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Determinants of Interest Margin in Pakistan: A Panel Data Analysis

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Abstract: This paper explores the determinants of the net interest margin (NIM) using unbalanced panel data from 2003 to 2017. This paper's objective is achieved by using a two-step system generalised method of moment (GMM) for estimation. Three different models are to account for two alternative measures of market competition. The empirical results of these models indicate that operating cost, profit tax, interest rate risk, Lerner index, national savings, money supply and the T-bill rate have significant positive associations with the NIM. Meanwhile, operational size, credit risk and the inflation rate negatively affect NIM. Furthermore, operating cost, taxation and the money supply are the main factors that influence the NIM. The present analysis provides a comprehensive view of the Lerner index, which is a better measure for capturing the degree of market power than the concentration measure (HHI). Managerial efficiency and risk aversion are bank-level factors that do not significantly determine NIM. Operating costs could be decreased by adopting new banking technologies. Therefore, higher competition, lower operating costs and restricted uncertain conditions in a macro environment, particularly in the money market, could reduce the NIM.

Keywords: net interest margin; competition; operating cost; dynamic panel

JEL Classification: E43; E49; E52

1. Introduction

The most imperative factor in evaluating the efficiency and effectiveness of financial institutions is the net interest margin (NIM). A high NIM can deter investment and economic growth, while also leading to inefficiency among firms within the financial sector. Interest margins are used to measure the efficiency and performance of banks, and they act as intermediaries in the collection of savings and the advancement of loans (Hamadi and Awdeh 2012). Monopoly power can be exercised by dominant banks in the market, meaning that these banks can earn monopoly rent by setting whatever prices they like. Exercising monopoly power lowers competition, which could cause banks to become inefficient, thus creating an overall condition of welfare loss (Chortareas et al. 2012).

The efficiency of a banking system can be observed by studying the NIM (Kasman et al. 2010). The NIM is the difference between the interest income that a bank receives from advancing loans to borrowers and the income the bank earns from other assets (minus the amount paid to depositors as interest on their savings), divided by the bank's income from earning assets (Raharjo et al. 2014).

Angbazo (1997) recognised that the NIM is a crucial component of banks' profitability and earnings. High lending rates adversely impact people who wish to acquire loans to start new businesses. As a result, high lending rates deter the growth of small and medium enterprises. Another result of high lending rates is that the stock of capital is reduced, leading to a decline in general productivity. Consequently, the level of employment and investment stagnate (Kiptui 2014).

The NIM must be kept low if private investment is to increase, as there is a direct link between the demand for loans and the level of interest rates (Churchill et al. 2014). According to Azeez and Gamage (2013), the effectiveness of the banking system could be observed by examining the interest spread.

According to Hawtrey and Liang (2008), the interest margin of banks indicates efficient price signals to market players. Therefore, there is much value in studying the determinants of interest margins. The banking sector plays a vital role in the economic growth of a region because of banks' roles as intermediaries in the transfer of funds from lenders to borrowers. Banks should provide this intermediary service at the lowest possible cost to improve social welfare (Maudos and Guevara 2004). A high NIM is usually an indicator of inefficiency, which adversely affects real domestic savings and investments (Brock and Rojas-Suárez 2000).

The interest spread could be reduced through market forces by increasing competition. Diamond and Dybvig (1983) suggested that a small interest margin signifies high competition in the banking industry. The interest rate spread rises either due to reduced deposit rates (thus discouraging savings) or increased lending rates (which affects the decisions of investors). Both of these cases have created concerns about the effectiveness in the lending channel of monetary policy (Khawaja and Din 2007). Large interest margins could promote stability in the banking system. This, in turn, could increase the capital and profitability of banks and prevent macro shocks and other external shocks.

Some studies have examined the determinants of NIM in Pakistan. Khawaja and Din (2007) probed the determinants of interest rate margins, focusing on industry concentrations and the supply of interest-insensitive deposits. Khan and Khan (2010) examined the impacts of industry-specific, firm-specific and macroeconomic variables on the interest rate spread. Alam et al. (2011) took different ratios of bank size, efficiency, and liquidity and compared the private and public banks. Siddiqui (2012) conducted a similar study in Pakistan and studied the determinants of the ex post interest spread of 14 commercial banks. The most relevant finding of these studies, as they relate to the present work, is that high interest margins deteriorate the growth rate of agriculture and industrial sectors while discouraging savers from depositing their savings in banks.

The above discussion reveals that a high NIM is a distressing issue currently facing the economy of Pakistan. Thus, in this work, we investigate the impact of new bank-specific, industry-specific and macroeconomic measures. The objective of this paper is to examine the determinants of the NIMs of commercial banks by including some new factors[1]. But main contribution of this study in the literature is related to the construction of a Lerner index for Pakistan's banking sector. However, these new variables are expected to have impact on the NIM. As such, the NIM model is estimated by employing a two-step system generalised method of moment (GMM). The empirical analysis reveals that operating cost, taxation, interest rate risk in the money market and the degree of market power significantly influence the NIM in Pakistan.

The remainder of this paper is organised as follows. Section 2 describes the literature review. The theoretical model is explained in Section 3. Section 4 contains a description of the econometric technique used in the study. The empirical results and discussion are given in Section 5. Finally, Section 6 covers the overall conclusions of the study.

2. Literature Review

Interest rate volatility creates financial management problems for financial intermediaries because it alters banks' interest margins. The relationship between bank portfolio behaviour and interest volatility was first identified by Samuelson (1945), and the edging hypothesis and expected utility maximisation approaches are well-known theoretical models related to this topic.

According to the hedging hypothesis, financial intermediaries try to minimise their shareholders' risk by matching the maturity of assets to that of liabilities, which leads to a positive risk premium

[1] These factors are mentioned at end of Section 3.

Michaelsen and Goshay (1967). Expected utility maximisation models are based on microeconomic banking firms. These models assume that the objective of financial institutions is to maximise the expected utility of terminal wealth, which is directly related to the interest margin (Pyle 1971). In a study that included quarterly data from 100 major US commercial banks, Ho and Saunders (1981) extended the hedging hypothesis and expected utility maximisation models, incorporating them into the analysis of interest margins. This analysis was the first model used to determine the interest spread of banks.

Since its introduction, this analysis has been extended by many researchers, such as McShane and Sharpe (1985), who altered the source of interest rate risk by replacing the interest rates on deposits and credits with uncertainty in the money market. Additionally, Allen (1988) included different types of credits and deposits in this type of analysis. Angbazo (1997) extended the basic model by considering default (credit) risk. Saunders and Schumacher (2000) conducted a global study using Ho and Saunders's (1981) original model to examine the impacts of bank competition and interest rate volatility on interest margins in six major countries of the European Union and the US. Furthermore, Maudos and Guevara (2004) explicitly incorporated operating costs into the model.

Hawtrey and Liang (2008) studied the banking sectors of fourteen Organisation for Economic Co-operation and Development (OECD) countries using data from 1985 to 2001. Their findings indicate several factors that influence the NIM, including scale effects, credit risk, interest rate volatility, operating costs, risk aversion and market power. Moreover, Zhou and Wong (2008) considered unbalanced panel data from 81 Chinese commercial banks from 1996 to 2003. They identified several factors that significantly positively affect interest margins, including the Herfindahl index, size of operations, management risk aversion, implicit interest payments, management quality and the opportunity cost of reserves. Barajas et al. (1998) studied the determinants of interest spread of the banks in Colombia for two decades before liberalization from 1974 to 1988 and after liberalization from 1991 to 1996. They found that there was no change in the interest spread during those two decades, that market power has a negative impact on interest spreads, and that a high loan quality raises those spreads.

In addition, Liebeg and Schwaiger (2006) investigated the determinants of the NIM in Austria, while Tennant and Folawewo (2009) used panel data from 33 low- and middle-income countries in their study on various market and macroeconomic factors that affect interest rate spreads. Valverde and Fernández (2007) examined the impact of market power on interest margins in Europe. Meanwhile, Kasman et al. (2010) examined the influence of consolidation on the determinants of the NIM. Their research took place after financial reforms in the banking systems of new member countries from Central and Eastern Europe. Fungáčová and Poghosyan (2011) investigated the effect on ownership structure on NIM in Russia.

Similar studies have been conducted elsewhere in the world. For instance, Ugur and Erkus (2010) studied the Turkish banking sector. Gounder and Sharma (2012) studied the determinants of the NIM in Fiji. Chortareas et al. (2012) used the dynamic panel data approach to investigate the determinants of the NIM in the Latin American banking industry while focusing on the roles of structural and non-structural competition. Hamadi and Awdeh (2012) took panel data from 53 ban

ks and studied the determinants of the NIM within the Lebanese banking sector. Azeez and Gamage (2013) examined the determinants of the NIM among Sri Lankan banks. Dumičić and Rizdak (2013) examined 152 banks in Central and Eastern Europe. Kiptui (2014) and Were and Wambua (2014) studied Kenya's banking industry and empirically tested the driving factors of interest spreads. Meanwhile, Raharjo et al. (2014) investigated the internal and external determinants of Indonesian banks' interest margins. Bektas (2014) used two new measures of interest spread in addition to previously established factors in a panel analysis in North Cyprus. Finally, Nasserinia et al. (2014) used the NIM as a proxy for performance and identified associations between certain bank-specific factors and the performance of the banking sector in Japan. Helhel (2015) studied the influence of bank and macroeconomic factors on the profitability of the banks in Georgia.

Islam and Nishiyama (2016) investigated the determinants of the NIM in four South Asian countries by employing the panel data of 230 banks for the period of 1997 to 2012. They found that bank level factors positively affect the NIM, while growth and market power reduce the NIM. Hijazeen (2017) examined the impact bank level and macroeconomic factors on NIM by taking the panel data from 13 commercial banks of Jordan. Agoraki and Kouretas (2019) took the data from 1998 to 2007, and studied the determinants of NIM for the banking industry of South Eastern European countries. Mesfin and Ram (2019) also investigated the determinants of the NIM by using the panel data from 13 banks in Ethiopia during 2010 and 2017. Angori et al. (2019) studied the effect of factors before and post crises in the Eurozone during 2008 and 2014. Diko (2019) studied the Turkish banking sector and took panel data from 23 banks from 2003 and 2015. The results indicate that bank level factors determine the NIM, particularly after the financial crisis in 2009 showed a decline in the NIM.

3. Theoretical Model

In this paper, we use the extended original dealership model developed by Ho and Saunders (1981). This model has been extended by many researchers, such as McShane and Sharpe (1985), Allen (1988), Angbazo (1997) and Maudos and Guevara (2004). In this model, the bank is considered as a risk-averse intermediator in the credit market. It sets the rates for deposits and loans in order to maintain a balance of asymmetric arrivals of deposits in banks and demand for loans. Deposit and lending rates are determined at the beginning of the decision period, and these rates are kept constant throughout this period. The bank must disentangle its operations in the money market to tolerate short-term interest risks by considering the asymmetry between the arrival of deposits and the demand for credit.

During this process, the bank faces several risks. It is assumed that a bank invests funds temporarily in the money market at a given interest rate. If the interest rate falls in the money market, then the bank faces reinvestment risk because deposits are made at the bank before the demand for loans has increased correspondingly. Similarly, when new demands for loans arrive before adequate deposits have been made, the bank is forced to borrow the required amount from the money market. If the interest rate in the money market subsequently rises, the bank then faces refinancing risk at the end of the decision period. In addition, the returns on loans and the amount of money lent are not always repaid, representing another credit risk faced by banks.

Based on the above discussion, the deposit rate on deposits and loan rates on advances are considered as float values[2]:

$$r_D = r - a \tag{1a}$$

$$r_L = r + b. \tag{1b}$$

Here, r is the risk-free interest rate in the money market, a and b are interest margins on deposits and loans, and are associated with risk-free interest, so r_D and r_L are the deposit rate and loan rate. The sum of these two floating values is the profit of the bank, rearranging (1a) and (1b);

$$S = r_l - r_d = a + b. \tag{2}$$

The original model of Ho and Saunders (1981) has been extended by Maudos and Guevara (2004) to include operating cost and risk premiums. The objective of the bank is to maximise the expected utility of its final wealth. The initial wealth of a bank is the difference between its total assets and

[2] Basically, the float values "a" and "b" are the interest rate on deposit and loan rate on advances subject to risk free interest rate in the money market, which is the benchmark rate for a bank here. The sum of the float values is the profit of the bank, which is indicated by Equation (2). Here, the objective of a bank is profit maximisation. Therefore, after maximising the objective function of the bank, Equation (7) reveals the profit of the bank. As S = a + b is the profit of the bank, which is equal to the net interest margin (NIM) in our study. Therefore, we did not include float values directly in econometric modelling.

total liabilities. Assets consist of loans (L) and the bank's position in the money market (M). Liabilities comprise of deposits.

$$W_o = L_o - D_o + M_o \tag{3a}$$

$$W_o = I_o + M_o \tag{3b}$$

Let $I_o = L_o - D_o$, which is the net credit amount. The following equation determines the final wealth of a bank:

$$W_T = I_o(1 + r_I + Z_I) + (1 + r + Z_M)M_o - C(I_O) \tag{4a}$$

$$= I_O + r_I I_O + Z_I I_O + M_O + rM_0 + Z_M M_O - C(I_O) \tag{4b}$$

$$W_T = (1 + r_w)w_o + Z_I I_O + Z_M M_O - C(I_O). \tag{4c}$$

In the above equation: r_I is the return that a bank expects to receive on the net amount of the loan I_O; $r_w = r_I\left(\frac{I_0}{w_0}\right) + r\left(\frac{M_0}{W_0}\right)$ is the average return on the bank's initial wealth; $C(I_O)$ is the operating expenses of the bank, which are associated with loans and deposits; $Z_I = Z_L(L_0/I_0)$ + (D_0/I_0) is the average risk of the net amount of loans; Z_L is the credit risk of the bank if D = 0; and Z_M measures the interest risk, which arises due to interest rate volatility in the money market. The distribution of Z_M and Z_L forms a normal distribution. That is, $Z_M \backsim N\left(0,\ \delta_M^2\right)$ and $Z_L \backsim N\left(0,\ \delta_M^2\right)$. Finally, δ_{LM} measures the covariance between L and M.

Using Taylor's expansion expression, the expected utility of terminal wealth EU(W) around the value of expected wealth $\overline{W}$ is determined as follows:

$$EU(W) = U\left(\overline{W}\right) + U'\left(\overline{W}\right)E\left(W - \overline{W}\right) + \frac{1}{2}U''\left(\overline{W}\right)E\left(W - \overline{W}\right)^2. \tag{5}$$

Here, $U' > 0$ and $U'' < 0$, which represents the assumption of risk aversion. In addition, we assume that the supply of deposits and the demand for loans tare random and adhere to the Poisson process. The probabilities P_D and P_L (which are the probabilities of the supply of deposits and demand for loans, respectively) are linear functions of the interest spread.

$$p_D = \alpha_D - \beta_D a \tag{6a}$$

$$p_L = \alpha_L - \beta_L b \tag{6b}$$

Here, both α and β are parameters that take the first order condition to maximise the expected utility of terminal wealth and to determine the optimal values of a and b. Finally, the following equation determines the optimal interest margin:

$$S = a + b = \tfrac{1}{2}\left(\tfrac{\alpha_D}{\beta_D} + \tfrac{\alpha_L}{\beta_L}\right) + \tfrac{1}{2}\left(\tfrac{C(L)}{L} + \tfrac{C(D)}{D}\right) - \tfrac{1}{4}\tfrac{U''\left(\overline{W}\right)}{U'\left(\overline{W}\right)}\left[(L + 2L_o)\delta_l^2 + (L + D)\delta_M^2 + 2(M_o - L)\delta_{lM}\right] \tag{7}$$

The following factors are related to the interest margin in this model. The ratio of α/β represents the competitive structure of the market and the possibility that a bank will attain a monopoly profit. The average operating cost requires a high margin, as indicated by the second term in the equation. The coefficient of absolute risk aversion is denoted by the term $-U''\left(\overline{W}\right)/U'\left(\overline{W}\right)$. The interest rate risk in the money market is measured as δ_m^2. The association between credit risk δ_l^2 and the uncertainty of loan returns is determined based on debtor default. The term δ_{lM} measures the degree of covariance between credit risk and interest rate risk. The size of the operation is reflected by the sum of loans and deposits (L + D) and the total volume of loans $(L + 2L_o)$.

The interest margin (S), which is derived from the theoretical model, could be considered as a 'pure' margin. Obviously, in practice, additional variables influence interest margins, specific aspects of institutions, regulatory policies, the macroeconomic environment, etc. Therefore, these factors could distort the pure margin and are difficult to incorporate into a theoretical model. Some of these

additional variables have been mentioned in the literature (e.g., national savings, managerial efficiency, the exchange rate, the T-bill rate and money growth).

4. Methodology and Data

In this paper, we use unbalanced quarterly panel data from forty six (46) commercial banks spinning from 2003Q2 to 2017Q1. The data for commercial banks is collected from the quarterly financial reports of each bank[3]. The data for other macroeconomic variables is obtained from State Bank of Pakistan website[4]. The construction of variables, and each variable mean and standard deviation are shown in the Table 1. The market structure, which is based on a theoretical model, can be captured by two alternative approaches. These are the Lerner index (LI) and Hirfindahl Hirschman index (HHI). We use STATA 14.2 software for estimation of the model.

Table 1. Construction of variables.

Dependent Variable	Description	Expected Sign	Mean	S.D
Net Interest margin	Interest earned minus interest payments divided by total assets		0.021	0.014
Independent Variables				
Operating Cost	The ratio of non-interest expenses to total assets	+	0.018	0.013
Risk Aversion	The ratio of capital to total assets	+ or −	0.155	0.288
Credit Risk	Non-performing loans divided by total loans	+	0.125	0.442
Operational Size	The logarithm of bank's total assets	−	0.775	3.983
Interest Rate Risk	The difference between the interbank rate and T-bill rate	+	0.512	0.589
Managerial Efficiency	The ratio of operating expenses to gross income	−	0.101	2.543
Herfindahl Hirschman Index	The sum of squares of market shares of each bank within the banking industry	+	0.085	0.017
Lerner Index	the difference between price and marginal cost divided by price	+	0.251	0.342
Taxation	tax rate on the profit of a bank	+	0.056	0.105
Inflation	Percentage change in CPI	+	0.022	0.018
Monet supply	Growth rate of M2	+	0.034	0.027
National Saving	Growth rate of national saving	+	0.046	0.108
Treasury Bill Rate	6 months Treasury bill rate	+	9.145	3.279

Econometric Specification and Estimation Strategy

For the empirical estimation of Equation (7) of a theoretical model for the banking sector of Pakistan, we needed to determine the model variables. The description of empirical proxy for each of these theoretical model variables, and other variables are given in Table 1. The table also shows the values of average and standard deviation of the variables.

[3] For example data for the MCB bank is obtained from https://www.mcb.com.pk/investor-relations/interim-reports. The data for other banks is obtained in the same way.

[4] http://www.sbp.org.pk/ecodata/index2.asp.

Therefore, we can write the theoretical model variables in Equation (7) along with other variables in an econometric model, so the following econometric model uses it to determine the determinants of the NIM:

$$NIM_{i,t} = \delta_0 + \delta_1 OPC_{i,t} + \delta_2 RA_{i,t} + \delta_3 CR_{i,t} + \delta_4 OS_{i,t} + \delta_5 IRR_{i,t} + \delta_6 ME_{i,t} + \delta_7 HHI_t + \delta_8 LI_{it} + \delta_9 TX_{it} + \delta_{10} INF_t + \delta_{11} GRM2_t + \delta_{13} NS_t + \delta_{14} TBR_t + \varepsilon_{i,t} \quad (8)$$

where i stands for bank and t stands for time. The NIM is net interest margin of a bank, which is the interest margin (S) in (7). OPC is operating cost of a bank. RA is risk aversion of a bank. CR is the credit risk of a bank. OS is operational size of a bank. IRR is interest rate risk of a bank. HHI is the Herfindahl Index at time t. LI is the Lerner index of bank i at time t. All of these are theoretical model variables in Equation (7). The following are other control variable beside theoretical model variables. ME is the managerial efficiency of a bank. TX is taxation. INF is the inflation rate. GRM2 is money supply. NS is national saving. TBR is the T-bill rate, and ε denotes the error term.

The panel data contains time series and cross sectional data. However, using panel data can have important econometric problems. Particularly, in a dynamic panel model, the lag of the dependent variable is included as an independent variable to capture the effects of inertia. Including the lag of the dependent variable makes the OLS estimator biased and inconsistent, but the estimator of the fixed effect would be biased, while its consistency depends on T (Nickell 1981). Anderson and Hsiao (1981) suggested an instrumental variable (IV) method for estimation of the dynamic panel data model. The estimates of this method are consistent, but it is not necessary to be efficient because it does not use all moment conditions (Ahn and Schmidt 1995).

However, Arellano and Bond (1991) proposed a generalized method of moment (GMM) for dynamic panel model estimation, so the results produced by GMM are more efficient than the ones produced by the instrumental variable method. They also recommended the Sargent test for over identification restrictions. Further, this literature was extended by Arellano and Bover (1995), and Blundell and Bond (1998). Therefore, we use a two-step system GMM for estimation of Equation (8) in our analysis, as suggested by Blundell and Bond (1998). We consider operating cost and inflation as being endogenous, and use money supply and the T-bill rate as instrument variables in our model. Both money supply and the T-bill rate are exogenous variables. As money supply rises in the economy, it is likely to raise the price level, and the opposite is true if money supply falls. Wages also go up due to higher prices. Further, wages also have an influence on the NIM. Similarly, the T-bill rate rivals the inflation rate; when there is a higher price level, most investors sell T-bills because of their low net return in real terms.

5. Results and Discussion

We use two alternative measures of market competition in our analysis: the Herfindahl-Hirschman Index (HHI) and the Lerner index (LI). Both of these are assumed to have a positive association with the NIM. The fixed effect and two-step system GMM technique are used to estimate Equation (8). Table 2 outlines the impact of explanatory variables on NIM. We have estimated four different models. The second model includes both the HHI and Lerner index (LI). The third model only involves the HHI, and the third model only uses the Lerner index. The main reason for estimating three different models is the negative sign of HHI in the second model; thus, we estimate the third model to improve the robustness of our findings. Total assets are used in the construction of both variables, and this could be why HHI is shown as having a negative impact on the NIM.

Table 2. Dynamic panel-data model estimation, fixed effect and two-step system GMM.

	(1)	(2)	(3)	(4)
VARIABLES	**Fixed Effect**	**Two Step System GMM**		
		NIM	**NIM**	**NIM**
Lagged of the NIM	0.1151 ***	0.2557 ***	0.2894 ***	0.2573 ***
	(0.0169)	(0.0470)	(0.035 2)	(0.0489)
Operating Cost	0.7725 ***	0.6145 ***	0.6370 ***	0.5829 ***
	(0.0168)	(0.0400)	(0.0387)	(0.0570)
Risk Aversion	0.0004	0.0040	0.0060 **	0.0020
	(0.0007)	(0.0026)	(0.0026)	(0.0026)
Credit Risk	0.0001	−0.0080 *	−0.0103 ***	−0.0109 ***
	(0.0005)	(0.0041)	(0.0039)	(0.0032)
Operational Size	0.0000	−0.0025 ***	−0.0021 ***	−0.0021 ***
	(0.0000)	(0.0007)	(0.0005)	(0.0007)
Interest Rate Risk	0.0005	0.0011 **	0.0006	0.0007 *
	(0.0004)	(0.0004)	(0.0005)	(0.0003)
Managerial Efficiency	0.0000	−0.0003	−0.0002	−0.0004
	(0.0000)	(0.0004)	(0.007)	(0.0007)
Taxation	0.0212 ***	0.0515 ***	0.0510 ***	0.0527 ***
	(0.0029)	(0.0104)	(0.0075)	(0.0074)
Hirfendahl-Index	−0.1033 ***	−0.0992 ***	−0.0593 ***	
	(0.0200)	(0.0332)	(0.0217)	
Lerner Index	0.0181 ***	0.0058 **		0.0069 **
	(0.0012)	(0.0029)		(0.0031)
Inflation Rate	0.0022	−0.0564 ***	−0.0443 ***	−0.0635 ***
	(0.0137)	(0.0119)	(0.0142)	(0.0140)
Money Supply	0.0413 ***	0.1244 ***	0.1284 ***	0.1415 ***
	(0.0073)	(0.0178)	(0.0192)	(0.0179)
National Saving	0.0041 **	0.0219 ***	0.0204 **	0.0177 ***
	(0.0020)	(0.0046)	(0.0087)	(0.0051)
T-bill rate	0.0582 ***	0.0734 ***	0.0692 ***	0.1094 ***
	(0.0090)	(0.0134)	(0.0122)	(0.0176)
Constant	0.0008	−0.0011	−0.0045	−0.0117 ***
	(0.0022)	(0.0045)	(0.0036)	(0.0031)
	Diagnostic Test			
Observations		1780	1781	1780
Number of banks	1872	46	46	46
AR (2)	46	0.89	0.130	0.093
Sargan test		0.279	0.430	0.273

Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Both the serial correlation test and the Sargan test support the non-rejection of the null hypothesis, i.e., no second serial correlation, and instruments are valid. The stars over coefficient of the variables represent the degree significance[5]. The results indicate that operating cost is the most important factor from which the NIM in the banking industry of Pakistan is derived. Operating cost has a significant positive impact on the NIM in all three models, implying that banks charge high interest rates to cover high operating costs.

This finding is similar to the results presented in studies conducted by Brock and Rojas-Suárez (2000) in Latin America; Maudos and Guevara (2004) in the UK, Germany, France, Spain, and Italy; and Angbazo (1997) in the United States. Credit risk is significant in all of the models except for model one. However, it has a negative effect on the NIM, which is opposite to the expected sign and that in

[5] As s *, s **, and s ***, denote 10 percent, 5 percent and 1 percent level of significance, respectively.

the literature. The main reasons for this may be a lack of monitoring of loans, and underwriting of advances in a hurry to get greater market share.

The capital-to-total-assets ratio is used for risk aversion. This ratio is statistically significant at the 5 percent level third model. Moreover, it has a positive effect on the NIM. It also shows a premium interest margin to the bank because solvency regulations put market pressure on the lending activities of banks. This outcome supports the findings of Carbo-Valverde and Udell (2009), who investigated the European banking sector.

Furthermore, the size of a bank influences the economies and diseconomies of scale. Large banks offer a wider variety of loans than small banks, which helps to reduce the risk of large banks. Large banks take advantage of economies of scale by reducing their NIM, as doing so improves their performance and reduces risk. This result is in line with the findings of Nasserinia et al. (2014) for German banks and Horváth (2009) for the Czech banking sector.

The difference between the Karachi Inter Bank Offer Rate (KIBOR) and the T-bill rate is used as a proxy for interest rate risk in the money market of Pakistan. In second and fourth models, the interest rate risk has a significant positive influence on NIM. This shows that the interest margin is sensitive to volatility. Interest rate volatility creates an uncertain environment in the money market, which, in turn, causes banks to raise their NIMs.

Additionally, banks are risk-averse intermediaries, and so the mismatch between the maturity of assets and liabilities—which is due to interest rate volatility—might lead to an increase in the NIM. This result is consistent with the findings of Hawtrey and Liang (2008) for OECD countries, Carbo-Valverde and Udell (2009) for the European banking sector, and Saunders and Schumacher (2000) for European countries and the United States.

The ratio of operating expenses to gross income is used as a proxy for managerial efficiency. Nevertheless, it has no role in determining the NIM. This could be why management quality does not have a strong influence on the rates offered on deposits and loans (Islam and Nishiyama 2016).

Furthermore, the ratio of tax amount to profit—which is used as a proxy for taxation—has a significant positive impact on the NIM. Corporate income taxes are levied by the government on the profits of firms or companies. Banks are directly taxed via corporate income tax and other taxes. Corporate income taxes are imposed on the pure profit of a bank. However, banks place some of the burden of this tax on their customers. This result is consistent with the findings of an international study conducted by Demirgüç-Kunt and Huizinga (1999) that encompassed 80 countries, as well as the study by Gelos (2009) carried out in Latin America.

HHI is a standard measure used to capture market concentration. HHI has a negative sign and is statistically significant at the 1 percent level in the second and third models. The negative sign might be linked to the concentration and the NIM that arise due to fierce competition. This is consistent with the results of studies conducted by Dietrich and Wanzenried (2011). This result supports the finding of a study carried out by Khawaja and Khawaja and Din (2007) that focused on Pakistan's banking sector. However, it opposes the findings of Khan and Khan (2010).

LI measures the market power of each bank in the industry[6]. LI has a significant positive effect on NIM in the first and the third model. This result implies that a bank can use monopoly power to charge high lending rates on loans and low deposit rates on deposits (Kasman et al. 2010). The significantly positive relationship between LI and NIM reflects the fact that banks with high market power charge high NIMs, as also indicated by Maudos and Solís (2009) and Sidabalok (2011).

Inflation rate is significantly and negatively related to the NIM. A negative sign implies that an unexpected rise in inflation makes banks slow to adjust their interest rates. As a result, banks' costs could exceed their revenue, which leads to a reduced NIM. Inflation can indirectly affect the cost of determination because, during the rise of the general price level, there is an incentive to save

[6] The formula of LI and its procedure of calculation is in Appendix A.

money, which reduces the demand for credit. Therefore, to boost the demand for credit, banks reduce their lending rates, which, in turn, reduces their profitability (Naceur and Kandil 2009). This finding is consistent with the results obtained by Amuakwa-Mensah and Marbuah (2015) in the Ghanaian banking sector.

Monetary authorities sometimes change the money supply, as it affects banks' intermediation activities. An increase in the money supply leads to more availability of cash with banks, so they raise lending, and consequently, the profitability of banks. This relationship was also found by Obeidat et al. (2013) in Jordan and Crowley (2007) in English-speaking African countries.

The growth rate of deposits is used as a proxy for the national saving rate. This variable positively affects the NIM. This result suggests that an increase in national savings is likely to encourage people to deposit their money in banks, meaning that banks can pay lower deposit rates to depositors in relatively unconcentrated markets. This finding is consistent with the results of Hamadi and Awdeh (2012) in the Lebanese banking sector.

Finally, the T-bill rate is an indicator of the policy rate imposed by the government. It is also a benchmark for commercial banks' lending rates. The T-bill rate has a statistically significant positive effect on NIM in all models in the current study, which corroborates the findings of Folawewo and Tennant (2008) in sub-Saharan countries, Tennant and Folawewo (2009) in middle- and low-income countries, and Sheriff and Amoako (2014) in Ghana's banking sector.

6. Conclusions and Policy Recommendations

The aim of this work was to investigate the determinants of NIM for the Pakistani banking sector by using quarterly unbalanced time panel data from 2003 to 2017. This followed the theoretical extended model of Ho and Saunders (1981). The main contribution of this paper is the construction and estimation of the Lerner index for the Pakistani banking sector. The practical contribution of this research work is that it provides guidance to monetary authorities when changing their monetary policy stance. Moreover, it reveals the existing condition of competition among the banks.

We used the two-step system GMM procedure proposed by Blundell and Bond (1998) and a fixed effect for the estimation of NIM model. The second model is estimated by using HHI and LI, along with other explanatory variables. HHI and LI were used independently for third and fourth models, respectively.

The estimated results of the second model show that the lag of the dependent variable (NIM), operating cost, Lerner index, national savings, money supply and T-bill rate are positively related to NIM. Meanwhile, the operational size, HHI, credit risk and inflation rate negatively impact the NIM. Managerial efficiency and risk aversion do not have a significant effect on the NIM in Pakistan's banking sector.

The empirical findings of the third model illustrate that interest rate risk and managerial efficiency do not impact the NIM. Meanwhile, operating cost, risk aversion, national saving rate, money supply and T-bill rate were identified as being positively and significantly associated with the NIM. Moreover, operational size, inflation rate and credit risk appeared to reduce the NIM.

The results of the fourth model indicate that operating cost, Lerner index, national saving rate, money supply, interest rate risk and the T-bill rate have a positive influence on the NIM, while inflation rate, credit risk and operational size seemed to reduce the NIM. Managerial efficiency and risk aversion did not appear to significantly explain interest margins across banks.

Interestingly, the Lerner index is the most influential factor in all models. Therefore, we can say that the Lerner index is an appropriate measure that captures the degree of competition in Pakistan's banking sector.

In light of this analysis, it is suggested that operating costs must be reduced by adopting efficient banking technologies and improving managerial practices. It implies that the commercial banks should initiate online banking services; this permits costumers to manage their accounts by transfer funds, checking accounts, manage investment and repayments of loans at their home. The banks should

install automated transaction machines (ATM), which have deposit facilities too. In addition, the management should focus on e filing services; all these will help in reducing the strength of staffs in the banks, which in turn affect operating costs.

Although competition has increased in the banking industry, there is still a need for proper measures to be taken to enhance the level of effective competition. Effective competition could be increased by relaxing restrictions on entering and leaving the banking industry. Allowing foreign banks to enter Pakistan's banking sector would also support this goal. Finally, banks should adopt strategic policy measures to minimise interest rate risk, profit taxes and inflation. Hence, it is vital to stabilise the macro environment in which banks operate.

The researchers can study the determinants of the NIM according to ownership of the banks, and compare the determinants of the NIM and interest rate spreads in the future.

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Appendix A

Lerner Index.

Lerner index (LI) is alternative measure of competition because it direct measures of the degree of competition in the market It is algebraically expressed as;

$$LI_i = \frac{P_i - MC_i}{P_i}$$

where price (P) usually approximates by TR/TA which sets a bank i for its product, TA is total assets, TR is total revenue, and MC_i is the marginal cost of extra unit of output. The translogarithmic cost function is used to estimate the value of marginal cost.

$$lnTC_i = \delta_0 + \delta_1(lnTA_i) + 0.5\delta_K(TA_i)^2 + \sum_{j=1}^{3} \alpha_j lnw_{ji} + \sum_{j}^{3}\sum_{k=1}^{3} lnw_{ji}lnw_{ki} + \sum_{j}^{3} \beta_j lnTA_i w_{ij}$$

where TC_i is the total cost of the bank, it is the sum of financial cost and operating cost. The w_i represents cost of the factors of production, as w_1 is the price of labor which equals the personal cost to total assets, w_2 is the price of physical capital and equals operating expenses (except personal costs) to fixed assets, and w_3 is the deposits' price, it is equal to financial cost to deposits. The simultaneous equations methodology has used to estimate it.

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