The Determinants of Net Interest Margins of Commercial Banks: Panel Evidence from China, India and Japan

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The Determinants of Net Interest Margins of Commercial Banks: Panel Evidence from China, India and Japan

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Abstract

The study examines the determinants of net interest margins of commercial banks of China, India and Japan. Using the cross-country panel data of 418 commercial banks during the period of 2011 to 2017 (practically the post global financial crisis period); we classified the determinants as bank-specific, industry specific and macroeconomic-specific variables. In line of the 'dealership model of margin determination' of Ho and Saunders (1981) and its later extensions, we viewed net interest margins or spread as a function of liquidity, profitability, credit risk, risk aversion, size, business growth, regulatory response and off- balance sheet income in the bank-specific cluster whereas the industry concentration in industry specific cluster and call money rate, inflation and GDP growth rate in macroeconomic clusters. We found evidence that liquidity, profitability, risk aversion, required reserve ratio, yield spread and GDP affect interest margins positively but size and rate of inflation negatively. Our empirical findings support the traditional structure-conduct-performance (SCP) hypothesis of Bain (1956) for the banking markets of China, India and Japan for the post global financial crisis (GFC) era.

Key Words: Net Interest Margins (NIM), GFC, HHI, Efficiency, Market Structure

JEL classification:

G21, C23

1. Introduction

There are two units in the economy- surplus unit (SU) and deficit unit (DU). Economic agents whose current level of income (Y) is greater than the current level of consumption (C) fall in the surplus unit and the economic agents whose current level of income (Y) is less than the current level of consumption (C) are in the deficit units. These economic agents include the households

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(h), business entities (b), government (g) and foreign and others (f). In the broader framework of financial intermediation, the depository financial institutions (DFIs) play a pivotal role to collect funds from the surplus units in the form of 'deposits' and channeling those to the deficit units. Commercial banks are the major type of depository financial institutions and their fundamental functions are to collect deposit and extend those in the form of 'loans and advances' to the deficit units. These financial intermediation services by the commercial banks contribute to the economic development of a country. The capacity to charge different rates of return on different financial intermediary functions by the commercial banks is obvious. Economics of existence of depository financial intermediaries lies in the charging capacity of higher interest rate (R) on their lending functions and lower interest rates (r) on the borrowing functions. In the literature of the microeconomics of banking, the difference between the lending rate (R^L) and the borrowing rate (r^D) is termed as the spread (S) or the net interest margins (NIM) (see Islam- Nishiyama, 2016a). Allen (1988) termed spread or bankers' mark-up as the difference between the weighted average of yields on assets (interest revenue) and liabilities (interest expense).

Although, maximization of the net interest margin is one of the most important objective functions of the commercial banks but a very high or low and volatile net interest margin can cause severe bank management problems and can create distrust among the stakeholders of the banking business. Banking is a highly regulated business unit where different stakeholders like the shareholders, the management, depositors, clients and customers, regulators and the society as a whole have diversified and vested interest. Higher net interest margins may deteriorate the business environment by promulgating the state of default risk and a reduction of social welfare by increasing the dead-weight loss. As the wealth maximizing agents, commercial banks have

strong arguments for charging higher margins. We, thus, judge that commercial banks should charge the optimum level of net interest margins.

In line of the Ho and Saunders' (1981) dealership model of commercial banking where the banks receive deposits funds at random intervals, and subsequently, utilize these funds to satisfy stochastically received loan request has been studied for many years by different scholars surrounding the globe in extended formats. Saunders and Schumacher (2000) decomposed the determinants of bank interest margins as regulatory components, market structure components and a risk premium component. Angbazo (1997) studied the dealership model in single-stage linear form with particular emphasize on the credit risk and the interest rate risk. Bernanke, Gertler and Gilchrist (BGG, 1999) in their dynamic general equilibrium model to clear the credit market frictions in business fluctuation and Gertler and Kiyotaki (GK, 2011) in their macroeconomic paper on financial intermediation and credit policy in business cycle analysis discussed about the net worth of banking firms and default probability and their impact on margin determination.

In this paper, we empirically tested the dealership model and its later extensions of bank net interest margin determinants in case of three Asian countries i.e. China, India and Japan, using fixed effect panel data of 418 commercial banks during the period of 2011 to 2017; notably the post Global Financial Crisis (GFC) period. Among 418, there are 214 Chinese, 71 Indian and 133 Japanese commercial banks. In fact, Japan, India and China are the top three of the four world economies right now. According to the International Monetary Fund World Economic Outlook (October, 2018), the projected GDP ranking from 2019 to 2023, Japan, India and China will remain among the top five largest global economies along with the Unites States of America and Germany. By the way, our motivation to study particularly the JIC's commercial banks and

their net interest margins determinants having many objectives. Those are: Japan is one of the largest OECD countries and they maintained a sustainable economic stance in the global stage and top ranked economy in Asia in terms of GDP per capita. China is right now the second largest economy and their economic growth were no less than 6 percent in recent past years. India achieving a super normal growth rate of 7 percent or more realistically. Japan is in true sense a capitalist economy, China officially a communist country and India having the characteristics of both; a mixed type of economy. Thus, we motivated to study these three countries' commercial banks together and to find out the similarities and dissimilarities (if any) and the post GFC period determinants of net interest margins.

We studied the determinants of the net interest margins of Japan, India and China (JIC) all-together as they are the top three Asian economies but following different types of economic spectrums. We viewed the determinants of net interest margins as the bank specific factors, industry specific factors and some macroeconomic specific factors where each firm within the economy compete among themselves to optimize their spread income. Using the fixed effect panel data, we ran the regressions of the JIC to test the theoretical models empirically. We also ran the country-wise fixed-effect panel regressions and presented in this paper along with the base-line regression results. In near past literature, we found similar studies[2] on developed and developing countries of USA, Europe, Australia, South Asia and Latin America but in case of Japan, India and China all together, this study is a unique addition to the literature of determinants of bank net interest margins.

[2] Kunt and Huizinga (199) studied 80 developed and developing countries, Saunders and Schumacher's (2000) studies included USA and six EU countries, Maudos and Fernandez de Guevara (2004) studied 5 European countries. Also Williams (2007), Islam et al. (2016) and Bouzgarrou et al. (2018) studied determinants of net interest margins on Australian, South Asian and French commercial banks respectively among others.

The rest of the paper has been arranged as follows: in section two, a review of literature is presented. In section three, we have developed the econometric methodology of the study, in section four, the sample and data have been presented. We have outlined the empirical result in section five followed by conclusion and policy implications in section six and appendix and references finally.

2. The Literature on Determinants of Net Interest Margins

The literature and the theoretical motivation of the studies on the determinants of net interest margins (NIM) underwent much development since the famous 'dealership model' of spread determination of the commercial banks by Ho and Saunders (1981). Ho and Saunders' (1981) dealership model is basically the extension of the hedging hypothesis and the theory of expected utility approach. In their landmark initiative, they proposed the two stage model of interest margin determination. In stage one; they argued the existence of 'pure spread' as the price of providing immediacy of services in face of the uncertainty generated by asynchronous deposit supplies and loan demands. In stage two; they attempted to measure the amount of pure spread by considering number of imperfections and regulatory restrictions. According to the model, pure spread is the difference between the bank lending rate (R^L) and the deposit rate (R^D). As there exist transaction uncertainty, banks set their interest rates as a margin relative to the interest rate of the money market (p). These happens as,

$$R^D = \boldsymbol{p} - \boldsymbol{a} \text{ and } R^L = \boldsymbol{p} + \boldsymbol{b}$$

Where a and b are the margins for the provision of immediacy services. Thus, as the risk averse, utility maximizer, bank's pure spread (S) could be determined as follows:

$$\boldsymbol{S} = R^L - R^D = \boldsymbol{a} + \boldsymbol{b} \quad \text{..... Equation 1}$$

Charging interest margins or spread by the commercial banks can be justified in many ways. As the wealth maximizing agent in the economy, they compete in the loan (L) and the deposit (D) market simultaneously. But bank itself cannot determine the volume of deposit as it is strictly exogenous. Whenever they maintain the credit inventory (I) but this variable is sensitive to the market interest rate (i). So, their position[3] in the money market also could be considered in determining their interest margins.

Lerner (1981) criticized the dealership model that it failed to recognize the bank as a firm having a certain production function associated with provision of the intermediation services. The presence of cost inefficiencies associated with the production process across banks can have a distortionary effect on the margin. The extension of the basic dealership model by Maudos and Guevara (2004) responded to this criticism by explicitly incorporating the role of operating costs and providing a detailed description of the link between riskiness and the margin in their one stage model of interest margin determinants which covered the data of 5 European countries to prove the model empirically.

Allen (1988) expanded the dealership model from a structure with one kind of loan and deposit to loans and deposits with many maturities that is the 'portfolio effect' apparent to margin determination. Angbazo (1997) studied the net interest margins of commercial banks reflect both default and interest rate risk premia. The study also showed that banks with more risky loans and higher interest rate risk exposure would select loan and deposit rates to achieve higher net interest margins and cross sectional differences in interest rate risk and liquidity risk are related to differences in off-balance sheet exposure.

[3] Money market position of a commercial bank may take any of the following two forms. That is (i) Short and (ii) long. Short position = $I^r > I^a$ and long position = $I^r < I^a$, where I^r is the required credit inventory and I^a is actual credit inventory.

Saunders and Schumacher (2000) conducted an international study on USA and European banks for the net interest margin determination for 1988-1995 period and found that implicit interest payments, opportunity cost, capital to asset ratio, market power and interest rate volatility affect net interest margins positively but they omitted any proxy variable for risk aversion and size of transaction in their model. Afanasieff et al. (2002) used a panel regression of 142 Brazilian banks and found that size of bank, opportunity cost and operating cost are positively related to interest margins but a set of macroeconomic variables such as the market interest rate, the volatility of market interest rate, inflation rate and output growth heavily affect margins as well.

Valverde and Fernandez (2007) applied Ho and Saunders dealership model to a multi-output framework and showed that the relationship between bank margins and market power varies significantly across bank specializations. They conducted empirical studies for a sample of 19,322 European banks from Germany, Spain, France, the Netherlands, Italy, the UK and Sweden and found that market power increases as output becomes more diversified towards non-traditional activities. Hawtrey and Liang (2008) studied the determinants of bank interest margins using panel data covering the banking sector of fourteen OECD countries and found that national banking industry interest margins are influenced by market power, operational cost, risk aversion, interest rate volatility, and credit risk, volume of loans, implicit interest payments and also quality of management. With a particular emphasis on the bank ownership structure, Fungacova and Poghosyan (2011) conducted empirical studies using panel data on the interest margin determinants in the Russian banking. They found that the impact of a number of commonly used determinants such as market structure, credit risk, liquidity risk and size of operations differs across ownership structure of banks but influence of operational cost and risk aversion are homogeneous. Among others, Tarus et al. (2012) studied the determinants of net

interest margins of commercial banks in Kenya using pooled and fixed effect panel covering the period of 2000-2009. They found that operating expenses, credit risk and inflation are positively and market concentration and economic growth are negatively related to the net interest margins. Pasiouras et al. (2007) studied the banking margins of 15 EU countries while using DEA approach, Stewart et. al. (2016) studied the efficiency of Vietnamese banking and found that the large and private banks are more efficient than the small and medium sized and the state owned banks. In 2008, Kaigo Zhou and Michael C.S. Wong conducted studies on the determinants of net interest margins of commercial banks in mainland China and found that the firm competitiveness, average operating costs, degree of risk aversion, transaction size, implicit interest payments, opportunity cost of reserve and management efficiency significantly affect the net interest margins. Michel R. King (2013) studied the Basel III net stable funding ratio and its effect on the bank net interest margins. His study includes 15 developed economies of the world including USA and Japan and found that cost effective strategies and diversified funding sources have opposite impacts on the interest margins.

In the literature of the determinants of interest margins of banks, we also recognize the studies of Bernanke, Gertler and Gilchrist (BGG, 1999) that in their famous business acceleration model of credit market imperfections, discussed about the firms' balance sheet condition should have effect on the lending rate that is determined by the commercial banks. Another seminal study was conducted by Gertler and Kiyotaki (2011) where their macroeconomic viewpoint on the interest margin is that so called risk aversion or the net-worth position of banks negatively and the default risk positively influences the net interest margins of banks.

The studies considering the global financial crisis (GFC) includes Bouzgarrou et al., (2018) who studied the bank profitability of French commercial banking market for the period of 2000 to

2012 considering net interest margins as a profitability measure and found that the foreign banks were more profitable than the domestic banks during the global financial crisis period. In 2017 Ozcan Isik et al., attempted the study of the determinants of net interest margins of Turkish listed banks with particular focus of post crisis era.

In recent years, Dwumfour (2018) under took studies on the banking spread determinants of different countries in Asia, Africa, Latin American countries. Barik et al., (2019) studied the net interest margins of banks in India and found that asset quality, deposit mix and operating cost among many significantly affect the interest margins of the banks in India. Qi et al., (2018) studied the determinants of interest margins of Chinese banks and found liquidity and credit risk having positive impact on bank spread. Among many, Young Tan (2019) carried out research on the competition and profitability of Chinese banking industry with particular focus on the ownership types.

We get the motivation for our present study by the inconclusive nature of the empirical literature of the determinants of net interest margins of commercial banks. We want to focus on the determinants of net interest margins by incorporating explanatory variables both from microeconomic specific and macroeconomic specific in our contemporary cross-country study. A prior cross country study was conducted by Kunt and Huizinga (1999) using global 80 countries' data over the period 1988 to 1995, however their particular concern was exogenous influences such as macroeconomic indicators, tax rates and the degree of international ownership, all of which found significantly related to interest margins. Complementing their works, our study results, reported here focus on both microeconomic and macroeconomic determinants of the net interest margins of banks.

3. Empirical Approach

The present study viewed the determinants of the commercial banks net interest margins as a function of some (a) bank specific factors, (b) industry specific factors and (c) macroeconomic factors those are also summarized in table 1 below. In total we used 14 explanatory variables of which 9 are bank specific, 1 industry specific and 4 macroeconomic specific. Regarding the variable selection, we were much more intuitive. We think that among the bank specific variables, liquidity, profitability, credit risk exposure, size of the firm, solvency, opportunity to grasp the business expansion, regulatory response, diversified income or off-balance sheet risk and finally the efficiency of the management will have significant deterministic role on the net interest margins of a commercial bank. We included the industry specific variable, Hirschman and Herfindahl Index (HHI) to capture the industry influence on the spread of a bank. Whereas, we included the macroeconomic variables such the money market interest rate, inflation and GDP growth rate to see the impact of these variables on the interest margins as these variables also have been studied by the researchers in previous literature.

Table-1: Description of variables used in the study

Variables	Description	Expected effect
Dependent variable: Net interest margins (NIM)	Difference between interest income and interest expense over Total Assets	
Independent variables		
(a). Bank-specific variables		
i. Liquidity	Liquid Assets to Total Assets Ratio	+
ii. Profitability	Earnings Available to Common Stockholders to Total Equity	+
iii. Credit Risk	Impaired Loan to Total Loan Ratio	+
iv. Size	Logarithm of Total Asset	+/-
v. Capitalization	Equity to Total Assets Ratio	+/-
vi. Business Expansion	Growth Rate of Loan	-
vii. Regulatory Response	Required Reserve to Total Assets Ratio	+
viii. Diversified Income	Net Non-interest (Off Balance Sheet)Income Ratio	+
ix. Efficiency	Operating Expenses over Total Assets Ratio	+
(b). Industry-specific variables		
x. Hirschman-Herfindahl Index (HHI)	Sum of square of market share in terms of Total Asset is a proxy for market structure variable	+/-
(c). Macroeconomic-specific variables		
xi. Standard Deviation of Short Term Interest Rate (SDINT)	Annualized standard deviation of monthly average of daily call money rates	+
xii. Rate of inflation	Annual Rate of Inflation (%)	-
xiii. Growth rate of GDP	Real Economic Growth Rate as a Percentage (%) change in Gross Domestic Product (GDP)	+

3.1. Variables

3.1.1. Dependent Variable

Net interest margins (NIM)

In this empirical study of the determinants of net interest margins or spread, net interest margins (NIM) is the dependent variable. Spread is the difference between the weighted average of yields on assets (interest revenue) and liabilities (interest expense) - also called the bankers' mark-up (Allen, 1988). We defined net interest margins of a bank as the ratio of the difference between interest income and interest expense and total assets.

3.1.2. Explanatory Variables

(a) Bank Specific Explanatory Variables

(i) Liquid asset to total asset ratio

Following Angbazo (1997), we used the variable liquid asset but calculated differently for our purpose. Angbazo (1997) used liquid asset to liabilities to proxy for the liquidity risk as the determinant of net interest margins. However, in our model, liquid asset (extracted from the Bank Focus database as the total earning assets) to total asset is a proxy for the liquidity position of the bank. We argue that banks are not only provider of liquidity on demand to the liability side but also on the asset side in the form of providing loan commitments and so on. Liquidity short or long both are unexpected by the bank. There exist the opportunity cost of holding excess liquidity and at the same time, liquidity crisis will lead the bank to the ultimate risk of 'bank run' and 'bank fail'. Banks whose liquidity position is better than others may charge extra margins on the loans they provide. For this, ceteris paribas, a positive sign is expected.

(ii) Return on Equity

In this study, return on average equity (ROE) has been used as the proxy measure of profitability. Yong Tan (2019) used return on asset (ROA) as the proxy for the profitability and studied its impact on the net interest margins in the Chinese banking industry. Instead, we defined ROE as the amount of net income as a percentage of shareholders equity. We considered ROE as the key determinant of bank profitability also relied on the average assets value to capture the changes during the fiscal year if any.

(iii) Impaired loan to total loan ratio (IL)

Impaired loan to total loan, which actually refers to the default risk of a bank, has been used as the explanatory variable in our model. Many of the past literature expressed this variable as credit risk or default risk and calculated differently. For example, Ho and Saunders (1981) used default premium (DPi) as the ratio of net loan charge-offs to total earning assets in their two stage model of determining net interest margins of banks. Moudos and Guevara (2004) used loans to total assets ratio as the proxy for credit risk. According to the Bank for International Settlements (BIS, 1999) loans are the largest and most obvious source of credit risk for most banks but we think this approach is too pessimistic to measure the credit risk for banks. However, this is natural for banks to charge additional on the initial margins on lending if the borrower's probability of being default is high. We expect ceteris paribas, a positive relationship between non-performing loan and the net interest margins.

(iv) Log (Total Asset)

Size of the bank is used as the proxy variable of information asymmetry in our econometric model of determinants of net interest margins. We want to see how information asymmetry affects the net interest margins of banks. But it is hard to find the information asymmetry variables from the disclosed chapters of the bank information from their financial statements. Then we aimed to characterize banks as small and large (relative size) in terms of their holding of assets. We calculated the size of the bank as the logarithm of total asset of that bank. Relative size of the bank in our model as explanatory variable, answers the question of whether the large banks are charging more or less in relation to the small banks or not. Our hypothesis is that,

holding others remaining constant, the relative size of the bank affect the net interest margin inversely.

(v) Equity to total asset ratio

The variable measures the capitalization of a bank considering the regulatory requirements regarding the minimum equity holdings. Following McShane and Sharpe (1985), we also used equity to total asset ratio as the proxy of degree of risk aversion of banks. Among others, Saunders and Schumacher (2000), Maudos and Guevara (2004) used the variable in the same way but Hawtrey and Liang (2008) used different approach to calculate the risk averseness of the banks by dividing securities plus other assets by volume of loans.

Regarding the relationship between equity to total asset ratio and the net interest margins of banks, we found contrast outcome in the past literature. Macroeconomic stream like Gertler and Kiyotaki (2011) framework argued that the rise in net worth (equity) relative to the capital stock reduces the expected default probability, holding other things remaining constant. The underlying economics of that proposition is that banks can charge lower margins where default probability is lower.

On the other hand, mainstream banking and finance literature expect positive sign arguing that customers are willing to bear (pay for) bank regulatory taxes in return for the positive externality related to bank monitoring. That is 'banks are special' and customers are willing to pay for that specialness (as cited by Saunders and Schumacher, 2000). To address the systematic risk and other regulatory reasons, banks maintain certain equity level. So, everything remains constant, the risk averse bank tends to charge more as the interest margins. Hence, we expect the positive relationship between equity to total asset ratio and the net interest margin.

vi. Growth of loan

Ho and Saunders (1981) showed that size of transaction and banks' interest margins are positively related. Maudos and Guevara (2004) also stated that banks apply large margins on sizable volume of loans. But the reality is different. We see big-loan-customers enjoy special discounted rate (prime rate) on their borrowings. Also, banks enjoy the economies of scale benefit of processing and maintenance cost of big loans which reduces banks operating cost to revenue. As Hawtrey and Liang (2008) expected negative relationship between log (loan) and interest margins arguing that increased volume of loans should result in a reduction of unit costs, which achieves economies of scale and results in narrower margins. Again, McShane and Sharpe (1985) assumed that size of the transaction is invariant across trading banks and time. We used the growth of total loan as the proxy for size of operation or so called *scale effect* in our model and expect positive relationship between loan growth and net interest margin.

vii. Required reserve to total asset ratio

Portion of deposits that a bank must hold but cannot lend out is the required reserve. This is one of the regulatory variables of central banks to conduct monetary policy. Although, this safeguards the depositors against sudden *run out of banks* but for banks, holding every penny from the deposit amount reduces the loanable funds so as reduce the probability of earning more interest income on loans or from investing in the financial markets. The larger the volume of required reserve, the greater will be the opportunity cost. In our econometric model of determinants of net interest margins of banks, we used *cash and due from banks* from bank focus database as the proxy measure for required reserve. Our hypothesis is, holding other things

remaining constant, the larger the volume of required reserve of a bank, the more will be the net interest margin.

viii. Net non-interest income

Modern banking and their services have been expanded in many folds so their sources of income and heads of expenditures. A bank incurs cost of deposits as the largest volume of interest expenses and the interest income on loans as the largest volume of interest income. Other than the interest income that is the non-interest income may include service and penalty charges, capital gain on assets sales, property leasing etc. On the other hand, expenses not included in the cost of deposits like almost all operating and overhead costs will be included as non-interest expenses.

Net non-interest income as the proxy for implicit interest payment and an explanatory variable to determine the net interest margin of banks can be found in many previous literature. Among others, Ho and Saunders (1981), Angbazo (1997), Saunders and Schumacher (2000) calculated this as the net non-interest income (non-interest expense less non-interest revenue) divided by earning assets whether Maudos and Guevara (2004) expressed the same as the percentage of total assets. We followed the later approach and expected that, everything else remaining constant, an increase in the net non-interest income will affect a bank's net interest margin positively.

ix. Operating expenses to total assets ratio

Operating expenses of a bank includes non-interest expenses like overhead and administrative cost, maintenance of properties and others. Controlling for these costs promotes efficiency of the

bank and enhances the competitiveness as well. Among others, Kunt et. all. (1999), Maudos and Guevara (2004), Hawtrey and Liang (2008) studied the effect of overhead expenses on determining interest margins of banks. We also employed the operating expenses to total asset ratio in our model to see how this variable affect the net interest margins of a bank. Principally, if a bank's unit operating expenses is relatively higher (less efficient), that bank will try to compensate that by charging additional on the regular margins. So, a positive sign has been expected.

x. Operating expenses to gross income ratio

Operating expenses to gross income ratio captures the bank management's efficiency showing the amount of expenses for every one dollar of income generated to the firm. According to Angbanzo (1997) as well as Maudos and Guevara (2004) the higher the quality of management of a bank, the higher the interest margins that will be imposed by the bank, on the ground that a high quality of administration implies a high yield and low cost composition of assets and liabilities. On the other hand Gischer and Juttner (2002) argued inverse relationship between the quality of management and the net interest margins of banks but failed to prove their hypothesis empirically. In our empirical model of determinants of net interest margins, our hypothesis is that bank may charge higher margins for their excellent service offered to the customers.

(b) Industry Specific Explanatory Variable

xi. Hirschman Herfindahl index (HHI)

We used the Hirschman Herfindahl Index (HHI) in our econometric model of determinants of net interest margins of banks to find out the relationship between market concentration and the net

interest margins in the sample countries. Hirschman Herfindahl index has been defined as the sum of squares of individual bank asset shares to the industry and the formula as follows:

$HHI = \sum_{i=1}^{n} S_i^2$ Where, S_i = Share (.) of individual bank to the industry.

This is a common and widely used measure of market concentration where higher market concentration means lower competition and vice versa. Past literature has contrasting views regarding the relationship between market concentration and interest margins of banks. Most of the recent studies[4] on the developed countries found positive sign coefficient for the variable. But Hesse (2007) and Fungacova and Poghosyan (2011) who studied Kenyan and Russian banking respectively found negative relationship between market structure and the net interest margins of banks. We expected positive relationship between the market concentration and net interest margins of banks supportive to the Ho and Saunders' (1981) proposition that, if a bank faces relatively inelastic demand and supply functions in the markets in which it operates, it may be able to exercise monopoly power by demanding a greater spread than it could get if banking markets were competitive.

(c) Macroeconomics specific explanatory variables

xii. Standard deviation of short term interest rate (SDint)

Past literature used variety of measures to proxy for the volatility of interest rates and its impact on the net interest margins of banks, including rates on short term money market rates to medium and long term capital market rates. For our model of determinants of net interest margins of banks, we used the annualized standard deviation of monthly average of daily call money rates.

[4] Angbanzo (1997), Saunders and Schumacher (2000), Maudos and Guevara (2004), Williams (2007) for reference.

Based on the monthly average of the daily call money rates, we have calculated the annual standard deviation. We also assumed that there will be positive impact of the SDINT on net interest margins of banks.

xiii. Rate of inflation

Although there is no empirical consensus on the effects of inflation on interest margins, high inflation rates are generally associated with high interest rates and therefore, higher interest margins. Even if inflation is not anticipated by banks, in the short term interest rates may not reflect the increased inflation, but in the medium and long term, banks will adjust their interest rates to compensate for the inflation premium and will increase the interest margins (Tarus et al., 2012). Kunt et al. (1999) found a positive relationship between inflation and the net interest margins in their study with global evidences from 80 countries. On the other hand, Abreu and Mendes (2003) found inverse relationship between rate of inflation and net interest margins of banks on a cross country study of Portugal, Spain, France and Germany. Our hypothesis is rate of inflation affect net interest margins positively. We expect a ceteris paribas negative relationship.

xiv. Growth rate of gross domestic product (GDP)

Growth rate of GDP or economic growth rate of a country is important variable to influence the determinants of net interest margins of commercial banks. Growth rate of GDP affect directly the demand and supply of deposits and loans and thus the banking activities. Kunt et al. (1999), Tarus et al. (2012) studied the importance of economic growth rate to determine bank interest margins and found inverse relationship. We also argue that economic growth brings prosperity to

the economy. Investors find various scope of investment and create opportunities for the banks for investment. Hence, our hypothesis is that growth rate of GDP will have significant and positive relationship with net interest margins.

3.2. Econometric Model

To study the determinants of the net interest margins of the commercial banks in China, India and Japan empirically, we viewed net interest margins (NIM) of a bank is a function of bank specific variables (BSV), industry specific variables(ISV) and macroeconomic specific variables (MSV). That is,

$$(NIM_{it}) = f\,[\{BSV\ (.)\},\ \{ISV\ (.)\},\ \{MSV\ (.)\}] \text{..... Equation (2)}$$

The general model to be estimated for the determinants of net interest margins (NIMs) of banks in China, India and Japan is of the following linear form:

$$\mathbf{NIM_{it}} = \mathbf{c} + \sum_{\mathbf{j=0}}^{\mathbf{J}} \boldsymbol{\beta}_{\mathbf{j}} \mathbf{X}_{\mathbf{it}}^{\mathbf{j}} + \sum_{\mathbf{l=0}}^{\mathbf{L}} \boldsymbol{\beta}_{\mathbf{l}} \mathbf{X}_{\mathbf{it}}^{\mathbf{l}} + \sum_{\mathbf{m=0}}^{\mathbf{M}} \boldsymbol{\beta}_{\mathbf{m}} \mathbf{X}_{\mathbf{it}}^{\mathbf{m}} + \boldsymbol{\varepsilon}_{\mathbf{it}}$$

$$\mathbf{where},\ \boldsymbol{\varepsilon}_{\mathbf{it}} = \boldsymbol{\nu}_{\mathbf{i}} + \boldsymbol{\upsilon}_{\mathbf{it}} \text{ .....Equation (3)}$$

Where, NIM_{it} is the net interest margin of bank i at time t where i = 1,.....,N, t = 1,....., T and c is a constant term. The superscripts *j, l* and *m* of X_{it} denote the bank-specific, industry specific and macroeconomic specific determinants respectively. ε_{it} is the disturbance with ν_i the unobserved bank-specific effect and υ_{it} the idiosyncratic error. The error components of the regression model also distributed as ν_i ~IIN (0, σ_ν^2) and independent of υ_{it} ~ IIN (0, σ_υ^2) where IIN denotes that independent, identical and normal (IIN).

We precede the following four step issues for the econometric model of NIM determinants.

Firstly, we tested the variables included in our empirical model for the multicollinearity problems. We tested the issue of multicollinearity using the correlation matrix and variance inflation factor (VIF) (see appendix table A1 and A2 respectively). Thus we included those variables having no multicollinearity problem.

Secondly, we tested our model for the heteroskedasticity issue. Using the LM heteroskedasticity test (xttest 3 for stata)[5] we detected the problem and allowed the robust standard error to get rid of the heteroskedasticity problem.

Thirdly, we examined whether the individual effects are fixed or random. The relevant Hausman test (the null hypothesis that the individual effect and the explanatory variables are uncorrelated) for equation 3 confirms the evidence in favor of a FE modeling[6]. A fixed effect or the within group estimator model refers to a regression model in which the group means are fixed (non-random) as opposed to a random effects model in which the group means are a random sample from a population (Ramsey et. el., 2002). Although fixed effect estimator has been criticized in the ground of biasness but we used the fixed effect panel estimator as it is the efficient one.

Finally, we addressed the unobserved time effects in the error components of our model as follows:

$$\mathbf{NIM_{it}} = \mathbf{c} + \sum_{\mathbf{j=0}}^{\mathbf{J}} \boldsymbol{\beta}_{\mathbf{j}} \mathbf{X}_{\mathbf{it}}^{\mathbf{j}} + \sum_{\mathbf{l=0}}^{\mathbf{L}} \boldsymbol{\beta}_{\mathbf{l}} \mathbf{X}_{\mathbf{it}}^{\mathbf{l}} + \sum_{\mathbf{m=0}}^{\mathbf{M}} \boldsymbol{\beta}_{\mathbf{m}} \mathbf{X}_{\mathbf{it}}^{\mathbf{m}} + \boldsymbol{\varepsilon}_{\mathbf{it}}$$

$$\mathbf{where},\ \boldsymbol{\varepsilon}_{\mathbf{it}} = \boldsymbol{\nu}_{\mathbf{i}} + \boldsymbol{\lambda}_{\mathbf{t}} + \boldsymbol{\upsilon}_{\mathbf{it}} \text{ .....Equation (4)}$$

[5] H0: sigma (i)^2 = sigma^2 for all and the value derived was χ^2 (107) = 8.80E+33 with p-value= 0.0000.

[6] The relevant Hausman test specification is $\chi^2(.) = (b-B)'[(v_b - v_B)^{-1}](b-B)$ and our calculated chi-squared statistics was $\chi^2(12)$ = 134.11 with p-value is 0.0000.

Where λ_t is the unobservable time effect and we tested the joint significance of time effects as $\boldsymbol{H_0 = \lambda_2 = \lambda_3 = \lambda_T = 0}$. The relevant LM test[7] approves the inclusion of time dummies. We experiment the model estimator for time dummies for all years jointly and separately. Considering all these, we estimated the determinants of net interest margins by the following fixed effect panel equation:

$$\mathbf{NIM_{it}} = \mathbf{c} + \sum_{\mathbf{j=0}}^{\mathbf{J}} \boldsymbol{\beta}_{\mathbf{j}} \mathbf{X}_{\mathbf{it}}^{\mathbf{j}} + \sum_{\mathbf{l=0}}^{\mathbf{L}} \boldsymbol{\beta}_{\mathbf{l}} \mathbf{X}_{\mathbf{it}}^{\mathbf{l}} + \sum_{\mathbf{m=0}}^{\mathbf{M}} \boldsymbol{\beta}_{\mathbf{m}} \mathbf{X}_{\mathbf{it}}^{\mathbf{m}} + \boldsymbol{\gamma} + \boldsymbol{\varepsilon}_{\mathbf{it}}$$

$$\mathbf{where},\ \boldsymbol{\varepsilon}_{\mathbf{it}} = \boldsymbol{\nu}_{\mathbf{i}} + \boldsymbol{\upsilon}_{\mathbf{it}} \text{ .....Equation (5)}$$

4. Sample and Data Description

In this current study of the determinants of the net interest margins of commercial banks of China, India and Japan, we studied 418 active commercial banks data in between 2011 and 2017. By country, we studied the panel data set of 214 Chinese, 71 Indian and 133 Japanese commercial banks respectively. We defined banks as the financial intermediary who takes deposits and provide loans and advances in the ordinary courses of business. For our analyses, we collected data from various sources. The dependent variable and the bank specific explanatory variables, we collected data from the *Bureau Van Dijk's Bank Focus database* (Bank Focus 2018) using the universal model of banking database. We took the primary data set from the Bank Focus but calculated by our own to get the Hirschman Herfindahl Index (HHI). Finally, for macroeconomic specific variables, we collected data from the Federal Reserve Economic

[7] The relevant LM test chi-squared statistics was χ^2 (6) = 29.89 with p-value= 0.0000.

Data (FRED, 2018). We collected the data regarding short term interest rate volatility of the respective countries and the monthly averages of the daily call money rates and later calculated the annual standard deviation at our own. From FRED *(2018)*, we also collected yearly data of rate of inflation and the growth rate of gross domestic product (GDP).

Table-2 in the following presents the summary statistics of the variables we included to study net interest margins of commercial banks of China, India and Japan. Mean net interest margins of the sample countries is 1.99% with the standard deviation of 0.0477 during the sample period. Among the bank specific independent variables, liquid asset to total asset ratio was 17.77%. Profitability of the banks in terms of return on equity was 8.74%. Non-performing loan ration was slightly higher than 3%. On an average, commercial banks in the sample countries maintained around 8% equity to total asset ratio whereas their loan growth was more than 12% per annum. Required reserve ration mean value was 14.18% and their off-balance sheet income ratio was 47.71%. Finally, their operating expense ratio was 17.20%.

We found the banking market in the sample countries is quiet competitive. Hirschman Herfindahl Index value 536 (= 0.0536*10,000) indicates the industry structure is already over competitive[8] or un-concentrated market. Mean standard deviation of short term interest rate (SDINT) is 0.0761. Average rate of inflation was 2.8% whereas the mean GDP growth rate of the countries was 5.4% during the sample period.

[8] As Lovett (1988) states that An *HHI* below 0.01 (or 100) indicates a highly competitive industry, An *HHI* below 0.15 (or 1,500) indicates an un-concentrated industry. An *HHI* between 0.15 to 0.25 (or 1,500 to 2,500) indicates moderate concentration and An *HHI* above 0.25 (above 2,500) indicates high concentration.

Table-2: Summary Statistics of the Variables Used in the Study

Variables	Number of Observations	Mean	Standard Deviation
Dependent Variable: Net Interest Margins (NIM)	2,174	0.01993	0.0477
Independent Variables			
Bank Specific			
Liquid Asset to Total Asset Ratio	2,174	0.1777	0.1559
Return on Equity	2,175	0.0874	0.0775
Non-performing Loan (NPL) Ratio	1,835	2.6939	4.4263
Log (Total Asset)	2,175	16.85	1.654
Equity to Total Asset Ratio	2,172	0.0799	0.2278
Loan Growth	1,865	0.1202	0.3473
Required Reserve Ratio	1,282	0.1418	0.5587
Net Non-interest Income Ratio	2,162	0.4771	0.00199
Total Operating Expense Ratio	2,174	0.1720	0.0066
Industry Specific			
Hirschman Herfindahl Index (HHI)	2,926	0.0536	0.0181
Macroeconomics Specific			
Standard Deviation of Short Term Interest Rate (SDINT)	2,926	0.0761	0.186
Rate of Inflation	2,926	2.802	2.571
Growth Rate of GDP	2,926	5.401	3.064

Table-3, we compared the net interest margins of the sample countries separately. Among the 3 countries, mean net interest margins in China were the highest (2.56%) and in Japan the lowest (1.29%). In case of India the mean spread (1.99%) was in between of China and Japan.

Table-3: Comparative Summary Statistics of Net Interest Margins (NIM) of JIC during the Sample period of 2011 to 2017

Net Interest Margins (NIM)	Japan	India	China	JIC
Average	1.269	1.986	2.557	1.993
Standard Deviation	0.404	11.11	1.166	4.772
Number of Banks Studied	133	71	214	418

5. Results

In this paper, we studied the determinants of the net interest margins of commercial banks of China, India and Japan. This empirical study includes the panel data of 418 commercial banks of 3 sample countries for the period of 2011 to 2017; notably the post global financial crisis era. We used fixed effect (FE) model to capture the specific characteristics of each group, using the within-group estimator. Firstly, we presented our baseline model result of the pooled estimation using the baseline econometric model in equation- 5. And then we presented the output of robustness check of our baseline model and finally demonstrated the country-wise regression results. In all the cases, we allowed for individual heterogeneity and used robust standard error[9].

5.1. Baseline Result

Result of our baseline model of fixed effect regression, where we assumed each country's banking sector as a single representative firm, has been presented in table -4. The first column of the table present the list of the dependent and independent variables but the independent variables have been presented in quite classification of bank specific, industry specific and macroeconomic specific variables respectively.

Another feature of the presentation of table -4 is that there are three models- model 1 is the base line fixed effect estimation output. Model 2 and model 3 present the Random effect (RE) and Ordinary Least Square (OLS) as the alternative estimation outputs. R-squared value for FE estimation is 0.4571 whereas that of RE is 0.6755 and of OLS is 0.7276. The adjusted R-square value of the OLS estimation is 0.7241.

[9] Confirmed by LM Heteroskedasticity test and the test statistics (p-value) are presented in the respective tables.

The independent variables, coefficients of the independent variables and the robust standard errors of the coefficients have been presented according to the initial hypotheses developed in the empirical approach section.

The liquidity risk was our center of intuition and we found that liquidity risk has significant effect on the net interest margins of the commercial banks in China, India and Japan during the post global financial crisis period. This is indeed supportive to the findings of Ming Qi (2018) who found liquidity risk has positive impact on banking spread in Chinese banking industry.

We found the managerial motivation to maximize the shareholders' wealth has significant impact on the commercial banks' spread. The estimation output states that for every 1.23% increase in return on equity, net interest margins will increase by 1%. This outcome supports the findings of Yong Tang (2019) who studied the spread determinants of the Chinese banks.

In this present study, we found positive, although statistically insignificant coefficient of the non-performing loans (NPL), which also captures the so called credit risk exposure of the banking firm. To remember, in the past, Ho and Saunders (1981), Angbanzo (1997), Saunders and Schumacher (2000), Maudos and Guevara (2004), Hawtrey and Liang (2008) studies, mostly on the developed countries, found positive and statistically significant relationship between credit risk and the spread. In counter, Williams (2007), Hesse (2007) and Fungacova and Poghosyan (2011), Kutan (2012) and Islam –Nishiyama (2016a) who studied on Australian banking, Kenyan, Russian, 36 dollarized banking system and South Asian banking respectively, found credit risk is negatively related to net interest margins. But current study result could not support the views in the past banking literature.

Table - 4: Determinants of net interest margins of banks in China, India and Japan, 2011-2017, total sample

Variables	**Fixed Effect (FE) Estimation**	**Random Effect (RE) Estimation**	**OLS Estimation**
Dependent Variable: Net Interest Margins (NIM)	Coefficient (β) (Robust Standard Error, σ)	Coefficient (β) (Robust Standard Error, σ)	Coefficient (β) (Robust Standard Error, σ)
Independent Variables ***Bank Specific***			
Liquid Asset to Total Asset Ratio	0.00499**	0.00147	-0.0115***
	(0.00249)	(0.00232)	(0.00167)
Return on Equity	0.0123**	0.0191***	0.0554***
	(0.00557)	(0.00569)	(0.00416)
Non-performing Loan (NPL) Ratio	0.000380	0.0151	0.0566***
	(0.0133)	(0.0124)	(0.00874)
Log (Total Asset)	-0.656***	-0.193***	-0.185***
	(0.197)	(0.0478)	(0.0190)
Equity to Total Asset Ratio	0.0444*	0.0503***	0.0581***
	(0.0253)	(0.0148)	(0.00580)
Loan Growth	-0.00485	-0.00370	0.00424**
	(0.00361)	(0.00328)	(0.00175)
Required Reserve Ratio	0.0601***	0.0788***	0.0983***
	(0.0200)	(0.0196)	(0.0134)
Net Non-interest Income Ratio	-0.0620	-0.0673	-0.0358*
	(0.0483)	(0.0465)	(0.0215)
Industry Specific			
Hirschman Herfindahl Index	-0.228***	-0.305***	-0.0872
	(0.0814)	(0.0660)	(0.0880)
Macroeconomics Specific			
Standard Deviation of Short Term Interest Rate (SDINT)	0.832***	1.019***	1.103***
	(0.160)	(0.154)	(0.238)
Rate of Inflation	-0.0633***	-0.0447***	-0.0623***
	(0.0171)	(0.0142)	(0.0207)
Growth rate of GDP	0.210***	0.245***	0.203***
	(0.0243)	(0.0143)	(0.0100)
Year	0.316***	0.360***	0.382***
	(0.0414)	(0.0416)	(0.0647)
Constant	10.37***	1.621*	1.913***
	(3.651)	(0.906)	(0.428)
Number of observations	1,034	1,034	1,034
Wald χ^2 , F –Stat (p value)	*F (13,243) = 31.44 (0.0000)*	*F(13)= 576.63 (0.0000)*	*F(13, 1020)=209.59 (0.0000)*
R-squared (R^2)	0.4571	0.6755	0.7276
Adjusted R^2	-	-	0.7241
Hausman Test, χ^2 (12)(p-value)	134.11 (0.0000)	- -	- -
LM Heteroskedasticity test, χ^2 (p-value)	4.7e+31 (0.0000)	- -	- -

Note: The table reports the regression output from Fixed Effect estimation (Model 1) of the net interest margins determinants. as the baseline estimator. The Coefficients that are significantly different from zero at the 1%, 5% and 10% level are marked with ***, **, and * respectively. Wald test is the test for the goodness of fit of the model while Hausman test confirm the justification of using fixed effect estimator and LM heteroskedasticity test justify the use of robust standard error for the models.

In this study, we found the size of the firm and the interest margins is negatively related. The coefficient of log (Total Asset) is statistically significant and depicts that for every 65.6 basis point increase in size variable will lead 100 basis point decreases in spread income. This finding supports the studies of Islam and Nishiyama (2016a) and Smirlock (1985) who found significant and negative impact of size on bank net interest margins.

Unexpectedly, we found no significant impact of equity variable on the net interest margins of commercial banks. Saunders and Schumacher (2000) found positive relationship whereas Gertler and Kiyotaki (2011) expect negative relationship between the equity position and the interest spread of commercial banks. Among other bank specific variables, we found only required reserve ratio has significant impact on interest margins though the impact is minimum. The result is also supportive to the baseline dealership model of net interest margins determination of Ho and Saunders (1981) and also the subsequent expansion and their studies of the model so as our initial hypothesis that everything else constant, increase in cost of reserve will cause increase in interest margins of banks. That is if the bank's cost of holding regulatory reserve increases, banks subsequently shift that cost burden to the customers.

Interestingly, our empirical study found statistically significant and negative coefficient of the industry specific variable, Hirschman Herfindahl Index (HHI). This means in the highly concentrated banking industry of a market lead to the exercise of the monopolistic behavior of the large banks. Apparently, this result depicts that large firms are charging lower margins in the sample countries banking markets.

Among the macroeconomics specific variables, we found standard deviation of short term interest rate (SDINT) have significant positive relationship in determining the net interest

margins of banks. This means the term structure of the interest rates or the yield spread of the economy positively affect the commercial banks spread. As result shows, in the sample period, for every 83.2 basis point change in the yield spread, net interest margins of commercial banks increased by 1 percent. We found statistically significant negative coefficient of inflation for the sample countries. This means when due to inflation, the purchasing power of the borrowers deteriorate, they cannot pay higher interest margins to the banks. Thus we cannot accept the findings of Yong Tan (2019) who found positive relationship between inflation and interest margins in Chinese banking industry.

The coefficient of the growth rate of Gross Domestic Product (GDP) and net interest margins are statistically significant and positively related. The underlying principles of that, when GDP grows, economic expansion also becomes visible. In that expansionary economy bank can charge higher from their customers. The estimation output shows that for every 21 basis point increase in GDP, net interest margins will increase by 1 percentage point. Barik and Raje (2019) studies of the net interest margins of banks in India also support our findings.

Finally we found the year dummies are significant in our baseline estimation meaning there is time specific heterogeneity after the global financial crisis period in commercial banking markets of China, India and Japan.

5.2. Robustness Check

Table -5 presents the Robustness check for the determinants of net interest margins of banks in China, India and Japan, 2011-2017, total sample (using Total Operating Expense Ratio as

alternative of Net-Non-interest Income Ratio). Operating expense to total asset ratio has been used as the efficiency variable and included in many of the past literature of interest margins determination (see Richard Dwumfour, 2018).

Instead of using net non-interest income ratio (proxy for off-balance sheet income), we used operating expense ratio in our regression equation to see the impact of efficiency on net interest margins of commercial banks. Due to the inclusion of this alternative variable, we found no significant change in the R-squared values of different models. We also found no significant change in the sign of the base line estimator and their level of significance in the robustness check output. Thus we claim that our baseline estimation output is robust and researchers and policy makers can use the baseline coefficients with confidence.

Table – 5: Robustness check for the determinants of net interest margins of banks in China, India and Japan, 2011-2017, total sample (using Total Operating Expense Ratio as alternative of Net-Non-interest Income Ratio)

Variables	Fixed Effect (FE) Estimation	Random Effect (RE) Estimation	OLS Estimation
Dependent Variable: Net Interest Margins (NIM)	Coefficient (β) (Robust Standard Error, σ)	Coefficient (β) (Robust Standard Error, σ)	Coefficient (β) (Robust Standard Error, σ)
Independent Variables ***Bank Specific***			
Liquid Asset to Total Asset Ratio	0.00525**	0.00113	-0.00627***
	(0.00243)	(0.00238)	(0.00154)
Return on Equity	0.0118**	0.0183***	0.0569***
	(0.00491)	(0.00531)	(0.00407)
Non-performing Loan (NPL) Ratio	-0.00979	0.00345	0.0451***
	(0.0133)	(0.0131)	(0.00860)
Log (Total Asset)	0.00715	-0.0592*	-0.147***
	(0.158)	(0.0322)	(0.0180)
Equity to Total Asset Ratio	0.0392	0.0377***	0.0366***
	(0.0251)	(0.0115)	(0.00570)
Loan Growth	-0.00500	-0.00395	0.000824
	(0.00361)	(0.00356)	(0.00171)
Required Reserve Ratio	0.0301**	0.0227	0.0678***
	(0.0150)	(0.0144)	(0.0137)
Total Operating Expense Ratio	1.125***	0.924***	0.563***
	(0.151)	(0.118)	(0.0554)
Industry Specific			
Hirschman Herfindahl Index	-0.158**	-0.134**	-0.00279
	(0.0764)	(0.0661)	(0.0850)
Macroeconomics Specific			
Standard Deviation of Short Term Interest Rate (SDINT)	0.436***	0.638***	0.775***
	(0.150)	(0.140)	(0.236)
Rate of Inflation	-0.0137	-0.0131	-0.0611***
	(0.0141)	(0.0120)	(0.0204)
Growth rate of GDP	0.128***	0.197***	0.201***
	(0.0235)	(0.0157)	(0.00979)
Year	0.201***	0.247***	0.321***
	(0.0377)	(0.0360)	(0.0640)
Constant	5.186*	5.275***	4.758***
	(2.828)	(0.835)	(0.375)
Number of observations	1079	1079	1079
Wald χ^2 , F –Stat (p value)	*F (13, 250) =38.22* *(0.0000)*	*F(13)= 702.26* *(0.0000)*	*F(13,1065)=217.36* *(0.0000)*
R-Squared R^2	0.5208	*0.6732*	0.7263
Adjusted R^2	-	-	0.7229
Hausman Test, χ^2 (12)(p-value)	113.32 (0.0000)	- -	- -
LM Heteroskedasticity test, χ^2 (p-value)	7.0e+31 (0.0000)	- -	- -

Note: The table reports the regression output from Fixed Effect estimation (Model 1) of the net interest margins determinants. Coefficients that are significantly different from zero at the 1%, 5% and 10% level are marked with ***, **, and * respectively. Wald test is the test for the goodness of fit of the model while Hausman test confirm the justification of using fixed effect estimator and LM heteroskedasticity test justify the use of robust standard error for the models.

5.3 Marginal Analysis

Following Moudos and Guevara (2004), we also conducted the marginal analysis of the variables included in our present empirical study of the determinants of net interest margins of commercial banks of China, India and Japan during the post global financial crisis period of 2011 to 2017. We conducted the marginal analysis in stata econometric software for two different models of interest margins determination.

Table-6: Marginal analysis of the determinants of net interest margins of commercial banks in China, India and Japan; 2011-1017 total sample

Variables	**Model 1**	**Model 2**
Dependent Variable: Net Interest Margins (NIM)	**dy/dx** (Standard Error, σ)	**dy/dx** (Standard Error, σ)
Independent Variables		
Bank Specific		
Liquid Asset to Total Asset Ratio	0.00499**	0.00525**
	(0.00249)	(0.00243)
Return on Equity	0.0123**	0.0118**
	(0.00557)	(0.00491)
Non-performing Loan (NPL) Ratio	0.000380	-0.00979
	(0.0133)	(0.0133)
Log (Total Asset)	-0.656***	0.00715
	(0.197)	(0.158)
Equity to Total Asset Ratio	0.0444*	0.0392
	(0.0253)	(0.0251)
Loan Growth	-0.00485	-0.00500
	(0.00361)	(0.00361)
Required Reserve Ratio	0.0601***	0.0301**
	(0.0200)	(0.0150)
Net Non-interest Income Ratio	-0.0620	
	(0.0483)	
Total Operating Expense Ratio		1.125***
		(0.151)
Industry Specific		
Hirschman Herfindahl Index	-0.228***	-0.158**
	(0.0814)	(0.0764)
Macroeconomics Specific		
Standard Deviation of Short Term Interest Rate (SDINT)	0.832***	0.436***
	(0.160)	(0.150)
Rate of Inflation	-0.0633***	-0.0137
	(0.0171)	(0.0141)
Growth rate of GDP	0.210***	0.128***
	(0.0243)	(0.0235)
Year	0.316***	0.201***
	(0.0414)	(0.0377)

In model 1 we included all the variables also included in our baseline FE regression and in model 2, we excluded the net non-interest income and included operating expense ratio as an alternative measure. In fact marginal analysis output, those are presented in table-6, support the outcome of our baseline regression coefficients.

5.3. Country-wise Regression Result

In this section of our study, we presented the regression outputs of the country-wise regressions. In section 5.3.1, the regression outputs of China, in 5.3.2, the same for India and finally, in section 5.3.3. the regression outputs of Japan have been presented. In the case of the determinants of the net-interest margins of commercial banks in China, in table -7, the baseline regression equation estimation has been presented. We also presented the robust outcomes for Chinese cases in the table-8. Following the same strategy of presentation, in table 9 and 11, the base line regression outputs of India and Japan have been illustrated whereas, in table 10 and 12, the robust outputs for India and Japan have been dully presented.

The bottom line of the outputs of the table are that, we found no significant deviation in the coefficients' sign and magnitude from our baseline regression output that has been outlined in the table-4.

5.3.1. China

Table - 7: Determinants of Net Interest Margins of Banks in China 2011-2017, Total Sample

Variables	**Fixed Effect (FE) Estimation**	**Random Effect (RE) Estimation**	**OLS Estimation**
Dependent Variable: Net Interest Margins (NIM)	Coefficient (β) (Robust Standard Error, σ)	Coefficient (β) (Robust Standard Error, σ)	Coefficient (β) (Robust Standard Error, σ)
Independent Variables ***Bank Specific***			
Liquid Asset to Total Asset Ratio	-0.00434	-0.0102**	-0.0257***
	(0.00603)	(0.00516)	(0.00225)
Return on Equity	0.0468***	0.0531***	0.0657***
	(0.0131)	(0.0118)	(0.00540)
Non-performing Loan (NPL) Ratio	0.178**	0.193**	0.206***
	(0.0862)	(0.0838)	(0.0317)
Log (Total Asset)	-0.675*	-0.185***	-0.153***
	(0.359)	(0.0479)	(0.0180)
Equity to Total Asset Ratio	0.0574	0.0531*	0.0823***
	(0.0468)	(0.0313)	(0.00933)
Loan Growth	0.00197	0.00193	0.00231
	(0.00312)	(0.00291)	(0.00180)
Required Reserve Ratio	0.0485**	0.0440*	0.0453***
	(0.0238)	(0.0229)	(0.0115)
Net Non-interest Income Ratio	-0.0782	-0.0756	-0.0233
	(0.0670)	(0.0534)	(0.0204)
Industry Specific			
Hirschman Herfindahl Index	-0.226	-0.578***	-0.644***
	(0.294)	(0.101)	(0.141)
Macroeconomics Specific			
Standard Deviation of Short Term Interest Rate (SDINT)	1.671***	2.008***	2.202***
	(0.341)	(0.298)	(0.369)
Rate of Inflation	-0.0266	-0.0246	0.0722**
	(0.0290)	(0.0325)	(0.0327)
Growth rate of GDP	0.203*	0.268**	0.152*
	(0.113)	(0.106)	(0.0857)
Year	0.371***	0.415***	0.465***
	(0.0512)	(0.0521)	(0.0521)
Constant	3.417	-0.00249	-0.000610
	(2.544)	(0.00253)	(0.0128)
Number of observations	1,034	1,034	1,034
Wald χ^2 , F –Stat (p value)	*F (13,243) = 26.15* *(0.0000)*	*F(13)= 2551.28* *(0.0000)*	*F(13, 1020)=1097.52* *(0.0000)*
R-squared (R^2)	0.6746	0.9264	0.9333
Adjusted R^2	-	-	0.9324
Hausman Test, χ^2 (12)(p-value)	43.51 (0.0000)	- -	- -
LM Heteroskedasticity test, χ^2 (p-value)	7.3e+30 (0.0000)	- -	- -

Note: The table reports the regression output from Fixed Effect estimation of the net interest margins determinants. Coefficients that are significantly different from zero at the 1%, 5% and 10% level are marked with ***, **, and * respectively. Wald test is the test for the goodness of fit of the model while Hausman test confirm the justification of using fixed effect estimator and LM heteroskedasticity test justify the use of robust standard error for the models.

Table - 8 Robustness Check for the Determinants of Net Interest Margins of Banks in China, 2011-2017, Total Sample (using Total Operating Expense Ratio as Alternative of Net-Non-interest Income Ratio)

Variables	**Fixed Effect (FE) Estimation**	**Random Effect (RE) Estimation**	**OLS Estimation**
Dependent Variable: Net Interest Margins (NIM)	Coefficient (β) (Robust Standard Error, σ)	Coefficient (β) (Robust Standard Error, σ)	Coefficient (β) (Robust Standard Error, σ)
Independent Variables ***Bank Specific***			
Liquid Asset to Total Asset Ratio	0.00135	-0.0106**	-0.0283***
	(0.00590)	(0.00507)	(0.00201)
Return on Equity	0.0306**	0.0447***	0.0673***
	(0.0121)	(0.0110)	(0.00491)
Non-performing Loan (NPL) Ratio	0.116	0.208***	0.207***
	(0.0738)	(0.0801)	(0.0287)
Log (Total Asset)	0.349	0.0354	-0.0935***
	(0.301)	(0.0448)	(0.0154)
Equity to Total Asset Ratio	0.0676*	0.0590**	0.0662***
	(0.0406)	(0.0282)	(0.00852)
Loan Growth	0.000108	0.00176	0.00416**
	(0.00247)	(0.00270)	(0.00162)
Required Reserve Ratio	0.00184	-0.00227	0.0110
	(0.0179)	(0.0197)	(0.0108)
Total Operating Expense Ratio	1.669***	0.749***	0.824***
	(0.269)	(0.160)	(0.0582)
Industry Specific			
Hirschman Herfindahl Index	-0.249	-0.437***	-0.292**
	(0.220)	(0.0963)	(0.129)
Macroeconomics Specific			
Standard Deviation of Short Term Interest Rate (SDINT)	-0.0378	1.270***	1.761***
	(0.442)	(0.326)	(0.335)
Rate of Inflation	0.0432	-0.0626*	-0.179***
	(0.0272)	(0.0327)	(0.0326)
Growth rate of GDP	-0.0395	0.422***	0.860***
	(0.108)	(0.109)	(0.0780)
Year	0.176***	0.276***	0.205***
	(0.0664)	(0.0570)	(0.0501)
Constant	0.778	0.00820***	0.00108
	(1.728)	(0.00255)	(0.0113)
Number of observations	1079	1079	1079
Wald χ^2 , F –Stat (p value)	*F (13, 250) =39.73* *(0.0000)*	*F(13)= 2808.20* *(0.0000)*	*F(13,1065)=1376.63* *(0.0000)*
R-Squared R^2	0.7285	*0.9322*	0.9438
Adjusted R^2	-	-	0.9431
Hausman Test, χ^2 (12)(p-value)	225.38 (0.0000)	- -	- -
LM Heteroskedasticity test, χ^2 (p-value)	1.5e+32 (0.0000)	- -	- -

Note: The table reports the regression output from Fixed Effect estimation of the net interest margins determinants. Coefficients that are significantly different from zero at the 1%, 5% and 10% level are marked with ***, **, and * respectively. Wald test is the test for the goodness of fit of the model while Hausman test confirm the justification of using fixed effect estimator and LM heteroskedasticity test justify the use of robust standard error for the models.

5.2.2. India

Table - 9: Determinants of Net Interest Margins of Banks in India 2011-2017, Total Sample

Variables	**Fixed Effect (FE) Estimation**	**Random Effect (RE) Estimation**	**OLS Estimation**
Dependent Variable: Net Interest Margins (NIM)	Coefficient (β) (Robust Standard Error, σ)	Coefficient (β) (Robust Standard Error, σ)	Coefficient (β) (Robust Standard Error, σ)
Independent Variables			
Bank Specific			
Liquid Asset to Total Asset Ratio	0.00995	0.0116	-0.0145***
	(0.0278)	(0.0310)	(0.00490)
Return on Equity	0.0110	0.0178*	0.0533***
	(0.00798)	(0.00910)	(0.00368)
Non-performing Loan (NPL) Ratio	-0.0166	0.00498	0.0580***
	(0.0157)	(0.0159)	(0.00736)
Log (Total Asset)	-0.876	-0.308**	-0.526***
	(0.737)	(0.156)	(0.0429)
Equity to Total Asset Ratio	0.00777	0.0617*	0.0845***
	(0.0797)	(0.0367)	(0.00606)
Loan Growth	-0.00950	-0.000971	0.0252***
	(0.00673)	(0.00369)	(0.00245)
Required Reserve Ratio	0.311	0.417***	0.522***
	(0.219)	(0.157)	(0.0476)
Net Non-interest Income Ratio	0.103	-0.0673	0.0967***
	(0.309)	(0.211)	(0.0374)
Industry Specific			
Hirschman Herfindahl Index	-0.0417	-0.769	-0.990***
	(0.641)	(0.475)	(0.283)
Macroeconomics Specific			
Standard Deviation of Short Term Interest Rate (SDINT)	-0.533	-0.276	-0.168
	(0.339)	(0.238)	(0.345)
Rate of Inflation	-0.0187	-0.0313	-0.0474
	(0.0211)	(0.0232)	(0.0304)
Growth rate of GDP	-0.0249	0.114	0.388***
	(0.0832)	(0.0969)	(0.0542)
Year	-0.292	-0.291*	-0.412**
	(0.180)	(0.152)	(0.191)
Constant	1.493	0.00427*	0.000520
	(1.235)	(0.00259)	(0.00942)
Number of observations	1,034	1,034	1,034
Wald χ^2 , F –Stat (p value)	*F (13,243) = 9.77* *(0.0000)*	*F(13)=617.82* *(0.0000)*	*F(13, 1020)=1030.27* *(0.0000)*
R-squared (R^2)	0.2871	0.8911	0.9292
Adjusted R^2	-	-	0.9383
Hausman Test, χ^2 (12)(p-value)	350.97	-	-
	(0.0000)	-	-
LM Heteroskedasticity test, χ^2 (p-value)	9.3e+26	-	-
	(0.0000)	-	-

Note: The table reports the regression output from Fixed Effect estimation of the net interest margins determinants. Coefficients that are significantly different from zero at the 1%, 5% and 10% level are marked with ***, **, and * respectively. Wald test is the test for the goodness of fit of the model while Hausman test confirm the justification of using fixed effect estimator and LM heteroskedasticity test justify the use of robust standard error for the models.

Table -10: Robustness Check for the Determinants of Net Interest Margins of banks in India, 2011-2017, total sample (using Total Operating Expense Ratio as alternative of Net-Non-interest Income Ratio)

Variables	Fixed Effect (FE) Estimation	Random Effect (RE) Estimation	OLS Estimation
Dependent Variable: Net Interest Margins (NIM)	Coefficient (β) (Robust Standard Error, σ)	Coefficient (β) (Robust Standard Error, σ)	Coefficient (β) (Robust Standard Error, σ)
Independent Variables			
Bank Specific			
Liquid Asset to Total Asset Ratio	0.0101	0.0131	0.00187
	(0.0275)	(0.0292)	(0.00417)
Return on Equity	0.0129	0.0203**	0.0507***
	(0.00836)	(0.0103)	(0.00321)
Non-performing Loan (NPL) Ratio	-0.0187	0.00658	0.0692***
	(0.0155)	(0.0162)	(0.00608)
Log (Total Asset)	-0.596	-0.155	-0.334***
	(0.787)	(0.124)	(0.0384)
Equity to Total Asset Ratio	0.00277	0.0648**	0.0708***
	(0.0774)	(0.0315)	(0.00467)
Loan Growth	-0.00965	0.00199	0.0216***
	(0.00657)	(0.00443)	(0.00214)
Required Reserve Ratio	0.304	0.336**	0.404***
	(0.216)	(0.146)	(0.0415)
Total Operating Expense Ratio	0.677	0.775*	1.612***
	(0.632)	(0.417)	(0.0956)
Industry Specific			
Hirschman Herfindahl Index	-0.309	-1.354***	-2.368***
	(0.709)	(0.498)	(0.240)
Macroeconomics Specific			
Standard Deviation of Short Term Interest Rate (SDINT)	-0.633*	-0.393*	-0.268
	(0.352)	(0.225)	(0.298)
Rate of Inflation	-0.0250	-0.0501*	-0.0810***
	(0.0225)	(0.0265)	(0.0264)
Growth rate of GDP	-0.0528	0.155*	0.436***
	(0.0819)	(0.0894)	(0.0463)
Year	-0.357*	-0.408***	-0.562***
	(0.193)	(0.156)	(0.165)
Constant	1.167	0.00636**	0.000844
	(1.233)	(0.00257)	(0.00802)
Number of observations	1079	1079	1079
Wald χ^2 , F –Stat (p value)	*F (13, 250) =12.08* *(0.0000)*	*F(13)= 685.65* *(0.0000)*	*F(13,1065)=1380.38* *(0.0000)*
R-Squared R^2	0.3000	*0.9116*	0.9440
Adjusted R^2	-	-	0.9433
Hausman Test, χ^2 (12)(p-value)	504.54	-	-
	(0.0000)	-	-
LM Heteroskedasticity test, χ^2 (p-value)	3.4e+29	-	-
	(0.0000)	-	-

Note: The table reports the regression output from Fixed Effect estimation of the net interest margins determinants. Coefficients that are significantly different from zero at the 1%, 5% and 10% level are marked with ***, **, and * respectively. Wald test is the test for the goodness of fit of the model while Hausman test confirm the justification of using fixed effect estimator and LM heteroskedasticity test justify the use of robust standard error for the models.

5.3.3. Japan

Table - 11: Determinants of Net Interest Margins of Banks in Japan 2011-2017, Total Sample

Variables	**Fixed Effect (FE) Estimation**	**Random Effect (RE) Estimation**	**OLS Estimation**
Dependent Variable: Net Interest Margins (NIM)	Coefficient (β) (Robust Standard Error, σ)	Coefficient (β) (Robust Standard Error, σ)	Coefficient (β) (Robust Standard Error, σ)
Independent Variables ***Bank Specific***			
Liquid Asset to Total Asset Ratio	-0.00231	-0.00113	-0.00226***
	(0.00380)	(0.00359)	(0.000768)
Return on Equity	0.00444	0.0104**	0.0224***
	(0.00663)	(0.00501)	(0.00315)
Non-performing Loan (NPL) Ratio	0.0243	0.0882***	0.106***
	(0.0390)	(0.0306)	(0.00932)
Log (Total Asset)	0.586	-0.0155	-0.0455***
	(0.548)	(0.0261)	(0.00948)
Equity to Total Asset Ratio	0.130	0.0501***	0.0385***
	(0.0805)	(0.0134)	(0.00445)
Loan Growth	-0.00828	-0.00569	-0.00226**
	(0.00577)	(0.00524)	(0.000971)
Required Reserve Ratio	0.0306*	-0.00395	0.00633
	(0.0156)	(0.0235)	(0.00904)
Net Non-interest Income Ratio	-5.74e-05	-0.0943***	-0.109***
	(0.0107)	(0.0257)	(0.0101)
Industry Specific			
Hirschman Herfindahl Index	-0.261***	-0.111	-0.158***
	(0.0800)	(0.0867)	(0.0401)
Macroeconomics Specific			
Standard Deviation of Short Term Interest Rate (SDINT)	-0.0430	0.459	2.858***
	(1.202)	(0.755)	(0.970)
Rate of Inflation	-0.0238	-0.0145	0.0258
	(0.0633)	(0.0283)	(0.0338)
Growth rate of GDP	0.0806**	0.0576	0.126***
	(0.0333)	(0.0401)	(0.0364)
Year	0.152	0.0706	0.0442
	(0.0949)	(0.0679)	(0.0930)
Constant	-6.100	0.00405***	0.00261
	(5.667)	(0.00104)	(0.00891)
Number of observations	1034	1034	1034
Wald χ^2 , F –Stat (p value)	*F (13, 243)=18.55 (0.0000)*	*F(13)= 5958.70 (0.0000)*	*F(13,1020)=862.02 (0.0000)*
R-squared (R^2)	0.2841	*0.9113*	0.9166
Adjusted R^2	-	-	0.9155
Hausman Test, χ^2 (12)(p-value)	211.41 (0.0000)	- -	- -
LM Heteroskedasticity test, χ^2 (p-value)	1.2e+06 0.0000	-	-

Note: The table reports the regression output from Fixed Effect estimation of the net interest margins determinants. Coefficients that are significantly different from zero at the 1%, 5% and 10% level are marked with ***, **, and * respectively. Wald test is the test for the goodness of fit of the model while Hausman test confirm the justification of using fixed effect estimator and LM heteroskedasticity test justify the use of robust standard error for the models.

Table – 12: Robustness Check for the Determinants of Net Interest Margins of Banks in Japan, 2011-2017, Total Sample (using Total Operating Expense Ratio as alternative of Net-Non-interest Income Ratio)

Variables	**Fixed Effect (FE) Estimation**	**Random Effect (RE) Estimation**	**OLS Estimation**
Dependent Variable: Net Interest Margins (NIM)	Coefficient (β) (Robust Standard Error, σ)	Coefficient (β) (Robust Standard Error, σ)	Coefficient (β) (Robust Standard Error, σ)
Independent Variables			
Bank Specific			
Liquid Asset to Total Asset Ratio	-0.000877	1.12e-05	0.00201**
	(0.00352)	(0.00285)	(0.000993)
Return on Equity	0.00366	0.00535	0.0187***
	(0.00654)	(0.00528)	(0.00412)
Non-performing Loan (NPL) Ratio	0.0288	0.0740**	0.114***
	(0.0364)	(0.0333)	(0.0113)
Log (Total Asset)	0.679	0.00616	-0.0424***
	(0.485)	(0.0298)	(0.0147)
Equity to Total Asset Ratio	0.143*	0.0617***	0.0240***
	(0.0747)	(0.0136)	(0.00654)
Loan Growth	-0.00810	-0.00742	-0.00617***
	(0.00576)	(0.00561)	(0.00133)
Required Reserve Ratio	0.0256*	-3.32e-05	0.00271
	(0.0148)	(0.0190)	(0.0124)
Total Operating Expense Ratio	0.302***	-0.0256	0.0551
	(0.0868)	(0.105)	(0.0385)
Industry Specific			
Hirschman Herfindahl Index	-0.256***	-0.141	-0.398***
	(0.0733)	(0.0993)	(0.0524)
Macroeconomics Specific			
Standard Deviation of Short Term Interest Rate (SDINT)	0.330	0.574	7.175***
	(1.118)	(0.689)	(1.266)
Rate of Inflation	0.0133	-0.0184	0.128***
	(0.0583)	(0.0305)	(0.0451)
Growth rate of GDP	0.0851***	0.0717*	0.308***
	(0.0320)	(0.0430)	(0.0486)
Year	0.0874	0.0899	-0.0179
	(0.0915)	(0.0658)	(0.125)
Constant	-6.387	0.00846***	0.00591
	(5.131)	(0.00179)	(0.0124)
Number of observations	1079	1079	1079
Wald χ^2 , F –Stat (p value)	*F (13, 250) =22.75*	*F(13)= 2887.23*	*F(13,1065)=478.59*
	(0.0000)	*(0.0000)*	*(0.0000)*
R-Squared R^2	0.2858	*0.8335*	0.8538
Adjusted R^2	-	-	0.8521
Hausman Test, χ^2 (12)(p-value)	211.41	-	-
	(0.0000)	-	-
LM Heteroskedasticity test, χ^2 (p-value)	1.2e+06	-	-
	(0.0000)	-	-

Note: The table reports the regression output from Fixed Effect estimation of the net interest margins determinants. Coefficients that are significantly different from zero at the 1%, 5% and 10% level are marked with ***, **, and * respectively. Wald test is the test for the goodness of fit of the model while Hausman test confirm the justification of using fixed effect estimator and LM heteroskedasticity test justify the use of robust standard error for the models.

6. Test of Homogeneity of the Coefficients across Three Countries

Regarding the determinants of net interest margins of commercial banks of China, India and Japan in previous section, we estimated the baseline regression equation (equation-5).Although the country dummy variables were not allowed in fixed effect model, but we did include country dummy variables in random effect and in pooled OLS estimation We found country-specific heterogeneity regarding the intercepts (α) in the baseline regression equation. However, it should be noted that in this baseline regression, the coefficients or slope parameters (β) were assumed to be homogeneous across three countries. On the other hand, for the country-by-country estimation of baseline regression equation, we allowed the slope parameters to be different across the countries. Indeed, we found some differences in the estimates of slope parameters in our country-wise regression that have been presented in section 5.3. Now the question must be asked. Is it plausible to assume the homogeneity in slope parameters of the commercial banks across China, India, and Japan? Or should we allow for the heterogeneity in slope parameters of the commercial banks across three countries? In order to answer this question formally, we conduct the test of homogeneity in slope parameters across three countries in this section.

6.1. Econometric Methodology

In testing for homogeneity of the coefficients across three countries, the idea is to set the benchmark country and test whether other country's coefficients are significantly different from the benchmark country's coefficients. In this paper, we set Japanese banks to be the benchmark. Recall that our fixed effect regression equation was formulated as follow;

$$\mathbf{NIM_{it}} = \mathbf{c} + \sum_{\mathbf{j=0}}^{\mathbf{J}} \boldsymbol{\beta}_{\mathbf{j}} \mathbf{X}_{\mathbf{it}}^{\mathbf{j}} + \sum_{\mathbf{l=0}}^{\mathbf{L}} \boldsymbol{\beta}_{\mathbf{l}} \mathbf{X}_{\mathbf{it}}^{\mathbf{l}} + \sum_{\mathbf{m=0}}^{\mathbf{M}} \boldsymbol{\beta}_{\mathbf{m}} \mathbf{X}_{\mathbf{it}}^{\mathbf{m}} + \boldsymbol{\gamma} \mathbf{D}_{\mathbf{2014}} + \boldsymbol{\varepsilon}_{\mathbf{it}}$$

$$\textbf{where, } \boldsymbol{\varepsilon}_{\mathbf{it}} = \boldsymbol{\nu}_{\mathbf{i}} + \boldsymbol{\upsilon}_{\mathbf{it}} \text{ .....Equation (6)}$$

In order to capture the country-specific effect in slope parameters, we introduce the country-specific cross-terms to the above equation as follow;

Now let, $\sum_{j=0}^{J} \beta_j X_{it}^j + \sum_{l=0}^{L} \beta_l X_{it}^l + \sum_{m=0}^{M} \beta_m X_{it}^m + +\gamma D_{2014} = \boldsymbol{\beta}.\boldsymbol{X_{it}}$ ....Equation (7)

Then, the equation is,

$$NIM_{it} = \alpha_i + \boldsymbol{\beta}.\boldsymbol{X_{it}} + \delta_c Z_{it}^c + \delta_I Z_{it}^I + \varepsilon_{it}$$ .....Equation (8)

Where, $Z_{it}^c \equiv \boldsymbol{X_{it}}.\boldsymbol{I_i^c}$ **and** $Z_{it}^I \equiv \boldsymbol{X_{it}}.\boldsymbol{I_i^I}$

Where, $\boldsymbol{I_i^c} = \mathbf{1}$ if bank $\boldsymbol{i}$ is Chinese bank and $\mathbf{0}$ otherwise and $\boldsymbol{I_i^I} =$

$\mathbf{1}$ *if bank* $\boldsymbol{i}$ *is Indian bank and* $\mathbf{0}$ *otherwise*

Interpretation:

β will be the benchmark coefficient which is Japanese bank. $(\boldsymbol{\beta} + \boldsymbol{\delta_c}.\boldsymbol{I_i^c}).\boldsymbol{X_{it}} = \boldsymbol{\beta_c} =$ $\boldsymbol{Chinese\ coefficient\ and}$ $(\boldsymbol{\beta} + \boldsymbol{\delta_I}.\boldsymbol{I_i^I}).\boldsymbol{X_{it}} = \boldsymbol{\beta_I} = \boldsymbol{Indian\ coefficient}$.

And null hypothesis $\boldsymbol{H_o}: \boldsymbol{\beta} = \boldsymbol{\beta_c} = \boldsymbol{\beta_I}$

Or, $\boldsymbol{H_o}: \boldsymbol{\beta_c} = \mathbf{0},\ \boldsymbol{\beta_I} = \mathbf{0}$

6.2. Empirical Result for Test of Homogeneity:

Table – 13: Test of Homogeneity across the sample countries, 2011-2017, Total Sample (null hypothesis $H_o: \beta = \beta_c = \beta_I$ or $H_o: \beta_c = 0,\ \beta_I = 0$)

Variables	**Fixed Effect (FE) Estimation**	**Random Effect (RE) Estimation**	**OLS Estimation**
Dependent Variable: Net Interest Margins (NIM)_CN	Coefficient (β) (Robust Standard Error, σ)	Coefficient (β) (Robust Standard Error, σ)	Coefficient (β) (Robust Standard Error, σ)
Independent Variables			
Bank Specific			
Liquid Asset to Total Asset Ratio_CN	-0.00203	-0.00960*	-0.0234***
	(0.00722)	(0.00578)	(0.00380)
Return on Equity_CN	0.0424***	0.0469***	0.0408***
	(0.0149)	(0.0132)	(0.0113)
Non-performing Loan (NPL) Ratio_CN	0.154	0.122	0.0866*
	(0.0958)	(0.0922)	(0.0518)
Log (Total Asset) _CN	-1.261*	-0.138**	-0.0755**
	(0.664)	(0.0565)	(0.0372)
Equity to Total Asset Ratio_CN	-0.0724	-0.00604	0.0515***
	(0.0943)	(0.0365)	(0.0178)
Loan Growth_CN	0.0103	0.00942	0.00419
	(0.00665)	(0.00662)	(0.00360)
Required Reserve Ratio_CN	0.0179	0.0206	0.0241
	(0.0288)	(0.0299)	(0.0290)
Net Non-interest Income Ratio_CN	-0.0782	-0.0223	0.0610
	(0.0687)	(0.0559)	(0.0401)
Industry Specific			
Hirschman Herfindahl Index_CN	0.0343	-0.465***	-0.657***
	(0.309)	(0.152)	(0.235)
Macroeconomics Specific			
Standard Deviation of Short Term Interest Rate (SDINT) _CN	1.714	-0.465***	-0.657***
	(1.266)	(0.152)	(0.235)
Rate of Inflation_CN	-0.00285	3.103***	1.997
	(0.0705)	(0.733)	(2.686)
Growth rate of GDP_CN	0.122	0.0706	0.189*
	(0.119)	(0.0495)	(0.109)
Year_CN	0.218**	0.163	-0.0490
	(0.109)	(0.119)	(0.157)
Dependent Variable: Net Interest Margins (NIM)_IN	***Coefficient (β) (Robust Standard Error, σ)***	***Coefficient (β) (Robust Standard Error, σ)***	***Coefficient (β) (Robust Standard Error, σ)***
Independent Variables_IN			
Bank Specific_IN			
Liquid Asset to Total Asset Ratio_IN	0.0123	0.0140	-0.0122
	(0.0285)	(0.0318)	(0.00848)
Return on Equity_IN	0.00654	0.0110	0.0266***
	(0.0105)	(0.0109)	(0.0103)
Non-performing Loan (NPL) Ratio_IN	-0.0410	-0.0513	-0.0471*
	(0.0426)	(0.0416)	(0.0269)
Log (Total Asset) _IN	-1.461	-0.309*	-0.465***
	(0.931)	(0.166)	(0.0764)
Equity to Total Asset Ratio_IN	-0.122	0.0109	0.0553***
	(0.115)	(0.0391)	(0.0156)

Loan Growth_IN	-0.00121	0.00815	0.0267***
	(0.00898)	(0.00733)	(0.00482)
Required Reserve Ratio_IN	0.280	0.429**	0.513***
	(0.223)	(0.173)	(0.0834)
Net Non-interest Income Ratio_IN	0.103	0.0354	0.193***
	0.0123	0.0140	-0.0122
Industry Specific			
Hirschman Herfindahl Index_IN	0.219	-0.614	-0.629
	(0.654)	(0.491)	(0.492)
Macroeconomics Specific			
Standard Deviation of Short Term Interest Rate (SDINT) _IN	-0.490	0.769	-0.221
	(1.266)	(0.704)	(2.712)
Rate of Inflation_IN	0.00509	0.0368	0.0218
	(0.0676)	(0.0359)	(0.105)
Growth rate of GDP_IN	-0.106	0.102	0.358***
	(0.0907)	(0.117)	(0.134)
Year_IN	-0.445**	-0.438**	-0.431
	(0.207)	(0.183)	(0.400)
Constant	-1.190	2.030**	1.782***
	(6.416)	(1.013)	(0.580)
Number of observations	1034	1034	1034
Wald χ^2 , F –Stat (p value)	*F (39, 243) =17.69*	*F(39)= 1491.96*	*F(39,994)=93.78*
	(0.0000)	*(0.0000)*	*(0.0000)*
R-Squared R^2	0.5654	*0.7318*	0.7863
Adjusted R^2	-	-	0.7779
Hausman Test, χ^2 (12)(p-value)	190.76	-	-
	(0.0000)	-	-
LM Heteroskedasticity test, χ^2 (p-value)	8.6e+30	-	-
	(0.0000)	-	-

Note: The table reports the regression output from Fixed Effect estimation of the net interest margins determinants. Coefficients that are significantly different from zero at the 1%, 5% and 10% level are marked with ***, **, and * respectively. _CN represents Chinese and _IN represents Indian abbreviation respectively. Wald test is the test for the goodness of fit of the model while Hausman test confirm the justification of using fixed effect estimator and LM heteroskedasticity test justify the use of robust standard error for the models.

6. Conclusions and Implications

This study investigates the determinants of net interest margins of commercial banks of China, India and Japan; the top 3 of the 4 largest economies of the world right now. Using a comprehensive cross –country panel data set with bank-level, industry-level and macroeconomic –level explanatory variables, this paper presents the empirical results on how bank specific, industry specific and macroeconomics specific factors affect the interest margins of commercial banks. We started from the dealership model of Ho and Saunders (1981) and later extension by other authors but followed the single stage model of margin determination. Our panel data covering the period of 2011-2017 carries significance that we particularly

focused on the post global financial crisis period. Regarding the econometric modeling, we used the fixed effect panel estimator as the baseline model estimator but also estimated the model using the random effect and the OLS estimators. In addition, we estimated the marginal effect of the independent variables on the dependent variable.

We found strong empirical evidence that among the bank specific factors, liquidity, profitability, regulatory capital, size and required reserve ratio have significant impact on net interest margins. Liquidity, profitability and regulatory capital and required reserve ratio have positive impact whereas size has negative impact on commercial banks' spread. The evidence support that the impact of regulatory capital (proxy by equity to total asset ratio) on interest margins that the views of Ho and Saunders (1981) and Saunders' and Schumacher (2000) who viewed that commercial banks should charge higher interest margins due to their excellence in financial capital. Again in the macroeconomic views of Gertler and Kiyotaki (2011) who propose the New Keynesian views in their famous business cycle acceleration in credit market imperfections where lending firm should charge lower whose equity condition is stronger and apparently our evidence support that.

We also found evidence of the structure conduct performance (SCP) hypothesis of Bain (1956) where the industry composition should have effect on the profitability of firms. Although the sample countries' banking industry seems over competitive, but still, the relatively larger firms have some monopolistic behavior in determining the net-interest margins of commercial banks.

Macroeconomic consequences in the economy found to have significant effect on commercial banks' spread. Evidence shows that yield spread, rate of inflation and GDP growth rate have significant impact on interest margins. We found opposite evidence of Yong Tan (2019) who found positive relationship of net interest margins with inflation and negative relationship with GDP growth rate.

Although, we conducted our empirical study using fixed effect, random effect and OLS estimations but fixed effect model performs better and generates the expected specification.

Robust standard errors have been incorporated for all the models, the robustness check and the country-wise regression which ensure the correct inferences from the estimation.

Regarding policy implications, we suggest the banks to take appropriate actions so that the default probability would have proper reflection in determining the interest margins. For the regulatory bodies, we recommend liberal policy actions for new entrants that could contribute to the improvement of the competitive environment in the industry in order to reduce the cost of financial intermediation.

In terms of directions for future research, studies on a number of additional explanatory variables like corporate tax rates, competition among banks and other financial institutions, ownership structure, deposit insurance, information asymmetry, portfolio effect would be tested as the extension of the model. Due to limitation of data and the degrees of freedom or for the potential multicollinearity problem, we could not have fruitful insight of the literature but doing such could be apparently an interesting path for future research.

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Appendix A.

Table A1

Correlation matrix* of the variables studied for the model of bank net interest margins determination of Japan, India and China (JIC)

Variables**	nim	lata	roe	il	log_TA	ETA	loangr~h	log_re~e	log_nn~A	ln_ope~A	log_HHI	STDV_i~e	Infla~on	GDP_growth
nim	1.00													
lata	0.04	1.00												
roe	0.49	0.18	1.00											
il	0.17	-0.15	-0.45	1.00										
log_TA	-0.14	0.06	0.32	-0.29	1.00									
ETA	0.44	0.31	0.08	0.26	-0.23	1.00								
loangrowth	0.33	0.16	0.48	-0.31	0.08	0.06	1.00							
log_reserve	-0.18	-0.10	-0.07	0.05	0.59	-0.16	-0.23	1.00						
log_nniiTA	0.04	0.17	0.21	-0.09	0.47	0.16	0.16	0.31	1.00					
ln_opexTA	0.36	-0.05	-0.14	0.33	-0.38	0.35	0.00	0.01	0.20	1.00				
log_HHI	-0.26	-0.07	-0.40	0.14	-0.14	0.04	-0.19	0.00	-0.08	-0.02	1.00			
STDV_intrate	0.37	-0.04	0.04	0.27	-0.17	0.21	0.11	0.04	0.14	0.34	-0.09	1.00		
Inflation	0.52	0.04	0.28	0.16	-0.07	0.23	0.24	-0.01	0.18	0.28	-0.36	0.72	1.00	
GDP_growth	0.73	0.16	0.55	0.04	0.08	0.30	0.43	-0.25	0.12	0.04	-0.27	0.30	0.51	1.00

*Output of Stata Econometric Software and ** refer to Table 1 of description of variables for elaboration of the names of the variables

Table A2

Variance Inflation Factor (VIF) of the variables studied for the model of bank net interest margins determination of Japan, India and China (JIC)

Variables	VIF	1/VIF
(a). Bank-specific variables		
i. Liquidity	1.23	0.812383
ii. Profitability	2.43	0.411959
iii. Credit Risk	1.85	0.541807
iv. Size	3.87	0.258164
v. Capitalization	1.61	0.622953
vi. Business Expansion	1.55	0.64723
vii. Regulatory Response	2.47	0.404526
viii. Diversified Income	1.87	0.53409
ix. Efficiency	1.89	0.528329
(b). Industry-specific variables		
x. Hirschman-Herfindahl Index (HHI)	1.39	0.720439
(c). Macroeconomic-specific variables		
xi. Standard Deviation of Short Term Interest Rate (SDINT)	2.39	0.418817
xii. Rate of inflation	3.04	0.329416
xiii. Growth rate of GDP	2.52	0.397144
Mean VIF	2.16	

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