been conducting independent monetary policy using the policy rate as its main instrument to signal its policy stance. The policy rate is set with the aim of influencing the aggregate demand and prices in the economy. As an operating target, it is periodically adjusted by the Monetary Policy Committee. In 2013, an interest rate corridor system was introduced in order to strengthen the interest rate channel of monetary policy.

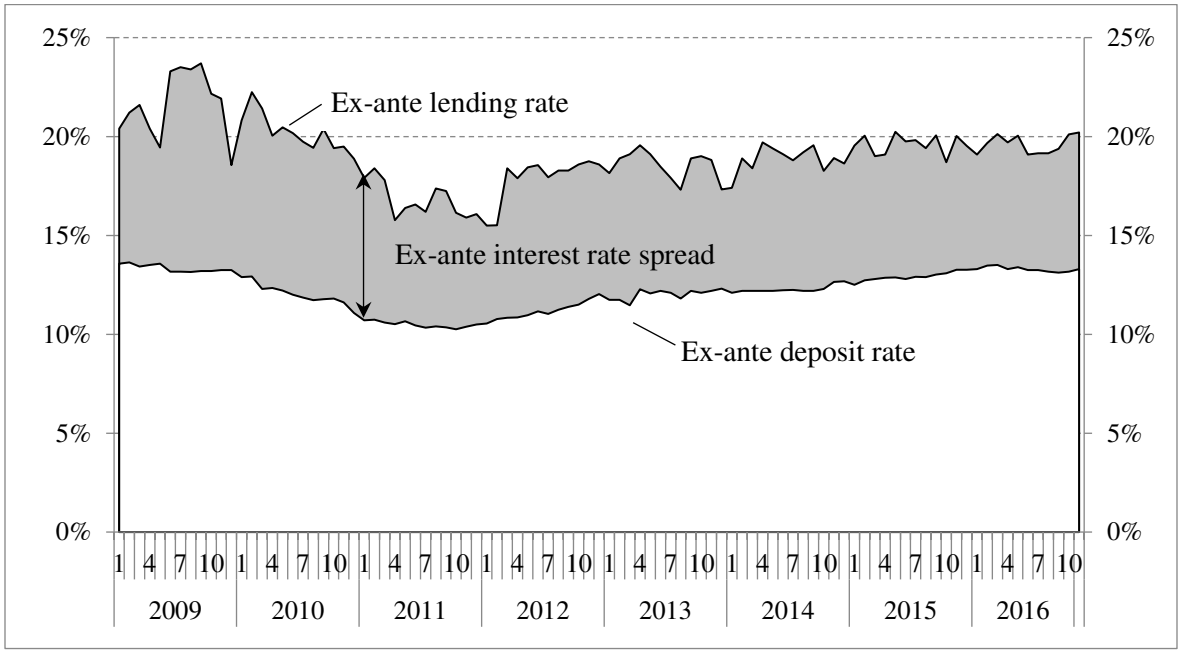
2.2 Anatomy of bank interest rates

The efficiency of bank intermediation is measured using both ex-ante and ex-post spreads. The ex-ante spread is the difference between the contractual rates charged on loans and rates paid on deposits. The ex-post spread is the difference between banks' actual interest revenues and their actual interest expenses. The ex-post spread differs from the ex-ante spread by the amount of loan defaults (Demirgüç-Kunt and Huizinga 1999).

As shown in Figure 1, banks' ex-ante (announced or before the event) lending rate declined until 2012 when it reaches 15.5% per annum, before turning up thereafter. The downward trend of the lending rate was explained by both the narrowing of the interest rate spread and the reduction in deposit rate. As the economy was in the expansion phase during the period 2010-2011 driven by high amount of FDI inflows in the mining sector and rapid increases in export revenues, the domestic banks' deposits rapidly increased, thereby intended to reduce the ex-ante deposit rate. During the expansion phase, banks had seen the credit risk as low, hence reduced the interest rate spread. Since super cycle of commodity prices ended and FDI in the mining sector stopped,

raising depreciation pressure and raising domestic economic uncertainty, banks immediately raised the interest rate spread in 2012 and started to increase the deposit rate. During the period 2012-2016, the interest rate spread was relatively stable around 6.5%, and the upward trend in the lending rate is mainly explained by the rise in deposit rate. The gradual increase in the domestic currency deposit rate can be explained by high inflation and exchange rate depreciation during the period 2013-2016.

Figure 1. Ex-ante bank lending and deposit rates and ex-ante interest rate spread, 2008M12-2016M10



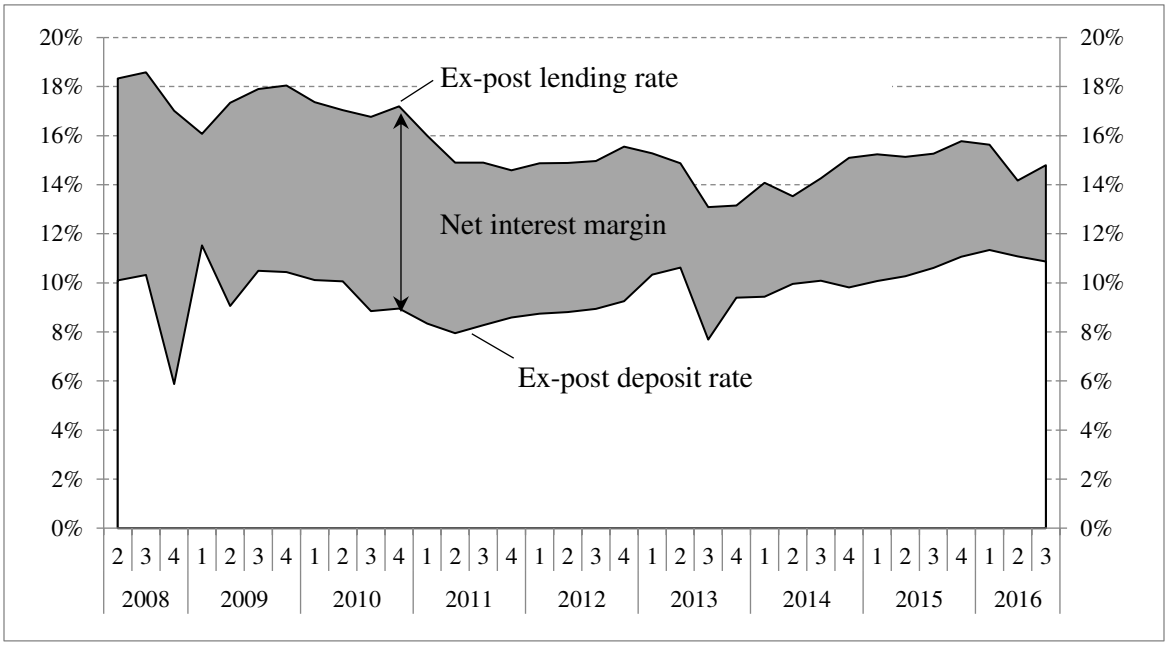
Source: Statistical Bulletin, Bank of Mongolia

As emphasized by Demirgüç-Kunt and Huizinga (1999), the ex-post spread is a more useful measure since it controls for the fact that banks with high-yield, risky credits are likely to face more defaults. As shown in Figure 2, the ex-post lending rate (actually earned rate) had a downward trend until 2014 when it reached 13% per annum, since then, it has started to increase and reached 16% per annum at the end of 2015. Net interest margin (ex post interest rate spread) has declined over time, and the recent upward trend of ex-post lending rate is mainly associated with upswing in ex post deposit rate.

As of third quarter of 2016, the ex-ante bank lending rate is 20%, which is 5 percentage points higher compared to the ex-post lending rate. Enhhuyag (2005) provides some explanations on why the ex-post bank lending could be lower in the case of Mongolia: (i) banks extend maturity and change lending rates when they realize that their initial loan conditions do not properly match with the borrowers' project, (ii) bank and borrower flexibly make amendments on the mutual loan agreement reflecting changes in domestic and external environments, (iii) according to the current regulation, overdue loans (exceeds 90 days) is included in total loans, but its

interest earning is not recorded in income statement as it is not paid. As ex-ante lending rate is calculated as loan interest earning to total loan ratio, it is estimated at low level, and (iv) increases in non-performing loans, stop of interest payments or weak enforcement operations on requiring full interest payments result in lower ex-post lending rate. Hence, banks may set higher ex-ante lending rate reflecting the expected loan default and its interest earning in the high credit risk environment.

Figure 2. Ex-post lending and deposit rates and net interest margin, 2008Q2-2016Q3



Source: Author's calculation based on banks' income statements and balance sheets

In what follows, the ex-post lending rate is decomposed using an accounting framework, which relies on the income statement and balance sheet of commercial banks. The ex-post lending rate is actual return on total loan outstanding measured in domestic currency and is received by banks 'after the fact- loans have been issued'. In the accounting framework, global factors affecting domestic ex-post lending rate is assumed to be captured in the exchange rate used to convert FX items in the income statement and balance sheet into domestic currency.

The consolidated income statement of commercial banks defines profit before taxes (P) as interest income (II) plus noninterest income (NII), minus interest expense (IP), operating cost OC), and provisions for loan losses ($Prov$). This identity can be rearranged and expressed as the interest margin (i.e., $II - IP$):

$$II - IP \equiv OC + Prov + P - NII \quad (1)$$

where interest income (II) equals to sum of loan interest income (LII) and other interest income OII) ($II = LII + OII$), whereas interest expense (IP) equals to sum total of deposit interest expense (DIP) and other interest expense (OIP) ($IP = DIP + OIP$).

Dividing this expression by average deposit (D) as a scaling factor, and using average loans (L) and assets (A), the following expression results:

$$\frac{LII}{L} * \frac{L}{D} - \frac{DIP}{D} \equiv \frac{OC}{D} + \frac{Prov}{D} + \frac{P}{A} * \frac{A}{D} - \frac{NII}{D} - \frac{NOII}{D} \tag{2}$$

where P/A = gross return on assets (*ROA*), *NOII = OII – OIP* is net other interest income.

Using the fact that loan interest income is equivalent to average lending rate times the average volume of loans, and that deposit interest expense is equivalent to the average deposit rate times average deposits, the following expression for the lending rate results:

$$r_L \equiv r_D + \delta r_L + \frac{OC}{D} + \frac{Prov}{D} + ROA * \frac{A}{D} - \frac{NII}{D} - \frac{NOII}{D} \tag{3}$$

where $r_L \equiv LII/L$ is lending rate, $r_D \equiv DII/D$ is deposit rate, $L/D \equiv (1-\delta)$ is the loan to deposit ratio, and δ is 'required reserve ratio'[4]. In the decomposition, δ varies each year depending on loan to deposit ratio. When large non-deposit liabilities (due to the BOM's quasi fiscal operations) are used for lending in the banking system, δ is no longer required reserve ratio. Because of quasi-fiscal operation implemented by the BOM, the ratio L/D for some years may exceed 1, and in such case, δ will be negative. Net other interest income (NOII = other interest income (OII) – other interest expense (OIP)) also affects the ex-post lending rate. Reductions in interest expenses on non-deposit liabilities reduce the spread, thereby the ex-post lending rate.

The result of the decomposition of ex-post lending rate into its various components according to equation (3) is presented in Table 1.

Table 1. Anatomy of the ex-post lending rate, in percent

	2008	2009	2010	2011	2012	2013	2014	2015	2016.Q3	Average
r_L	16.2	16.1	15.1	12.3	13.5	11.6	13.3	14.8	14.0	14.2
Decomposition:										
r_D	9.3	8.3	7.5	7.2	8.0	8.1	9.2	10.2	10.1	8.6
Spread:	6.9	7.8	7.6	5.1	5.5	3.5	4.1	4.6	3.9	5.5
δr_L	-4.2	0.2	3.5	1.1	0.1	-2.4	-3.3	-3.1	-1.6	-1.1
OC/D	7.1	6.3	4.6	4.2	4.7	4.4	4.9	5.4	4.9	5.2
$Prov/D$	1.6	3.3	0.9	0.8	0.6	1.2	1.2	2.8	3.5	1.8
$ROA * A/D$	4.1	0.1	2.5	4.1	3.7	4.2	3.8	2.6	1.1	2.9
$-NII/D$	-2.3	-2.7	-2.6	-3.4	-3.0	-3.1	-2.5	-2.4	-3.1	-2.8
$-NOII/D$	0.7	0.6	-1.2	-1.6	-0.6	-0.7	0.0	-0.7	-0.9	-0.5
Memorandum:										
ROA	2.3	0.1	1.7	2.6	2.2	1.8	1.7	1.2	0.5	1.6
$A/D * 100$	182.6	167.7	147.2	154.6	169.7	233.4	222.0	225	227.2	192.2

Source: Author's calculation based on banks' balance sheet and income statement.

[4] In a simple framework where banks issue loans using only their deposits (even with zero equity), δ can be considered as 'required reserve ratio'.

Table 1 reveals that the average ex-post lending rate actually earned by banks was about 14 percent per annum over the period 2008-2016, and of which, about 8.5 percentage points was the ex-post deposit rate, whereas about 5.5 percentage point was the interest rate spread. On average approximately 7 percentage points of this spread was attributable to various costs- namely operation cost (5.2 percentage points) and provisions for loan losses (1.8 percentage points), and 3 percentage points are associated with bank's profitability. Positive net income from other activities (besides issuing loans and taking deposits) has allowed banks to lower the interest rate spread over the period. For instance, 2.8 percentage points and 0.5 percentage points of the spread are attributable to noninterest income and net other interest income, respectively.

The ex-post lending rate was about 16% during the period 2008-2009, and reduced over high growth phase reaching 11.6% in 2013, mainly reflecting a decrease in the interest rate spread (i.e., declines in operating costs and loan loss provisions and increases in noninterest income). The lending rate has kept at a higher level during economic recessions (occurred for the period 2008-2009 and 2015-2016) driven by adverse external shocks. The Mongolian economy has grown at annual rate of 7.9% on average for the period 2010-2018. However, the growth has been volatile over time as the economy frequently hits by external and domestic shocks. During the high growth phase occurring between 2011 and 2013, average annual growth stood at 13.7%, mainly contributed by high amount of FDI inflows, commodity export revenues and expansionary macroeconomic policies. Loose monetary and fiscal policies started in 2012 to buffer the economy from the external shocks supported the economic growth for a while (i.e., the period 2013- 2014), but at the cost of economic vulnerabilities. The growth plummeted to 1.2 percent in 2016 because of unavoidable recession started since 2015 when FDI stopped, commodity demand and prices fell, and credit condition tightened. The slight increase in the lending rate observed over the period 2014-2016 was associated with both the deposit rate and the interest rate spread driven by increases in the deposit rate and loan loss provisions. Over the period, deposit rate increased by 2 percentage points, while interest rate margin rose by 1 percentage point.

The analysis reveals that bank profit behaves in a strong pro-cyclical manner, whereas the cost of loan loss provisions changes in a counter-cyclical manner. The profit component ($ROA * A/D$) in Table 1 has decreased during the recession phases (i.e., 2008-2009 and 2015-2016), while it increased for the high growth phase. For instance, the component took value of 0.1 percentage point in 2009 when the economy is hardly affected by global financial crisis (GFC). Since then, it increased to 4.1 percentage point in 2011 and kept at the level during the period 2011-2014. Instead, the provision component ($Prov/D$) increased during the recession phase (i.e., 3.3 percentage point in 2009 from 1.6 percentage point in 2008) and decreased for the expansion phase. For instance, it is kept at the level of below 1.5 percentage point for the period 2010-2014 but increased to 3.5 percentage level in 2016 when the economy faced with the recession.

The average asset to deposit ratio of the banking system is high at 192.2%. This implies that large non-deposit liabilities are also used for lending in the Mongolian banking system, and

dynamics in interest expenses on non-deposit liabilities would also be important to explain the spread. The high asset to deposit ratio can be explained by the fact that the BOM has implemented quasi-fiscal operations during the period 2012-2016. The quasi-fiscal operations were implemented like policy lending programs targeted on specific sectors to spur economic growth when the economy was hit hard by adverse external shocks. The BOM injected cheaper liquidity to banks, which issued same amount of subsidized loans to the targeted sectors. As a result, banks' assets have increased much quicker than their deposits. From Table 1, net other interest income (NOII) has contributed to reduce the spread, hence the ex-post lending rate for the period 2010-2016. The non-deposit liabilities of banks increased by the BOM's subsidized lending program have resulted in reducing the ex-post lending rate as the financing sources were much cheaper compared to the deposit rates.

Though the accounting framework used in the section is helpful to decompose the lending rate into the deposit rate and items contributing to the interest rate spread, the framework cannot provide any answers as to how the deposit rate and the interest rate spread would respond to changes in its determinants at the margin. To answer the question, in the next section, models for the analysis of the determinants of deposit rate and interest rate spread are discussed in detail.

3. Modelling of lending rate, deposit rate and interest rate spread

3.1 Theoretical framework

It can be assumed that the lending rate (r_L) is sum of deposit rate (r_D) and interest rate spread (sp), which reflects costs of risk, operating cost, and profitability ($r_L = r_D + sp$). In what follows, models for analyzing determinants of interest rate spread and deposit rate are discussed.

The starting point for examining factors explaining the interest rate spread is the dealership model of Ho and Saunders (1981). A couple of papers (i.e., Maudos and Guavare 2004, Valverde and Fernández 2007 and Entrop et al. 2015) extend the model and provide theoretical foundations for factors explaining the interest rate spread. In the models, a bank is viewed as a risk-averse dealer in the credit market, acting as an intermediary between demanders and suppliers of funds. The planning horizon is a single period during which the bank sets interest rates at the beginning of the period (before any deposits or loans are made) remain constant for the whole period. The banks, who are risk averse and have to deal with demands for loans, and offers of deposits, that reach them asymmetrically in time, must set interest rates on loans (r_L) and deposits (r_D) optimally so as to minimize the risk deriving from the uncertainty of interest rates in the money markets to which they have to resort in the event of excessive demand for loans or insufficient supply of deposits.

The presented paper relies on the model of Maudos and Guevare (2004) that results the optimal interest rate spread (sp) as follows:

$$sp = r_L - r_D = \frac{1}{2}\left(\frac{\alpha_D}{\beta_D} + \frac{\alpha_L}{\beta_L}\right) + \frac{1}{2}\left(\frac{C(L)}{L} + \frac{C(D)}{D}\right)$$

$$-\frac{1}{4}\frac{U''(\bar{W})}{U'(\bar{W})}[(L+2L_0)\sigma_L^2+(L+D)\sigma_M^2+2(M_0-L)\sigma_{LM}] \quad (4)$$

According to the theoretical models, factors explaining the interest rate spread are as follows:

- *Market power*. The competitive structure of the banking industry is determined by the extent to which loan demand and deposit supply are inelastic with respect to the intermediation fees charged, represented by the factors β_L and β_D. The less elastic the demand for credit (or supply of deposits), the less will be the value of β, and the bank will be able to apply high margins if it exercises monopoly power. Consequently, α/β ratio proxies the possible monopoly profits implicit in bank margins.
- *Operating cost*. The average operating cost C incurred per unit of transaction volume L (or D), i.e., $C(L)/L, C(D)/D$ is passed on to lenders and borrowers as in a standard monopolistic setting. Banks with higher personal costs associated with the new transaction (or having higher costs because they offer their customers more services) will charge higher fees in loans and deposits. When there is no market power or risk, positive margin compensates for costs.
- *Risk components*. Risks associated with bank's financial intermediation are as follows:
    - *Risk aversion*. In the model, this component is measured by the coefficient of absolute risk aversion, $-U''(\bar{W})/U'(\bar{W})$, where on the assumption that the bank is risk-averse, $U''(\bar{W})<0$, the former expression is greater than zero. Certainly, the more risk-averse bank will charge higher margins.
    - *Interest rate risk*. The high volatility of money market interest rate (σ_M^2) implies the greater market risk, and it will therefore be necessary to operate with higher margins as banks will require a higher premium at the margin.
    - *Credit risk*. It is captured by σ_L^2. The greater the uncertainty or the volatility of the expected return on the loans granted (risk of default), the greater will be the margin with which the bank works.
    - *Covariance or interaction between interest rate risk and credit risk* (σ_{LM}). Banks are prone to joint occurrence of credit and interest rate risks. For example, when the expected loan repayment is not made on time, banks may need to borrow from the money market to maintain liquidity requirement or issue new loans. The co-occurrence of the two risks can be differently reflected in interest rate spread compared to occurrence of each risk. Hence, the interaction between interest rate risk and credit risk is considered as an independent determinant of interest rate spread. The greater the interaction, the greater will be the spread.
- *The size of banking operation.* The interest rate spread is also affected by the average size of the credit and deposit operations undertaken by the bank ($L+D$), the total volume of loans ($L+2L_0$) and gap between supply of capital in the money market M_0 and loan (L) ,(M_0-L). The model predicts the unit margins are an increasing function

of the average size of operations. The potential loss will be greater for those banks in which the volume of credits granted is greater.

3.2 Empirical approach

A number of papers (i.e., McShane and Sharpe 1985, Angbazo 1997, Maudos and Guevare 2004, Valverde and Fernández 2007 and Entrop et al. 2015) use a single-stage approach or directly study factors explaining the interest rate margin. In this paper, the empirical analysis follows the single-stage approach and uses publicly available time-series data. Therefore, the reduced-form empirical equations of the bank lending rate, deposit rate and interest rate spread should include these sub-grouped variables:

$$y_t = f(S_t(\cdot), R_t(\cdot), OE_t(\cdot), M_t(\cdot), \varepsilon_t) \tag{5}$$

where $y_t \in \{r_{L,t}, r_{D,t}, sp_t\}$ is the dependent variable, which will be bank lending rate, deposit rate, and interest rate spread, $S_t(\cdot)$ is a vector of market structure variables, $R_t(\cdot)$ is a vector of risk variables determining the interest rate spread[5], $OE_t(\cdot)$ is a vector of banks' operation variables, $M_t(\cdot)$ is a vector of macroeconomic control variables and ε_t is the error term. These vectors of variables are selected in the estimation as:

Market structure, $S_t(\cdot)$. Concentration ratio (CR) and Herfindahl index ($HERF$) of bank loan and deposit markets are used as proxies for market structure variables (α_D/β_D and α_L/β_L). Low concentration or strong competition in deposit market may result in an increase in the bank deposit rate. In the highly concentrated loan market, big banks may exercise their market power to keep the interest rate spread at the high level.

Risk components, $R_t(\cdot)$. Proxies for risks are selected as follows:

- *Credit risk* (σ_L^2). As an observable and standard indicator, non-performing loan to total loan ratio (NPL) is chosen for the proxy of credit risk in the estimation. Banks with higher NPL ratio may raise the interest rate spread (as well as lending rate) to cover the expected loss and to dampen the demand for loan, of which quality is worsening.
- *Interest rate risk* (σ_M^2). As financial markets are underdeveloped (i.e., there are no frequent contracts in the market) in Mongolia, time-varying measures for market implied interest rate risk are not available. GARCH volatility of the interbank market interest rate ($IBRSD$) is used as a proxy for the interest rate risk. The GARCH volatility is a popular way to measure the time-varying volatility of the IBRSD. The high volatility of the interest rate implies the greater uncertainty about the funding cost on the money market, and banks will require a higher premium at the interest rate spread.

- *Credit- interest rate risk covariance* (σ_{LM}). The product of NPL and $IBRSD$ is used to proxy for the interaction between credit and interest rate risks. The expected coefficient

[5] This vector of variables is not included in the deposit rate equation.

sign can be expected as positive since bank will require higher premium to capture the coexistence of the risks.

The size of banking operation, $OE_t(\cdot)$. Annual growth of M2 money is used as proxy for the size of banking operation. Banks' main operations include taking deposits and issuing loans. The broad money (M2) consists of both deposits and loans. Hence, the broad money is a standard measure capturing size of banking operations. In this regard, the M2 growth can be a determinant of the lending rate. M2 growth may have different effects on the interest rate spread and deposit rate. For instance, the potential loss will be greater for a big banking sector in which the volume of M2 (or credit) is greater. To reflect the potential loss, the interest rate spread will be higher. On the other hand, larger the size of the banking sector, greater could be its competitive advantage, and therefore lesser the interest rate spread charged by banks. Moreover, the high M2 growth (greater supply of deposits) may result in lower deposit rates. Therefore, the overall impact of M2 growth on the lending rate can be only determined from empirical analysis.

Macroeconomic control variable, $M_t(\cdot)$. This vector of variables is chosen as follows:

- *Money market interest rate.* Weighted average inter-bank market interest rate (IBR) is used for the proxy of money market interest rate. De Bondt (2005) shows how money market interest rate (or policy rate) affects bank deposit and lending rates using a standard marginal cost pricing model.

- *Inflation.* Annual inflation (INF) is used since the annual lending rate is observed as the dependent variable in the estimation. Inflation and its expectation integrate effects of nominal contracting. For example, they are the key factors affecting customer's decision to deposit their fund at the deposit rate offered by banks. In addition, inflation is itself a key indicator of macroeconomics risk. Thus, it is expected to have a positive influence on the interest rate spread.

- *State of the economy.* The cyclical component of industrial product (IP_GAP) is used to proxy the state of the economy. The cyclical component of the variable is calculated using Hodrick-Prescott (HP) filter for seasonally adjusted data. Deposit rate may decline during the economic expansion period and may increase during the economic recession as observed in the Section 2.2. According to the financial accelerator theory, the spread between the lending rate and risk-free interest rate will increase during the economic recession.

- *Development of stock market.* Annual growth of the market capitalization (G_SM) is used to proxy the development of the stock market. Banking sector and stock market are alternative choices for the large companies which are looking for financing and for investors who have sufficient fund. High bank deposit rates may adversely affect the

development of stock market since people prefer to place deposits at the banks. In such case, the banking sector is a substitute rather than complement for stock market.

- *Government budget.* Growth of budget expenditure (G_FC) is selected for proxy of fiscal policy. When the budget deficit is financed from the domestic market, it will crowd out private investments and credits since banks might prefer to purchase government securities rather than issuing new loans. In addition, the higher government expenditure may result in higher inflation. Segura-Ubiergo (2012) shows that the effect of fiscal policy on the lending rate is strong in Brazil-one of the countries with high interest rates.

3.3 Econometric methodology: Markov-Switching dynamic regression

In the empirical analysis, Markov-switching regression is employed based on the pre-determined empirical result (i.e., Ang and Bekaert 2002) that interest rates behave quite differently in different time periods. The method permits asymmetry and non-linearity in responses of interest rate to changes in explanatory variables. Since there is no sufficient evidence that all explanatory variables correspond with regime changes, Markov-Switching Vector Autoregressive model (MS-VAR) is not considered in the analysis.

To study the determinants of bank lending rate, deposit rate and interest rate spread shown in equation (5), the following general specification of the Markov-switching dynamic regression is used:

$$y_t = a(s_t) + B_1 x_t + \cdots + B_p x_{t-p} + A_1(s_t) z_t + \cdots + A_q(s_t) z_{t-q} + \varepsilon_t \qquad (6)$$

where y_t is the dependent variable at time t, s_t represents the state, $a(s_t)$ is the state-dependent intercept, x_t is a vector of exogenous variables (some variables of $S_t(\cdot), R_t(\cdot), OE_t(\cdot), M_t(\cdot)$) with state-invariant coefficients B, z_t is a vector of exogenous variables (some variables of $S_t(\cdot), R_t(\cdot), OE_t(\cdot), M_t(\cdot)$) with state-dependent coefficients $A(s_t)$, p and q are time lags, ε_t is an independent and identically distributed (i.i.d.) normal error with mean 0 and state-invariant variance ($\varepsilon_t \sim i.i.d.N(0, \sigma^2)$). x_t and z_t may contain lags of y_t. State-dependent coefficients (i.e., $a(s_t)$, $A(s_t)$) takes different values depending on states ($s_t = \{1, \dots, k\}$, where k is the number of states).

Markow-Switching model analyses have been conducted recently in economic studies. Markov-Switching model becomes an alternative to the linear model by allowing change in parameters, but they are used for series that are believed to transition over a finite set of unobserved states, allowing the process to evolve differently in each state. The transitions occur according to a Markov process. The time of transition from one state to another and the duration between changes in state is random. Thus, these models can be used to understand the process that governs the time at which interest rate transitions between rise and fall and the duration of each period.

The Markov-switching regression model used in this paper assumes that the Markov state variable governing the timing of regime switches is exogenous. This assumption is a limitation

of the methodology since some papers (i.e., Kim et al. 2008, Kang (2014) and Hwu et al. 2020) have recently developed 'endogenous switching' model, in which latent state variable driving the regime switching is endogenous, and found evidence in favor of endogenous switching model. The use of the endogenous switching model in analyzing lending rate dynamics is left to the future research.

4. Data and empirical results

4.1 Data

The data used in this paper includes monthly time series of weighted average bank lending rate, weighted average bank deposit rate, the interest rate spread (the bank lending rate minus the bank deposit rate), weighted average inter-bank market rate, annual inflation, NPL ratio, total loans, total deposits, industrial product (at 2010 constant prices), annual growth of M2 money, annual growth of stock market capitalization, growth of budget expenditure, concentration ratios and Herfindahl indexes of loan and deposit markets of the banking sector. All interest rate and change variables are measured in percentage, and natural logarithm is taken for level variables in the estimation. The analysis of the bank lending rate covers the period from December 2002 to October 2016[6]. However, the analyses of the bank deposit rate and the interest rate spread cover the period from December 2008 to October 2016 as the data on the bank deposit rate are only available since December 2008[7]. The cyclical component of industrial product (IP_GAP) is measured using Hodrick-Prescott (HP) filter for seasonally adjusted data of 12 months moving average of industrial product as there is the strong volatility in the industrial product. Both concentration ratios and Herfindahl indices in loan and deposit markets are calculated using individual banks' loan and deposit. The data series are obtained from monthly statistical bulletins of the Bank of Mongolia and the National Statistics Office of Mongolia.

4.2 Empirical results

In time series econometric analysis, it is required to test the unit root of time series in the regression. Many studies (i.e., Hamilton 1989, Cecchetti and Mark 1990 and Engel 1994) that employ a Markov-switching variance or trend growth rate simply assume a unit root in the series of interest. The Phillips-Perron test is used in the pre-testing of the unit root, and the results show that both lending and deposit rates sampled in the paper are I(1). The non-linearity in the series of the bank lending rate, deposit rate and the interest rate spread is also tested using both Ramsey-RESET test and BDS statistics suggested by Brock et al. (1987), and the results show that the null hypothesis of linearity of the series is rejected for all variables. As pre-conditions are met for the use of Markov-Switching model, the models for the lending rate, the deposit rate and the interest rate spread are estimated. In the estimation, two states are assumed considering the relatively short sample size and stationary residuals of each estimated model.

[6] The sample starts from December 2002 as the inter-bank market rate is only available since then.
[7] Prior to December 2008, the Bank of Mongolia did not calculate the weighted-average deposit rate.

Table 2. Markov-Regime Switching regressions for lending rate, interest rate spread and deposit rate

Lending rate ($r_{L,t}$)		Interest rate spread (sp_t)		Deposit rate ($r_{D,t}$)	
Sample: 2002M12-2016M10		Sample: 2008M12-2016M10		Sample: 2008M12-2016M10	
Variables	Coefficients	Variables	Coefficients	Variables	Coefficients
Regime 1		Regime 1		Regime 1	
Constant	29.2***	Constant	5.94***	Constant	13.8***
IBR_{t-4}	0.01	IBR_{t-4}	0.05	IBR_{t-1}	0.05*
NPL_{t-5}	0.44***	NPL_{t-5}	0.34***	G_M2_{t-6}	-0.02***
$IBRSD_t$	0.34***	$IBRSD_t$	1.18***	$IP\_MA\_GAP_{t-3}$	-0.07***
$IBRSD_{t-3} \times NPL_{t-3}$	0.06****	INF_{t-2}	0.27***		
INF_{t-2}	-0.10				
G_M2_{t-6}	-0.02***				
Regime 2		Regime 2		Regime 2	
Constant	21.2***	Constant	3.64*	Constant	14.7***
IBR_{t-4}	0.23***	IBR_{t-4}	0.22***	IBR_{t-1}	0.07***
NPL_{t-5}	0.86***	NPL_{t-5}	0.39***	G_M2_{t-6}	-0.02***
$IBRSD_t$	0.04	$IBRSD_t$	-0.09	$IP\_MA\_GAP_{t-3}$	0.002
$IBRSD_{t-3} \times NPL_{t-3}$	0.03*	INF_{t-2}	-0.02		
INF_{t-2}	0.45***				
G_M2_{t-6}	0.05***				
General		General		General	
HHI_D_t	-0.01***	$CR5\_D_t$	-0.15***	HHI_D_t	-0.001***
HHI_L_t	0.006**	$CR2\_L_t$	0.20***	G_SM_{t-3}	-0.001*
IP_GAP_t	-0.03***	IP_GAP_t	-0.01***	$log(\sigma_t^2)$	-1.64***
G_SM_{t-1}	-0.007***	G_SM_{t-1}	-0.02***		
G_FC_{t-1}	0.004***	$log(\sigma_t^2)$	-0.70***		
$log(\sigma_t^2)$	-0.20***				
Transition matrix parameters		Transition matrix parameters		Transition matrix parameters	
p_{11}: Constant	4.31***	p_{11}: Constant	5.17***	p_{11}: Constant	3.25***
p_{11}: G_L_{t-3}	-0.48**	p_{21}: Constant	-6.83**	p_{21}: Constant	-4.38***
p_{21}: Constant	-2.15***				
p_{21}: G_L_{t-3}	0.13				
Log-likelihood	-233.3	Log-likelihood	-92.0	Log-likelihood	12.62

Note: *** $p < 0.01$; ** $p < 0.05$; *** $p < 0.10$.

Table 2 shows the estimated parameters for the models. All explanatory variables determined from the theoretical framework are remained in the estimated equations, and the lag selection procedure of explanatory variables is based on a sort of the general-to-specific approach[8]. The general-to-specific modelling is a central method for selecting useful empirical models and

[8] Up to 12-time lags are considered for all explanatory variables, and the selected model is based on the criteria that log-likelihood increases when a variable is dropped from the regression. As it is empirical analysis, whether the coefficient is statistically significant, and the sign of the coefficient is in line with economic meaning are also considered in the selection of the model.

allows to simplify an initially general model that adequately characterize the empirical evidence within the theoretical framework (Campos et al. 2005).

The effect of the inter-bank market rate (IBR_{t-4}), NPL ratio (NPL_{t-5}), inflation (INF_{t-2}), change in M2 money (G_M2_{t-6}), standard deviation of the inter-bank market rate ($IBRSD_t$) and product of the inter-bank market rate and NPL ratio ($IBRSD_{t-3} \times NPL_{t-3}$) on the lending rate ($r_{L,t}$) varies depending on the regime. Constant term, the NPL ratio, the change in M2 money and the standard deviation of the inter-bank market rate are found significant in determining the lending rate for both regimes.

As expected, risk components (the NPL ratio and product of the NPL ratio and the standard deviation of inter-bank market rate) are positively correlated with the lending rate. The time lag of 5 months may reflect the fact that NPLs transfer to the loss after some lags, therefore banks re-set their lending rates to cover the costs regarding to the credit risks. The change in M2 money is negatively correlated with the lending rate in the regime 1, but positively correlated in the regime 2. The regime 1 is for higher lending rate, while the regime 2 is for relatively lower lending rate. The interest rate risk (the standard deviation of inter-bank market rate) is significant and positively correlated with the lending rate in the regime 1, while the inter-bank market rate (IBR_{t-4}) and inflation (INF_{t-2}) are significant and positively correlated with the lending rate in the regime 2.

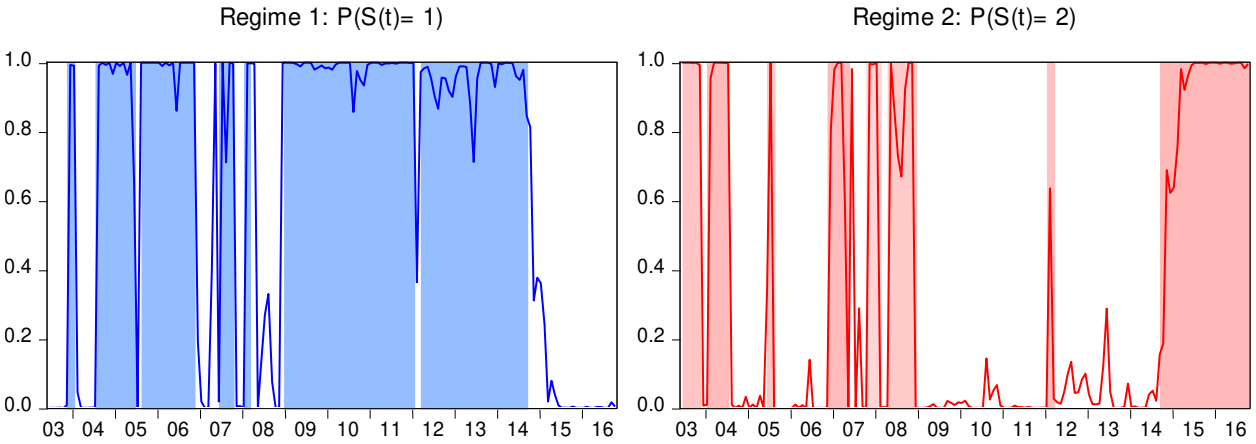
The time-lag and the magnitude of the coefficient on the interbank market rate imply that the interest rate pass-through from the policy rate to the lending rate is slow, incomplete and changes over time. The result is in line with the finding reported by Gan-Ochir and Kaliappa (2016). In addition, the effect of the NPL ratio on the lending rate is stronger in the regime 2.

Regardless of the regime, competitive structures of loan (HHI_L_t) and deposit (HHI_D_t) markets, the state of the economy (IP_GAP_t), the development of stock market (G_SM_{t-1}) and the government budget (G_FC_{t-1}) have significant effects, and signs of the significant coefficients are as expected. As end of 2017, Herfindahl indices of credit and deposit markets take values of 0.17 and 0.20, respectively. The result may indicate that moderate level of concentration (or relatively weak competition) exists in the markets. More concentration in the credit market leads to higher lending rate, while concentration in the deposit market results in lower deposit rate and lending rate. Moreover, business cycle and change in budget expenditure are reflected in the lending rate. A positive change in budget expenditure starts to raise the lending rate after one month, and the lending rate decreases during the expansion phase of the business cycle. Another interesting result is that change in stock market capitalization has positive and significant impact on the lending rate, even though the impact is weak.

The growth of bank loans (G_L_{t-3}) significantly affects the probability that bank lending rate remains in the regime of high lending rate. For instance, the growth of bank loans reduces the probability. The estimated probabilities of transition from one regime to the other (P) are as follows: $p_{11} = 0.93$ (standard deviation of 0.1), $p_{12} = 0.07$ (standard deviation of 0.1), $p_{22} =$

0.86 (standard deviation of 0.05), $p_{21} = 0.14$ (standard deviation of 0.05). The expected (average) duration that the bank lending rate spends in the regime of high lending rate is 14 months[9], while the expected duration of the low lending rate regime is about 7 months. 95% confidence interval for the duration that the bank lending rate spends in the high lending rate regime is [7.5, 33.3] months, while 95% confidence interval for the duration of low lending rate regime is [3.7, 16.3] months. The results suggest that the lending rate spends a significant amount of time in both regimes. Estimated probabilities of being in the higher lending rate state (regime 1) and being in the lower lending rate state (regime 2) are shown in Figure 3.

Figure 3. Estimated probabilities that bank lending rate remains in regime 1 and regime 2



If we classify as higher lending rate state for those months with an estimated probability exceeding 0.7, the identified episodes of the state occurred between January 2009 and September 2014 (except for February 2012). The lending rate have been in the lower lending rate state since October 2014. This result presents that the recent movements in the bank lending rate can be explained by the relationship among variables under the low credit growth state (the regime 2).

Markov-switching models of the interest rate spread and the bank deposit rate are also estimated to identify what factors affect the bank lending rate through changing the two components as well as to formulate policy guidance on lowering the interest rate spread and bank deposit rate. The results are shown in the last 2 columns of Table 2.

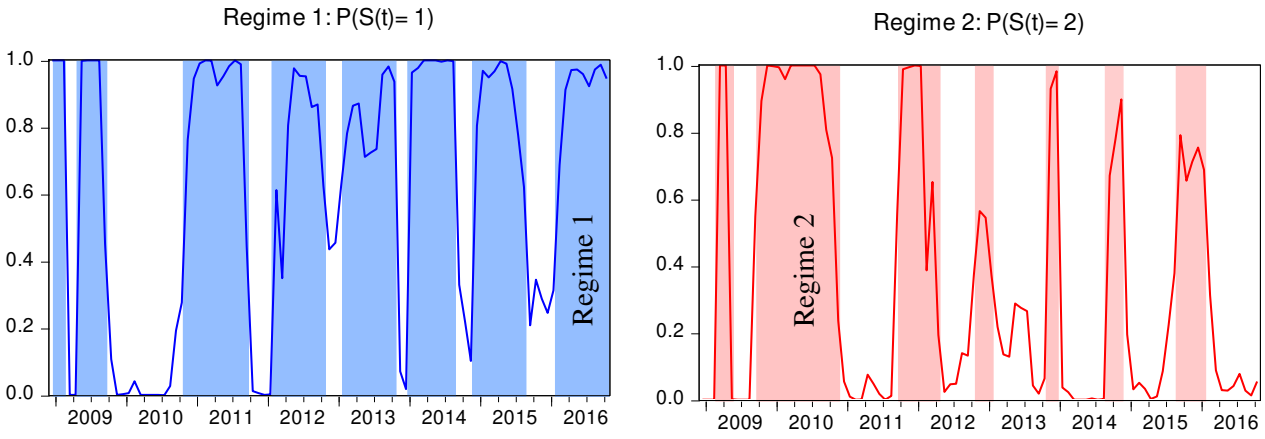
The results show that the impacts of the inter-bank interest rate on the bank deposit rate and the interest rate spread are statistically significant (only in regime 2 for the interest rate spread). Structure of deposit market, stock market development and business cycle also affect both the bank deposit rate and the interest rate spread. For proxy variables for business cycle, the industrial production gap (IP_GAP_t) affects the interest rate spread, while the gap measured based on 12-month moving average of industrial production ($IP\_MA\_GAP_{t-3}$) affects the bank

[9] This expected duration that the lending rate spends in regime 1 is estimated as $E(D_1) = 1/(1 - p_{11}) = 14.3$ months.

deposit rate only in the regime 1. Herfindahl index of deposit market (HHI_D_t) has an impact on the bank deposit rate, while the concentration ratio of deposit market ($CR5\_D_t$) calculated covering top 5 banks significantly affect the interest rate spread.

NPL ratio (NPL_{t-5}) affects the interest rate spread in both regimes, while the impacts of inflation (INF_{t-2}) and interest rate risk ($IBRSD_t$) on the interest rate spread are statistically significant in only regime 1. The regime 1 is for lower interest rate spread, while the regime 2 is for higher interest rate spread. Regardless of the regime, structure of credit market ($CR2\_L_t$) affects the interest rate spread. Change in M2 money (G_M2_{t-6}) has statistically significant effect on the bank deposit rate. These results are in line with theoretical assumptions in the sense that credit market structure, risks associated with lending activities affect the interest rate spread, while growth of deposit affect the bank deposit rate. The results shown in Table 2 are in line with findings of studies conducted in Mongolia (i.e., Boldbaatar 2006, Gan-Ochir 2009 and Gan-Ochir and Kaliappa 2016).

Figure 4. Estimated probabilities that interest spread remains in regime 1 and regime 2



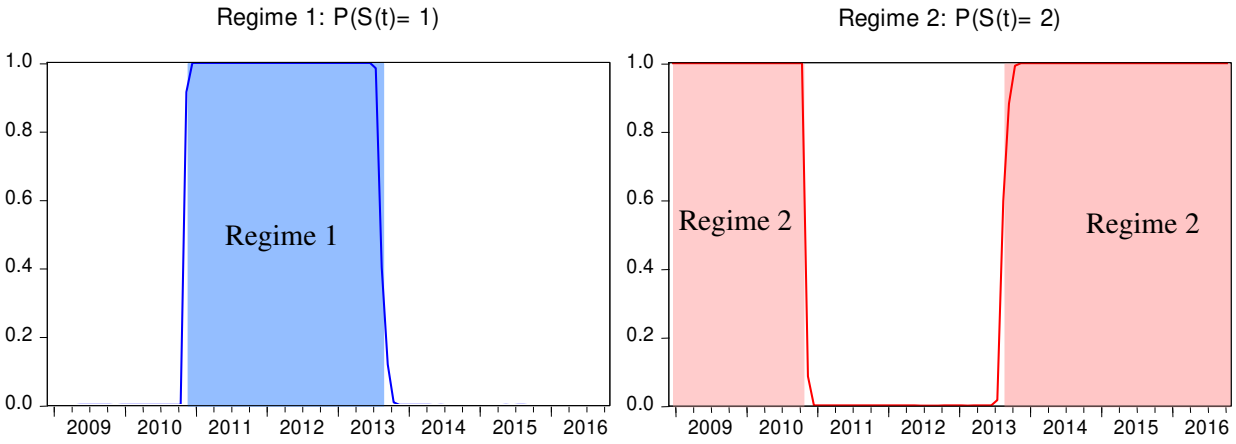
The probability of regime transition is exogenously determined for estimated models of the interest rate spread and the bank deposit rate. Probabilities of regime transition for the interest rate spread equation are estimated as follows: $p_{11} = 0.87$, $p_{12} = 0.13$, $p_{22} = 0.76$, $p_{21} = 0.24$. The average duration that the interest rate spread spends in regime 1 is 7.6 months, while the average duration of regime 2 is 4.2 months. 95% confidence interval for the duration that the bank deposit rate spends in regime 1 is [4.0, 17.7] months, while 95% confidence interval for the duration of regime 2 is [2.2, 8.9] months. The results suggest that the interest rate spread spends a significant amount of time in the lower interest rate spread state (regime 1) compared to the higher interest rate spread state (regime 2). Estimated probabilities of being in the lower interest rate spread state and being in the higher interest rate spread are shown in Figure 4.

When we classify lower interest rate episodes as spread those months with an estimated probability of being in the lower spread state exceeding 0.7, the identified episodes of lower interest rate spread (regime 2) occurred since January 2016. This implies that NPL ratio,

inflation, interest rate risk, market structure ($CR5\_D_t$ and $CR2\_L_t$), economic activity and stock market development significantly affect recent movements in the interest rate spread.

Probabilities of regime transition for the bank deposit rate equation are estimated as follows: $p_{11} = 0.96$, $p_{12} = 0.04$, $p_{22} = 0.99$, $p_{21} = 0.01$. The expected durations that the bank deposit rate respectively spends in the lower deposit rate state (regime 1) and the higher deposit rate state (regime 2) are 27 months and 80 months, respectively. For the ex-ante deposit rate, the duration of being in a certain regime is much longer compared to those of the ex-ante lending rate and the interest rate spread. It is in line with the fact that the ex-ante deposit rate is sticky, reflecting strong competition among banks in the deposit market and high and volatile inflation. Estimated probabilities of being in the lower deposit rate state (regime 1) and being in higher deposit rate state (regime 2) are shown in Figure 5.

Figure 5. Estimated probabilities that bank deposit rate remains in regime 1 and regime 2



If we classify as higher deposit rate those months with an estimated probability of being in the higher deposit rate state exceeding 0.7, the identified episodes of higher deposit rate occurred during the recession phase of the economy (i.e., 2009 and 2014-2016). However, the lower deposit rate episodes occurred during the expansion phase of the economy, covering the period 2011-2013. The result suggests that the state of deposit rate (i.e., regime 1 or regime 2) depends on phases of the business cycle in Mongolia.

The lending rate was in regime 1 (the state of higher lending rate) when deposit rate was in regime 2 (the state of higher deposit rate) and the interest rate spread was in regime 1 (the state of lower interest rate spread) for the period 2011-2013. From Table 2, the deceleration of M2 growth increases the deposit rate, which leads to the rise in the lending rate. However, the lower NPL ratio and stable interbank market rate lead to the lower interest rate spread.

From comparisons of the identified episodes, it is certain that the transition of the bank lending rate from the higher lending state (regime 1) to the lower lending state (regime 2) between August 2013 and September 2014 has been mainly driven by changes in the interest rate spread since episodes of lower spread and higher deposit rate occurred during the period. The lending

rate has been in regime 2 (the state of lower lending rate) when deposit rate is in regime 2 (the state of higher deposit rate) and the interest rate spread is in regime 1 (the state of lower interest rate spread) since the beginning of 2015. The deceleration of M2 growth increases the deposit rate, while lower NPL ratio and stable interbank market rate lead to the lower interest rate spread. Another observation is that the interest rate spread frequently change its regimes, in which factors affecting to it are different.

5. Conclusion

This paper has examined factors to explain high interest rates in Mongolia by using both an accounting framework and the Markov Switching approach. Several important results stand out. First, the decomposition of the ex-post lending rate based on the accounting framework shows that high deposit rate is a key reason explaining the high lending rate in Mongolia. Operating costs and provisions for loan losses of banks are main factors explaining the relatively high interest rate spread. Provisions for loan losses have been pro-cyclical and compose most of the ex-post interest rate spread during the economic downturn. Second, Markov Regime-Switching approach shows that effects of some factors affecting bank interest rates and the interest rate spread vary over time depending on the regime (i.e., financial conditions and monetary policy). For example, when the growth of bank loans is low (regime 2 for the lending rate), the effect of inflation on the lending rate and the spread is statistically significant and the impact of NPL ratio on the bank lending rate and the spread is strong. It is also found that the interest rate pass-through from the interbank market rate to the lending and deposit rates is slow, incomplete and changes over time. The results support the view that permitting asymmetry and non-linearity in responses of interest rate to changes in explaining factors are important in the interest rate analysis. Third, structures of credit and deposit markets and macroeconomic factors affect the lending rate and the interest rate spread regardless of which regime they are in. The market competition and concentration are important factors reflected in the setting of bank lending and deposit rates. Fourth, the factors affect the lending rate through different channels. Market structure, risks associated with lending operations (credit risk, interest rate risk, the interaction between the risks and inflation) and industrial product affect the lending rate transmitting through the interest rate spread, whereas the growth of M2 money and stock market development influence the lending rate channeling through the deposit rate. The interbank interest rate, economic activity and stock market development influences the lending rate through changing both the deposit rate and the interest rate spread. Finally, the analysis suggests that the high lending rate in Mongolia is compatible with underdeveloped stock market, low savings ratio, inefficient operating costs of banks, high credit risk, higher interbank market rate driven by unstable inflation, strong competition in deposit market and high concentration in the loan market. Overall, policy measures aiming to affect the deposit and lending rates should differ depending on the states of the rates since explanatory variables and time lags are different for each state. There is evidence that phase of business cycle is a leading indicator for state of deposit rate.

References

Allen, L 1988, 'The determinants of bank interest margins: A note', *Journal of Financial and Quantitative Analysis,* vol. 23, no. 2, pp. 231-235.

Angbazo, L(1997), 'Commercial bank net interest margins, default risk, interest rate risk and off balance sheet activities', *Journal of Banking & Finance,* vol. 21, 55-87.

Ang, A and Bekaert, G 2002, 'Regime switches in interest rates', *Journal of Business & Economic Statistics*, vol. 20, no. 2, pp. 163-182.

Berger, AN, Demirgüç-Kunt, A, Levine, R and Haubrich, JG 2004, 'Bank Concentration and Competition: An Evolution in the Making', *Journal of Money, Credit, and Banking*, vol. 36, no. 3, pp. 433-451.

Boldbaatar, D 2006, *Measurement and Implication of commercial banks' interest rate spread in the selected SEACEN countries,* The SEACEN Centre, Graphic Stationers Sdn, Bhd, Malaysia.

Blagov, B, Funke, M and Moessner, R 2015, 'Modelling the time-variation in Euro area lending spreads', BIS Working Papers, No 526, Bank for International Settlements.

Brock, W, Dechert, W, Scheinkman, W 1987, 'A test for independence based on the correlation dimension," Department of Economics, University of Wisconsin at Madison, University of Houston, and University of Chicago, Unpublished manuscript.

Campos, J, Ericsson, N and Hendry, D 2005, 'General-to-specific modelling: An overview and selected bibliography', International Finance Discussion Papers, No. 838, Board of Governors of the Federal Reserve System.

Cecchetti, S and Mark, NC 1990, 'Evaluating Empirical Tests of Asset Pricing Models: Alternative Interpretations', *American Economic Review*, vol. 80, no. 2, pp. 48-51.

Corvoisier, S and Gropp, R 2002, 'Bank concentration and retail interest rates', *Journal of Banking & Finance*, vol. 26, no.11pp. 2155–2189.

De Bondt, GJ 2005, 'Interest rate pass-through: Empirical results for the Euro Area', *German Economic Review,* vol. 6, no. 6, pp. 37-78.

Demirgüç-Kunt, A and Huizinga, H 1999, 'Determinants of commercial bank interest margins and probability: Some international evidence', *The World Bank Economic Review,* vol. 13, no. 2, pp. 379-408.

Demirgüç-Kunt, A, Laeven, L and Levine, R 2004, 'Regulations, Market Structure, Institutions, and the Cost of Financial Intermediation', *Journal of Money, Credit and Banking*, vol. 36, no. 3, pp. 593-622.

Engel, C and Hamilton, JD 1990, 'Long swings in the dollar: Are they in the data and do markets know it?', *The American Economic Review,* vol. 80, no. 4, pp. 689-713.

Engel, C 1994, 'Can the Markov switching model forecast exchange rates?', *Journal of International Economics*, vol. 36, pp. 151-165.

Enhhuyag, B 2005, 'Some recommendations on calculating and disseminating ex-post lending rate', BOM Working Paper no. 3, Ulaanbaatar: The Bank of Mongolia (In Mongolian).

Entrop, O, Memmel, C, Ruprecht, B and Wilkensc, M 2015, 'Determinants of bank interest margins: Impact of maturity transformation'*, Journal of Banking & Finance*, vol. 54, pp. 1-19.

Gan-Ochir, D 2009, 'Determinants of bank lending and deposit rates in Mongolia', BOM Working Paper no. 7, Ulaanbaatar: The Bank of Mongolia (In Mongolian).

Gan-Ochir, D and Kaliappa, K 2016, 'Interest rate pass-through in Mongolia', *The Developing Economies*, vol. 54, no. 4, pp. 1-21.

Garcia, R and Perron, P 1996, 'An analysis of the real interest rate under regime shifts', *The Review of Economics and Statistics*, vol. 78, no. 1, pp. 111-125.

Goldfeld, S and Quandt, R 1973, 'A Markov model for switching regressions', *Journal of Econometrics,* vol. 1, no. 1, pp. 3-15.

Hamilton, JD 1989, 'A new approach to the economic analysis of nonstationary time series and the business cycle', *Econometrica,* vol. 57, no. 2, pp. 357-384.

Hamilton, JD 1994, *Time Series Analysis,* Princeton: Princeton University Press.

Hannan, T and Berger, A 1989, 'Price rigidity and market structure: theory and evidence from the banking industry', Finance and Economics Discussion Series 59, Board of Governors of the Federal Reserve System (US).

Hannan, T and Berger, A 1991, 'The rigidity of prices: evidence from the banking industry', *American Economic Review*, vol. 81, no. 4, pp. 938-945.

Ho, TS and Sanders, A 1981, 'The determinants of bank interest margins: Theory and empirical evidence', *The Journal of Financial and Quantitative Analysis,* vol. 16, no. 4, pp. 581-600.

Hwu, S, Kim, C and Piger, J 2020, 'An N-state endogenous Markov-switching model with applications in Macroeconomics and Finance', *Macroeconomic Dynamic*, forthcoming.

Jappelli, T 1993, 'Banking competition in southern Italy: A review of recent literature', *Studi Economici*, vol. 49, pp. 47–60.

Kang, K 2014, 'Estimation of state-space models with endogenous Markov regime-switching parameters', *The Econometrics Journal*, vol. 17, no. 1, pp. 56-82.

Kim, C, Piger, J and Startz, R 2008, 'Estimation of Markov regime-switching regression models with endogenous switching', *Journal of Econometrics*, vol. 143, no. 2, pp. 263-273.

Maudos, J and Guevara, JF 2004, 'Factors explaining the interest margin in the banking sectors of the European Union', *Journal of Banking & Finance,* vol. 28, no. 9, pp. 2259-2281.

McShane, R and Sharpe, I 1985, 'A time series/cross section analysis of the determinants of Australian trading bank loan/deposit interest margins: 1962-1981', *Journal of Banking and Finance,* vol. 9, 115-136.

Rhoades, SA 1993, 'Efficiency effects of horizontal (in-market) bank mergers', *Journal of Banking & Finance*, vol. 17, no. 2-3, pp. 411-422.

Saunders, A and Schumacher, L 2000, 'The determinants of bank interest rate margins: an international study', *Journal of International Money and Finance*, vol. 19, no. 6, pp. 813-832.

Segura-Ubiergo, A 2012, 'The puzzle of Brazil's high interest rates', IMF Working Paper WP/12/62, International Monetary Fund.

Shahbaz, M, Destek, MA and Okumus, I and Sinha, A 2019, 'An empirical note on comparison between resource abundance and resource dependence in resource abundant countries', *Resource Policy,* vol. 60, pp. 47-55.

Slovin, M and Sushka, ME 1983, 'A Model of the Commercial Loan Rate', *The Journal of Finance*, vol. 38, no. 5, pp. 1583-1596.

Quandt, R 1972, 'A New Approach to Estimating Switching Regressions', *Journal of the American Statistical Association,* vol. 67, no. 338, pp. 306-310.

Valverde, SC and Fernández, FR 2007, 'The determinants of bank margins in European banking', Journal *of Banking & Finance*, vol. 31, no. 7, pp. 2043-2063.