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# Examining the Relationship Between Banking Competition and Solvency, Liquidity and Credit Risks in Pakistan

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**ABSTRACT**

*This study empirically examines the relationship between the banking competition and the risks faced by the financial sector (i.e. solvency, liquidity, and credit risks) considering 31 banks for the period 2001 to 2018. Banks are further sub-divided into three categories i.e. state-owned banks, foreign banks, and private/commercial banks. The results reveal that Pakistan's banking industry is relatively elastic and an increase in competition is directly associated with solvency risk, liquidity risk and credit risk of financial institutions and these findings corroborate the competition fragility theory. Besides, state-owned banks have a lesser probability to cope with solvency risk, however, foreign banks appear to face the least liquidity risk whereas private banks appear to face the least credit risk among the entire cluster.*

**Keywords**
Banking Competition, Market Power, Solvency Risk, Liquidity Risk, Credit Risk, Pakistan.

**JEL Classification**
G21, G28, K22, L11

## 1. Introduction

The financial sector acts as a backbone of the economy that controls the money supply and plays a pivotal role in the financial development and economic growth of an economy. Banks usually take funds from surplus monetary assets and lends as advances. Industrial, agricultural and economic development would not be possible without an efficient banking system (Babar, 2011). Banking Ordinance (1962) of Pakistan defines banking as "accepting for lending or investment of deposits of money from the public, repayable on demand or otherwise and withdrawal by cheque, draft, order or otherwise".

In this competitive world, the banking industry faces various risks either external or internal and it becomes difficult for the banks to compete within and outside the system (Beck et al., 2013). External risks arise due to difficulty in making enough returns on investments/equity, regulatory pressures issued from the central authorities, and failure in delivering the services that customers demanded like the use of advanced technologies. However, the increasing popularity of financial technology (Fintech) companies who



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provide financial services to customers like the banking system but are not banks further poses a threat to the banking industry. Internal risks come in the form of competition within the banking system because they have to compete with each other to earn higher profits (Thorsten et al., 2012). To increase profit, banks usually take some risk-taking initiatives which could have a severe impact within the banking industry and in the overall economy (Zuzana et al., 2013). To address this issue, several questions arise like how does the banking competition affect the risks faced by the banks? (Jimenez et al., 2008). How the policy-makers aim at an increase in competition among banks; affecting their risk-taking initiatives at an individual level and at system; as a whole? Riaz (2009) argue the relationship between competition and stability in the context of market concentration, Zuzana et al. (2015) analyze in the context of their impact on lending channels, and Schaeck et al. (2006) examine that up to what level of competition is good for the economy under given circumstances.

To protect this global issue, an international agreement was signed in December 1987 between central banking authorities (i.e. Basal Accord). This agreement contains two important clauses – a minimum risk asset ratio requirement and a minimum leverage requirement. The minimum risk asset ratio requirement suggests a set of procedures for deciding how much capital a bank should have to support its risk-weighted assets, off-balance sheet assets, straight lending, and bank's domestic and offshores assets and operations. A minimum leverage ratio requirement is based on the bank's capital that cannot be less than a certain proportion of total liabilities. To address the aforesaid ratios, capital adequacy sub-divided into credit risk, operational risk, market risk, liquidity risk, and legal risk. The rules and regulations to determine these risks have been set out under the Basal Accord. Thus, central banks through their policies enforce the BIS implementations and ensure that the commercial banks abide by those set of procedures[1].

Among these risks, solvency, liquidity, and credit risks are of prime concern for the banking industry and such risks are inter-related. Therefore, this study aims to determine the competitiveness of the banking industry in Pakistan by analyzing the relationship between competition and the risks faced by the financial institutions using the sample of 31 banks in Pakistan during the period lasting from 2001 to 2018.

## 2. A review of the earlier studies

### 2.1 Banking competition

The relationship between banking competition and financial sector stability has been widely argued in theoretical and empirical literature with contradictory views that are, competition fragility theory and competition stability theory (Berger et al., 2006).

[1] Solvency: Models, Assessment and Regulation (2005) by Stanstrom (First edition) and A Comparative Assessment of Basel II/III and Solvency II (2012) by Gatzert & Wesker.

Competition fragility theory is based on the Charter value hypothesis (Keeley, 1990) which debated that an increase in banking competition leads to a decrease in lending rates and an increase in deposits rates that cause the bank's profit margin to decrease which eventually decreases bank's franchise value. This enforces that banks to take risk-taking initiatives, causing instability of the individual institution and the economy as a whole. On the other hand, the competition stability approach (Klaus et al., 2006) predicts that an increase in banking competition results in a decrease in interest rates which implies better credit options for borrowers. This provides the ease to repay their debt obligation which reduces the risk of the overall loan portfolio and thereby improving the financial sector stability of the individual institution and the economy as a whole (Elmas, 2010). Ijaz et al., (2020) studied 38 European countries for 2001 to 2017 and concluded that banking competition in terms of Boone Indicator supports economic growth and increases overall financial stability. Juan et al., (2020) explored the Baltic countries over the period 2001 to 2014 and found inverse U-shaped relationship between competition in terms of Lerner Index and financial stability in terms of Z-Score.

Riaz (2009) measures the association between banking competition and financial sector stability of the banking industry in Pakistan using a non-structural approach and reported that the banking sector of Pakistan as a whole is consistent with a monopolistic competitive market structure. In a recent study, Tahir et al. (2016) employed Panzer and Rose methodology and found that the banking industry of Pakistan is operating under the characteristics of monopolistic competition. Also, he confirmed that massive deregulations and financial liberalization contributed positively to improving the competition condition of Pakistan's banking sector. Subsequently, Mehmood et al. (2017) analyzes the banking industry using Boone indicators and found that the banking industry of Pakistan is more competitive. However, inefficient banks are impairing their market shares to efficient banks. In another study, Faisal (2016) use Panzer and Rose methodology and suggested that liberalization and deregulation of Pakistan's banking industry is successful in providing a competitive environment.

### 2.2 Solvency Risk

Almarzoqi et al. (2015) report an inverse relationship between profitability and competition. This suggests that an increase in market competition leads to a decrease in bank lending rates, which eventually affects the profitability of banks. This also implies that banks having large market power are more profitable. If profitability is considered only as a key determinant of competition, then competition may hurt profitability and so may reduce solvency. Allan et al. (2011) decompose the relationship between competition and capital stock into two parts: (a) micro-prudential structure envisages a minimum capital requirement for unexpected losses, thus, treating the capital stock as exogenous. In this case,

market competition does not affect the capital stock of a given bank. Whereas, (b) some banks' despite minimum capital requirement hold more than the regulatory requirements. Considering this argument, it is conferred that price competition may affect the capital stock of a bank (increase in market competition reduces the bank profitability and retained earnings which may induce credit institutions to set high targets for capital ratios and to ensure accessibility of capital in bank's distress. Thus, if the bank is raising capital in the short run, an increase in competition may imply more capital stock. In this case, competition has two counteracting effects on the bank's solvency; reduction in profit margins and an increase in the bank's capital. Hence, the overall result depends on which factor dominates the other, that is, if a fall in bank's profit is small than the rise in bank's capital, the overall impact of increasing competition is positive and vice versa.

Selvi et al. (2009) argues that the debate of a positive or negative relationship depends upon the construction of variables chosen for competition and solvency. Each variable is equally important but has its pros and cons. Kashif et al. (2016) examined that increase in loan growth along with competition was the result of insolvency for Pakistani banks due to weak prudential regulation among competitors, asymmetric information of the borrowers, and underestimation of the risk of lending during credit booms.

### 2.3 Liquidity risk

Liquidity risk refers that a bank may not fulfill its short-term debt obligations, either due to the non-accumulation of enough funds or securities or investments that cannot be converted into cash to obtain good market price. Marcus et al. (2008) divide liquidity risk into the funding liquidity and market liquidity and established a link with margin requirement. If margin requirements are higher, funding liquidity will also be higher than market liquidity and vice versa. Dian & Moshe (2014) analyzed a bank's decision to borrow in interbank markets or sell assets and reported that banks prefer to borrow rather than selling assets because of lower chances of adverse selection on the overall portfolio than on some of its assets. On the market liquidity front, it is emphasized that higher liquid assets have low returns and illiquid assets have a higher return. As banks with low market power, which is high competition, may invest in highly liquid assets to increase the availability of funds in terms of their short-term borrowings and to forgo return benefits that investing in illiquid assets and vice versa. Banks diversified their portfolio by investing in both local and foreign securities to get the advantage from the market (Lapteacru, 2014).

Ahsen (2012) examined the market liquidity risk of Pakistani banks during the period between 2004 and 2009 and found that liquidity risk significantly affects banking profitability whereas liquidity gap and NPLs are exacerbating liquidity problems. Farhan & Amir (2013) analyzed the liquidity position and identified that the liquidity of Pakistani banks is positively associated with the policy rate and negatively related to inflation.

### 2.4 Credit risk

Beck et al. (2006) argued that surge in market competition causes a reduction in lending rates which distress the credit risk of the overall loan portfolio in two different perspectives: (a) decrease in lending rates enables the borrowers to fulfill their obligation which reduces the probability of default and increase the profitability thereby reducing the risk of the overall loan portfolio, and (b) decrease in lending rates reduces profitability from the provision of credit. This reduces franchise value and induces managers to take risk-taking initiatives by allowing credit to riskier borrowers, thus increases the average credit risk of the loan portfolio. Emiliano et al. (2000) suggested that credit risk management and measurement is one of the areas where the difference between theory and practice is wider. According to Emiliano, banks have diversified loan portfolios comprising different sectors of the economy, and fluctuations in one sector may affect the further availability of loans of a particular industry of the other sector.

Cheron (2013) reported that interest rate, net income, tax, inflation, and discount rate increase the NPL ratio in Pakistani banks. Usman (2014) studied the relationship between loan growth and risk-taking behavior during the expansionary periods and identified that loan growth significantly affects NPLs and decrease the solvency of banks with a time lag of many years. Besides, he reported that weak prudential regulation, the asymmetric information of the borrowers, and underestimation of lending risks in boom phases leads to higher NPLs. Kashif et al. (2016) argued that an increase in loan growth correspondingly increases non-performing loans and increasing solvency risks for Pakistani banks due to their weak prudential regulation.

## 3. Banking Competition in Pakistan

Prior studies indicate that the Pakistan Banking Industry operates under a less competitive environment (Riaz, 2009; Ayesha, 2012). Since the last decade, there had been a decrease in corporate tax from 58% to 35% which enabled the banks with more market share to generate more revenue and this helped them to expand their scope of business and stability (Bilal et al., 2011). The banking sector is one of the most important sectors of the economy not only in terms of employment opportunity but also in terms of its operations. Since the 1980s, an increase in banking competition and an increase in nonperforming loans induces risks in the banking industry in Pakistan. In Pakistan, there is no significant research carried out by using the Lerner Index to assess the competition and relationship between competition and financial sector stability. Furthermore, there is no significant research that decomposed the Pakistani banking industry into state-owned banks, private banks, and foreign banks for research analysis. Some Scholars like Alam et al. (2011) compared the financial performance of public and private banks. Babar et al (2016) used the CAMEL approach to evaluate the performance and stability of commercial banks in Pakistan. Usman (2014) made a comparison of Islamic and non-Islamic banks in terms of stability. Riaz (2009) uses the Hershman Herfindahl Index (HHI) to determine the stability of Pakistan's banking industry.

# 4. Data and methodology

## 4.1 Data

We take the entire baking sector as a population, which includes state-owned, private, and foreign banks. To maintain symmetry and harmony among banking operations and comparability, Islamic banks, agricultural banks, micro-finance banks, and other lending institutions are not considered in this study. The list of banks along with their date of establishment in terms of business operation is presented in Appendix I. To circumvent the problem of heterogeneity and autocorrelation, panel FGLS technique is employed to estimate our findings. This study employs 31 banks operating in Pakistan and the data is gathered from their financial statements during the period from 2001 to 2018. Banks are sub-divided into three categories which include 11 commercial banks, 5 state owned-banks, and 15 foreign banks. The era of the early 1970s comprises only five big banks because small banks were amalgamated into them due to the nationalization policy of that time. Hereinafter, 1990 was a period of policy shift where banks were privatized and foreign banks were allowed to be operated in Pakistan. Later 2000 was a period with technical innovations and implementation of international accords, therefore, such period was a dream period to study the impact of competition on stability and the way they interact with each other along with the sector-wise in-depth analysis.

## 4.2 Empirical Models

To examine the relationship of banking competition/market power on the financial sector stability at the institution-level, Model (1) is used to evaluate the financial stability of a bank concerning various sources of risk (the solvency risk, liquidity risk, and credit risk of the assets portfolio).

$$Risk_{it} = \alpha_i + \beta_1 Competition_{it-1} + \beta_2 BankControl_{it-1} + \varepsilon_{it} \quad \ldots\ldots\ldots \qquad (1)$$

where *i* represents the bank and *t* indicates the time in the year. We segregate the risks of assets portfolio into solvency, liquidity, and credibility. The main explanatory variables comprised: price competition at the bank-level (the Lerner Index), and banking risks. The control variables include (a) loan to asset ratio (net loans/total assets), (b) government bonds ratio (government bonds/total assets), (c) asset growth (percentage change in assets), (d) non-performing loan ratio (non-performing loans/total advances), (e) non-interest income ratio (non-interest income/ total revenues. The independent variables are taken as one period lag because changes in the current year do not affect stability in the same period but appear after a lag (Almarzoqi, et al., 2015). We include a dummy variable in equation (1) to examine the behavior of each sector on different risks. Model (2) can be expressed as:

$$Risk_{it} = \alpha_i + \beta_1 Competition_{it-1} + \beta_2 BankControl_{it-1} + \beta_3 Dummy_i + \varepsilon_{it} \quad \ldots.(2)$$

Equation (2) is estimated thrice separately by assigning 1 for state-owned dummy variable banks and 0 otherwise; 1 for foreign banks dummy variable and 0 otherwise and 1 for private banks and 0 otherwise.

$$Risk_{it} = \alpha_i + \beta_1 Competition_{it-1} + \beta_2 BankControl_{it-1} + \beta_3 Competition_{it-1} * Dummy_i + \varepsilon_{it} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

To extend our analysis, we add an interaction term by multiplying banking competition and each sector to determine how this variable influences the bank risk. In Model (4), we include both the dummy variable and interacting dummy variable were incorporated to determine the combined impact of market power/competition on various risks.

$$Risk_{it} = \alpha_i + \beta_1 Competition_{it-1} + \beta_2 BankControl_{it-1} + \beta_3 Competition_{it-1} * Dummy_i + \beta_4 Dummy_i + \varepsilon_{it} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

### 4.3 Variables

Earlier studies identified two main variables namely; banking competition and financial stability. In this study, banking competition is measured through the Lerner index, and financial stability is estimated in the shape of solvency (Z-Score), liquidity (Liquidity Ratio), and credibility (Non-Performing Loan Ratio). A brief description of these variables is explained in the ensuing paragraphs.

#### (a) Bank competition:

In the empirical literature, the banking competition is measured through the structural and non-structural approaches. Structural measures are based on the competition that can be inferred from indirect proxies like market structure or market share whereas non-structural measures are measured directly. Structural measures include Hirschman Herfindahl Index (HHI) and CR5 (Structure-Conduct-Performance Paradigm) whereas non-structural measures comprise Lerner Index, Panzar, and Ross H-Statistics and Boone Indicator. All these measures are based on the analysis of the effective behavior of institutions on the market (Zuzana, 2013).

The level of banking competition is analyzed using various measures, for instance, price competition, market contestability, and market concentration. Lerner Index is used as a proxy for bank competition and its value ranges between zero and one. The zero value specifies perfect competition and one shows pure monopoly. The Lerner Index is calculated as:

$$Learner\ Index_{it} = \frac{P_{it} + MC_{it}}{P_{it}} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (5)$$

whereas $P_{it}$ is the price of bank *i* at *t* time, $MC_{it}$ is the marginal cost of bank *i* at time *t*. The price of banking products on a single output is determined as a proxy of the ratio of total revenues to total earning assets. Total revenues comprise interest and non-interest income, and equity-accounted profit/loss operating income.

$$Price_{it} = \frac{TR_{it}}{TEA_{it}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

where $TR_{it}$ is the total revenue of bank *i* at time *t* and $TEA_{it}$ is the total earning asset of bank *i* at time *t*. In this study, the total cost function is calculated by using a translog functional form (Khalil, 2005, Hector *et al.* 2007):

$$lntc_{it} = \alpha_0 + \alpha_1 lnq_{it} + \alpha_2 (lnq_{it})^2 + \sum_{j=1}^{3} \alpha_3 \, lnI_{jit}.lnq_{it} + \sum_{j=1}^{3}\sum_{k=1}^{3} \alpha_4 \, lnI_{jit}.lnI_{kit} + \sum_{j=1}^{3} \alpha_5 \, lnI_{jit} + \varepsilon_{it} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(7)$$

where $lntc_{it}$ is the log of the total cost of bank *i* at time *t*, $lnq_{it}$ is the output (total assets) of bank *i* at time *t* and $lnI_{jit}$ is the input price of bank *i* at time *t* whereas the value of *j* ranges from 1 to 3. j=1 refers input labor; j=2 for input physical capital and j=3 for input borrowed funds and *k* is the input prices of other banks. The price of labor is the unit price of labor which is calculated as the proportion of personnel expenses to the number of personnel in a bank for a given time. The price of physical capital is calculated as the ratio of other noninterest expenses to fixed assets. Finally, the price of funds is the unit price of funds, and it is calculated as the ratio of interest expenses to the total deposit: (a) input labor = Personal expenses/No. of persons, (b) input physical capital = non-interest expense/fixed assets, and (c) input funds = interest expense/total deposits (Elmas, 2011).

The marginal cost is derived from the total cost function by driving Equation (7), w.r.t. $lnq_{it}$ as

$$MC_{it} = \frac{dlntc_{it}}{dlnq_{it}} = \frac{tc_{it}}{q_{it}} * (\alpha_1 + 2\alpha_2 lnq_{it} + \sum_{i=1}^{3} lnI_{kit}) \quad \ldots\ldots\ldots\ldots(8)$$

**(b) Solvency risk**

The solvency of a bank is generally measured by three parameters: profitability of the bank; availability of adequate capital stock; and economic conditions. The first two indicators are computed by Z-Score because it is calculated as the sum of equity-asset ratio (covering the first factor) and the return on assets (covering the second factor) divided by the standard deviation of return on assets (covering the change in the second factor). The third factor is the capital adequacy ratio (CAR) which is measured by the weighted average combination of on-balance sheet items, off-balance sheet items, market risk, credit risk, and operational risk. In this research, solvency risk is proxied by the Z-Score which is an indirect measure of the bank from insolvency.

$$Z - score_{it} = \frac{E/A_{it} + ROA_{it}}{S.D.(ROA_{it})} \ldots\ldots\ldots\ldots\ldots\ldots(9)$$

where higher the value of Z-Score refers to better solvency of a bank. $E/A_{it}$ is the equity to asset ratio for bank *i* in year *t*, $ROA_{it}$ is the return on asset for bank *i* in year *t*, and S.D. ($ROA_{it}$) is the standard deviation of return on asset. Z-score shows an inverse measure of solvency risk which illustrates that higher value shows the lower solvency risk and vice versa.

**(c) Liquidity risk**

There are two broad measures of measuring liquidity risk (i.e. liquidity gap and liquidity risk elasticity). The liquidity gap means the net liquid assets of a firm that represent the excess value of the firm's liquid assets over its volatile liabilities (Almarzoqi et al., 2015). Liquidity risk elasticity is the change of net of assets over-funded liabilities that occur when the liquidity premium on the bank's marginal funding cost rises by a small amount. Liquidity Ratio is the ratio between liquid assets and short-term borrowing which illustrates the size of the liquid assets buffer of a bank; at its disposal and liquidity index which is calculated by discounting the present values of liquid assets (Diana & Moshe, 2014).

$$LR_{it} = \frac{LA_{it}}{STB_{it}} \dots\dots\dots\dots\dots\dots (10)$$

where $LR_{it}$ is the liquidity risk of bank *i* for year *t*, $LA_{it}$ is the liquid assets for bank *i* for the year *t* and $STB_{it}$ is the short term borrowing of bank *i* for the year *t*. Liquidity ratio is an inverse measure for liquidity risk, that is, higher the liquidity ratio, lower will be the liquidity risk.

**(d) Credit risk**

For measuring credit risk, Allen et al. (2011) classified four broad categories of measuring the credit risk i.e. external ratings approach, financial analysis models, the Merton / KMV structural model, and the transition-based models of Credit Metrics and Credit Portfolio View and provide relevant pros and cons of each method. Edward et al. (1998) measures the credit risk by establishing a new model known as mortality risk framework to measure the risk and returns on loans and analyze the risk-return structures of portfolios of credit-risk exposed debt instruments. The credit risk represents the loans created by the bank of the securities held on the balance sheet. A good measure for the asset portfolio risk is the Non-Performing Loans (NPLs) ratio.

$$CR_{it} = NPL_{it}/GL_{it} \dots\dots\dots (11)$$

where $CR_{it}$ is the credit risk of bank *i* for year *t*, $NPL_{it}$ is the non-performing loan of bank *i* for year *t* and $GL_{it}$ is the gross loan of bank *i* for year *t*. NPL is defined as a loan that is in default or close to being in default. Credit ratio shows a direct link to credit risk i.e. higher the credit ratio higher will be the credit risk.

## 5. Empirical results

### 5.1 Descriptive statistics

Table 1 shows the descriptive statistics of the variable used in this study. Lerner Index (L) is used as a proxy for banking competition/market power had a minimum value of -0.468 (Lerner index is calculated in short-run and the negative value of Lerner Index could be possible in short-run, (Sofronis et al., 2013) and a maximum value of 0.581 with mean 0.12 and standard deviation 0.30. This shows that the banking industry in Pakistan is

operated in a competitive environment. Z-Score is used as an inverse proxy for solvency measures had a minimum value of 0.2%, the maximum value of 71.3% with mean 30%, and standard deviation 24% showing overall better solvency position. Liquidity Ratio (LR) has a minimum value of 0.8%, maximum value 223% with mean 107%, and standard deviation 0.9 which predicts that assets of the banking industry are highly liquid. Non-performing loan ratio (NPL) has a minimum value of 3%, maximum value 30% with mean 9.9%, and standard deviation 0.08 indicating that the non-performing loans are less likely to occur in the banking industry of Pakistan. Loan to assets ratio (LAR) has a minimum value of 15.3%, maximum value 65.9% with mean 42.3%, and standard deviation 0.43. Non-interest income ratio (NIIR) has a minimum value of 7%, maximum value of 57.7% with mean 24% and standard deviation of 0.137. Asset growth (AG) has a minimum value of -13.3%, a maximum value of 66.4% with an average growth of 17.7% and a standard deviation of 0.19. Return on average equity (ROAE) has a minimum value of -37.7%, maximum value 98.4% with mean 24%, and standard deviation 0.298. Government bonds ratio (GBR) has a minimum value of 0.3%, a maximum value of 88.3% with a mean 27% and a standard deviation of 0.146. The graphical representation of the variables for the sample period can be shown in Appendix II. For understanding, the graphs are further split into the overall national level, state-owned, private, and foreign banks.

Before regression, some further tests like cross-sectional dependence, panel unit root, serial correlation, and heteroskedasticity tests are conducted. The results of these tests shown in Appendix III, IV, V, and VI respectively. The results indicate that there is no unit root and cross-section dependency however, there is a problem of serial correlation and heteroskedasticity that could generate inconsistent coefficients with usual panel regression. Therefore, the models are regressed using the FGLS technique that corrects the heteroskedasticity and serial correlation of observations within a cross-section. For a large sample, FGLS is preferred over GLS under the presence of heteroskedasticity or serial correlation and all the properties of FGLS are common as compared to GLS (Mantobaye, 2017).

**Table 1**: Descriptive Statistics

| Variable | Mean | Median | Max. | Min. | Std. Dev. | Obs. |
|---|---|---|---|---|---|---|
| Leaner Index | 0.120 | 0.159 | 0.581 | -0.468 | 0.307 | 454 |
| Z-score | 0.305 | 0.213 | 0.713 | 0.002 | 0.240 | 454 |
| Liquidity Ratio | 1.070 | 0.653 | 2.230 | 0.008 | 0.921 | 454 |
| NPL Ratio | 0.099 | 0.085 | 0.327 | 0.003 | 0.086 | 454 |
| Loan to Asset Ratio | 0.423 | 0.437 | 0.659 | 0.153 | 0.128 | 454 |
| Non-Interest Income Ratio | 0.240 | 0.210 | 0.577 | 0.071 | 0.137 | 454 |
| Asset Growth | 0.177 | 0.146 | 0.664 | -0.133 | 0.194 | 454 |
| Return on Average Equity | 0.240 | 0.239 | 0.984 | -0.377 | 0.298 | 454 |
| Govt. Bond Ratio | 0.270 | 0.255 | 0.883 | 0.003 | 0.146 | 434 |

This table presents the descriptive statistics of 31 Pakistani banks during the period from 2001 to 2018.

### 5.2 Effect of solvency risks on banking competition

Table 2 exhibits the empirical estimation between solvency risk and banking competition. Model (1) shows that the Lerner index increases the market power (decrease in market competition), increases the Z-Score (i.e. improves the solvency of banks). This finding is in line with the competition fragility theory which envisages that banks with more market power are less likely to take risks; increases profit margins and therefore increase stability (Almarzoqi et al., 2015). The negative association of loans to assets ratio indicates that an increase in advances decreases stability through an increase in risk-taking initiatives of the banks. Banks with more shares of government bonds among their assets show higher solvency, however, this study negates on the plea that despite government bonds are high-quality assets but yield low return as compared to advances lent, so it is a rationale for a stable bank to go for riskier assets and get more return. Thus, stable banks hold less share of government bonds in their asset's portfolio. Assets growth show expansion in banks' balance sheet. In this context, banks disproportionately increase their assets (extend new credits to more risky borrowers that may increase solvency risk of banks showing a negative relationship with the Z-Score). NPL ratio is directly associated with solvency risk (Franklin et al., 2011), i.e., higher the NPL ratio; higher will be the solvency risk (lower will be the Z-Score). Non-Interest Income ratio (NIIR) comprises banks' fees, services, etc., representing the diversified sources of banks' income. Whenever banks rely more on their non-interest income, it increases the borrowing cost of loans and unusual burdens on the customers who then search for the alternatives and withdrawing their investments thereby decreasing the Z-Score.

Model (2), (5), and (8) are estimated by incorporating the interacting dummy variable for state-owned, foreign, and private banks respectively. Model (2) suggests that the effect of market power on state-owned banks is 16.5 times more than that of foreign and private banks. Models (5) and (8) show that market power for foreign banks is 1.70 times less than state-owned and private banks and private banks have the market power of 5.3 times less than state-owned and foreign banks respectively. More market power for state-owned banks indicates more faith from the general public. Furthermore, the government supervised the banks for public welfare, not for its profit motive. However, a decrease in market power for foreign and private banks mainly comprises due to lack of confidence by the general public and lack of branch operations especially by foreign banks who are confined to just big cities.

Model (3), (6), and (9) are further classified as state-owned, foreign, and private banks to determine the impact of each sectors' competition; on banks' stability; by introducing dummy variables. Model (3) indicates the coefficient for state-owned dummy variable to be 8.89 which means that for a given level of market power, the average solvency for state-owned banks will be higher by 8.89 times then foreign and private banks. Similarly, Models (6) and (9) show that for a given level of market power, the average solvency of foreign banks is decreased by 2.49 times and for private banks, it is decreased by 3.06 times respectively. State-owned banks have support from the government and enjoy better solvency irrespective of the market power. The decrease in solvency for private and foreign banks is due to strict rules and regulations from the central bank.

Models (4), (7), and (10) include the results of both dummy and interacting term which is multiplied by the dummy for state-owned, foreign, and private banks with Learner Index. Model (4) predicts that on average state-owned banks have 6.29 times higher solvency by keeping overall market power constant and their market power is 14.14 times more than foreign and private banks. Likewise, Model (7) suggests that on average foreign banks have 1.68 times less solvency by keeping overall market power constant and their market power is 2.62 times less than state-owned and private banks. The results of Model (10) present that on average commercial banks have 2.67 times less solvency by keeping overall market power constant and their market power is decreased by 3.5 times relative to state-owned and foreign banks.

### 5.3 Effect of liquidity risks on banking competition

Table (3) demonstrates the relationship between liquidity risks and banking competition. In Model (1), the positive coefficient of the Lerner index indicates that an increase in market power (decrease in market competition) increases the liquidity ratio. This illustrates the existence of lower liquidity risk which is consistent with the competition fragility theory. This is because the banks with more market power have passive management style, that is, their liquidity buffer is a function of their cash flows and profits whereas banks with less market power have active management style i.e. their liquid buffer is a function of cash flows only (tend to adjust their liquid buffer according to the cash flow). The rationale for active management is that whenever there is a dire need for liquid assets, instead of access to the interbank market for obtaining loans and paying interest, they opt to use their cash flows to build their buffer of liquid assets (Almarzoqi et al., 2015). Banks' liquidity position mainly depends both on the quality and quantity of lending activities. The negative relationship of LAR shows that an increase in banks' lending activities decreases the liquidity ratio and it is obvious that banks have either two options i.e. invest in illiquid assets (yields more return) and invest in liquid assets (yields low return). Banks opt to choose a combination of these two but normally made more investment in illiquid assets to

generate more revenue thus decreases the liquidity ratio. The coefficient of NIIR is negative with liquidity ratio because income from non-interest sources may be important for liquidity but are rigid and less volatile. Therefore, banks who rely more on non-interest income or have high non-interest earning may need to hold less liquidity. NPL is directly associated with liquidity risk, that is, higher the NPL ratio; higher will be the risk and vice versa, therefore, the negative sign indicates that whenever the NPL ratio increases; banks tend to convert their liquid assets into ready cash and thereby decreases their liquidity ratio. Government bond ratio is negatively associated with liquidity ratio because although the government bonds appear to be stable but yield less return therefore banks continue to invest in riskier bonds to get more return. Assets growth show expansion in banks' balance sheet because the increase in assets is positively related to an increase in liquidity ratio.

Model 2, 5, and 8 are estimated by incorporating the interacting dummy variable for state-owned, foreign, and private banks respectively. Model (2) shows that effect of market power for state-owned banks is 0.15 times lower than that of foreign and private banks whereas market power for foreign banks is 0.15 times higher than state-owned and private banks and private banks have the market power of 0.13 times lower than state-owned and foreign banks (Models 5 and 8). Model (3) indicates the coefficient for state-owned dummy variable to be 0.4 which means that for a given level of market power, the average liquidity for state-owned banks will be higher by 0.4 times than foreign and private banks. For a given level of market power, the average liquidity of foreign banks is 0.23 times less than state-owned and private banks and private banks have 0.02 times more liquidity than state-owned and foreign banks (Models 6 and 9). State-owned banks have more investment in government securities i.e. T-bills and PIBs and are thus more liquid. Low liquidity for foreign banks is mainly due to an increase in advances to increase their market power rather than investing in liquid assets. Liquidity for private banks is less the state-owned banks because they adjust their liquidity buffer according to the given situation.

Model 4 shows that on average state-owned banks have 0.46 times higher liquidity by keeping overall market power constant and their market power is 0.46 times less than foreign and private banks. In Model 7, on average foreign banks have 0.26 times less liquid by keeping overall market power constant and their market power is 0.31 times higher than state-owned and private banks. However, Model 10 reflects that on average commercial banks have 0.05 times more liquidity by keeping overall market power constant and their market power is less than 0.21 times from state-owned and foreign banks.

### 5.4 Effect of credit risk on banking competition

Table (4) displays the relationship between credit risk and banking competition We report an inverse relationship between the Lerner index and market power (Model I). We argue this evidence that banks with more market power are risk-averse and due to their already increased profit margin, they are reluctant to invest in risky assets. Prior studies argue that an increase in banking competition decreases lending rate which influences the dominancy of either way (a decrease in lending rates makes it easy for the borrowers to pay back their debt hence, NPL ratio decreases or decrease in lending rates decreases profit margins for the banks and to increase their profit margin, banks lent more advances even to riskier customers which could increase NPL ratio, (Almarzoqi, 2015).

In Model 2, the effect of market power for state-owned banks is 0.016 times more than that of foreign and private banks while the market power for foreign banks is 0.001 times more than state-owned (Model 5) and private banks and private banks have the market power of 0.008 times less than state-owned and foreign banks (Model 8). Model (3) elaborates the coefficient for state-owned dummy variable to be 0.037 which means that for a given level of market power, the average NPL ratio for state-owned banks will be higher by 0.03 times then foreign and private banks. Model 4 shows that on average state-owned banks have 0.04 times more NPL ratio by keeping overall market power constant and their market power is 0.029 times less than foreign and private banks. Model 7 suggests that on average foreign banks have 0.018 times less NPL ratio by keeping overall market power constant and their market power is 0.019 times more than state-owned and private banks. Model 10 indicates that on average private/commercial banks have 0.012 times less NPL ratio by keeping overall market power constant and their market power is increased by 0.006 times than state-owned and foreign banks.

**Table 2 Effect of solvency risk on banking competition**

| **Variables** | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|---|---|---|---|---|---|---|---|---|---|---|
| Lerner(-1) | 4.759*** | 2.033 | 4.068*** | 1.945*** | 5.492*** | 4.804*** | 6.199*** | 6.709*** | 5.609*** | 6.793*** |
| | (2.9163) | (1.0956) | (2.4683) | (1.0404) | (2.3074) | (2.8890) | (2.517) | (3.333) | (3.352) | (3.358) |
| Loan to Asset Ratio(-1) | -29.833*** | -29.277*** | -27.878*** | -28.057*** | -30.007*** | -29.913*** | -29.887*** | -29.648*** | -26.921*** | -27.183*** |
| | (-7.165) | (-7.046) | (-6.702) | (-6.718) | (-7.188) | (-7.137) | (-7.061) | (-7.132) | (-6.247) | (-6.327) |
| Government Bonds Ratio(-1) | 0.536 | 0.408 | 0.018 | -0.044 | 0.305 | -0.141 | -0.318 | 0.446 | 1.739 | 1.246 |
| | (0.188) | (0.142) | (0.006) | (-0.015) | (0.105) | (-0.048) | (-0.105) | (0.153) | (0.579) | (0.408) |
| Asset Growth(-1) | -2.573** | -2.411* | -2.260 | -2.057 | -2.526** | -2.054 | -1.772 | -2.707** | -2.077** | -2.213 |
| | (-1.827) | (-1.652) | (-1.578) | (-1.389) | (-1.776) | (-1.460) | (-1.230) | (-1.910) | (-1.457) | (-1.551) |
| Non-Performing Loan Ratio(-1) | -11.163** | -11.826*** | -13.050*** | -11.878*** | -11.445*** | -10.993** | -10.466** | -11.473*** | -10.123** | -10.554*** |
| | (-1.965) | (-1.967) | (-2.284) | (-1.968) | (-1.968) | (-1.908) | (-1.730) | (-2.015) | (-1.708) | (-1.784) |
| Non-Interest Income Ratio(-1) | -2.789 | -2.305 | -2.317 | -2.773 | -2.765 | -3.421 | -3.852 | -2.589 | -4.141 | -3.797 |
| | (-0.960) | (-0.758) | (-0.799) | (-0.909) | (-0.946) | (-1.169) | (-1.281) | (-0.882) | (-1.384) | (-1.269) |
| Lerner(-1)*State Owned Bank | | 16.507*** | | 14.142*** | | | | | | |
| | | (3.515) | | (2.896) | | | | | | |
| State owned Banks | | | 8.893*** | 6.294*** | | | | | | |
| | | | (3.205) | (2.184) | | | | | | |
| Lerner(-1)*Foreign Banks | | | | | -1.705 | | -2.625 | | | |
| | | | | | (-0.521) | | (-0.783) | | | |
| Foreign Banks | | | | | | -2.493 | -1.683 | | | |
| | | | | | | (-1.174) | (-0.799) | | | |
| Lerner(-1)*Private Banks | | | | | | | | -5.300 | | -3.504 |
| | | | | | | | | (-1.517) | | (-0.991) |
| Private Banks | | | | | | | | | -3.069 | -2.673 |
| | | | | | | | | | (-1.412) | (-1.217) |
| Constant | 42.147*** | 41.805*** | 40.182*** | 40.464*** | 42.252*** | 43.582*** | 43.216*** | 42.214*** | 42.078*** | 42.202*** |
| | (15.913) | (15.587) | (14.850) | (14.655) | (15.745) | (14.423) | (14.015) | (15.858) | (15.483) | (15.568) |

t-values in Parenthesis ***p<0.01, **p<0.05, *p<0.1

**Table-3 Effect of liquidity risk on banking competition**

| Variable | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|---|---|---|---|---|---|---|---|---|---|---|
| Lerner(-1) | 0.347*** | 0.369*** | 0.281*** | 0.341*** | 0.267*** | 0.270*** | 0.093*** | 0.405*** | 0.342*** | 0.417*** |
| | (4.733) | (4.790) | (3.926) | (4.472) | (2.854) | (2.567) | (0.984) | (4.629) | (4.679) | (4.775) |
| Loan to Asset Ratio(-1) | -1.64*** | -1.68*** | -1.58*** | -1.71*** | -1.64*** | -1.77*** | -1.77*** | -1.64*** | -1.67*** | -1.67*** |
| | (-8.727) | (-8.901) | (-8.567) | (-9.342) | (-8.684) | (-9.630) | (-9.569) | (-8.714) | (-8.780) | (-8.733) |
| Govt Bond Ratio(-1) | -0.76*** | -0.74*** | -0.70*** | -0.61*** | -0.76*** | -0.60*** | -0.57*** | -0.75*** | -0.72*** | -0.71*** |
| | (-5.610) | (-5.370) | (-5.227) | (-4.493) | (-5.574) | (-4.426) | (-4.191) | (-5.438) | (-5.272) | (-5.185) |
| Asset Growth(-1) | 1.04*** | 1.04*** | 0.918*** | 0.865*** | 1.03*** | 0.89*** | 0.89*** | 1.02*** | 1.02*** | 1.025*** |
| | (3.621) | (3.597) | (3.222) | (3.068) | (3.584) | (3.176) | (3.181) | (3.552) | (3.582) | (3.585) |
| Non-Performing Loan Ratio(-1) | -0.014 | -0.018 | 0.050 | 0.069 | -0.010 | -0.024 | -0.007 | -0.029 | -0.037 | -0.044 |
| | (-0.172) | (-0.213) | (0.610) | (0.847) | (-0.122) | (-0.288) | (-0.079) | (-0.348) | (-0.442) | (-0.522) |
| Non Interest Income Ratio (-1) | -0.073 | -0.063 | -0.070 | -0.047 | -0.085 | -0.078 | -0.102** | -0.085 | -0.072 | -0.090 |
| | (-1.064) | (-0.915) | (-1.005) | (-0.688) | (-1.216) | (-1.120) | (-1.569) | (-1.211) | (-1.040) | (-1.284) |
| Lerner(-1)*State owned Banks | | -0.152 | | -0.59*** | | | | | | |
| | | (-0.937) | | (-3.666) | | | | | | |
| State owned Banks | | | 0.405*** | 0.461*** | | | | | | |
| | | | (3.719) | (4.167) | | | | | | |
| Lerner(-1)*Foreign Banks | | | | | 0.158 | | 0.319*** | | | |
| | | | | | (1.315) | | (2.658) | | | |
| Foreign Banks | | | | | | -0.23*** | -0.26*** | | | |
| | | | | | | (-2.786) | (-3.158) | | | |
| Lerner(-1)*Private Banks | | | | | | | | -0.138 | | -0.212*** |
| | | | | | | | | (-1.092) | | (-1.652) |
| Private Banks | | | | | | | | | 0.023 | 0.056*** |
| | | | | | | | | | (0.264) | (0.629) |
| Constant | 1.769*** | 1.778*** | 1.659*** | 1.686*** | 1.773*** | 1.927*** | 1.942*** | 1.778*** | 1.775*** | 1.769*** |
| | 16.297 | 16.309 | 14.903 | 15.300 | 16.311 | 17.036 | 17.017 | 16.369 | (16.292) | (16.240) |

t-values in Parenthesis ***p<0.01, **p<0.05, *p<0.

**Table-4 Effect of credit risk on banking competition**

| **Variables** | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|---|---|---|---|---|---|---|---|---|---|---|
| Lerner(-1) | -0.054*** | -0.055*** | -0.056*** | -0.053*** | -0.055*** | -0.058*** | -0.069*** | -0.050*** | -0.051*** | -0.053*** |
| | (-7.975) | (-7.217) | (-8.075) | (-7.141) | (-5.688) | (-8.368) | (-6.871) | (-6.059) | (-7.418) | (-6.430) |
| Loan to assets Ratio(-1) | -0.028** | -0.026 | -0.017 | -0.018 | -0.028* | -0.036** | -0.036** | -0.027 | -0.020 | -0.020 |
| | (-1.705) | (-1.529) | (-1.052) | (-1.119) | (-1.676) | (-2.150) | (-2.142) | (-1.608) | (-1.183) | (-1.201) |
| Government Bonds Ratio(-1) | -0.022** | -0.023** | -0.016 | -0.014 | -0.022* | -0.016 | -0.014 | -0.023** | -0.025*** | -0.026*** |
| | (-1.803) | (-1.831) | (-1.292) | (-1.133) | (-1.749) | (-1.278) | (-1.054) | (-1.829) | (-2.023) | (-2.076) |
| Asset Growth(-1) | -0.041*** | -0.041*** | -0.042*** | -0.042*** | -0.041*** | -0.043*** | -0.045*** | -0.042*** | -0.040*** | -0.040*** |
| | (-6.812) | (-6.745) | (-6.787) | (-6.908) | (-6.711) | (-7.009) | (-7.195) | (-6.926) | (-6.654) | (-6.669) |
| Lerner(-1)*State owned Banks | | 0.016 | | -0.029*** | | | | | | |
| | | (0.851) | | (0.019) | | | | | | |
| State owned Banks | | | 0.037*** | 0.042 | | | | | | |
| | | | (2.880) | (0.013) | | | | | | |
| Lerner(-1)*Foreign Banks | | | | | 0.001 | | 0.019 | | | |
| | | | | | (0.076) | | (1.376) | | | |
| Foreign Banks | | | | | | -0.013 | -0.018** | | | |
| | | | | | | (-1.328) | (-1.708) | | | |
| Lerner(-1)*Private Banks | | | | | | | | -0.008 | | 0.006 |
| | | | | | | | | (-0.562) | | (0.412) |
| Private Banks | | | | | | | | | -0.010 | -0.012 |
| | | | | | | | | | (-0.993) | (-1.073) |
| Constant | 0.109*** | 0.107*** | 0.102*** | 0.102*** | 0.109*** | 0.122*** | 0.126*** | 0.108*** | 0.107*** | 0.107*** |
| | (10.922) | (10.564) | (9.969) | (10.052) | (10.857) | (10.125) | (10.233) | (10.809) | (10.731) | (10.789) |

t-values in Parenthesis ***p<0.01, **p<0.05, *p<0.1

## 6. Conclusions

Pakistan's banking industry is diverse and rich with extreme policy measures. It had tasted the fruits of extreme nationalization policy on one hand and open-ended privatization at the other. Before 2000, the number of private/foreign banks was too low and their operations were also very limited but after 2000, there was a period when the banking industry of Pakistan had started and incorporated technological innovations and international accords. Therefore, despite the overall look, a sector-wise detailed study is necessary to investigate the performance of key financial variables along with the way they interact with each other.

The banking industry shows a relatively high level of competition and a low level of market concentration. The overall stability of the banking industry is quite satisfactory especially during the global financial crisis. When we compare Pakistan's banking system (PBS) with global banking, PBS shows a high level of solvency, a satisfactory buffer of liquid assets concerning deposits and short-term borrowings, and relatively low non-performing loans.

This study employs four models to determine the relationship between market power and stability. The first model explains that how the market power affects stability using three different types of risks i.e. solvency, liquidity, and credit risk after accounting the on-balance sheet variables – which explains the positive relationship between market power and stability. Second, third and fourth models are segregated into state-owned, private, and foreign banks by introducing separate dummy variables, separate interacting dummy variables, and both to determine the impact of each sector on stability. State-owned banks appear to be more solvent because of their high Z-Score whereas the foreign banks have the least solvency. Foreign banks appear to be more liquid while state-owned banks have the least due to their low liquidity ratio and private banks have more credibility whereas state-owned banks are the least creditworthy due to their high NPLs.

Banks' primary function is to convert liquid deposit (liabilities) to illiquid assets such as loans, which makes them inherently vulnerable to liquidity risk. Management of such risks is to preserve their ability to fulfill their role. While some outflows are known with certainty, however, others depend on the external events which become the sources of liquidity risk (Alam, 2012). Liquidity risks could be reduced if a bank incorporates liquidity costs in their internal pricing and in case of a new product approval process, which alienates the risk-taking incentives with the liquidity risk exposures. A bank should actively monitor and control liquidity risk exposures within and across legal entities, business lines, and currencies. Funding strategies should be established that provide effective diversification of resources and tenor of funding.

According to the SBP, the NPL ratio is 8.6% in December 2019 which seems much higher. NPL ratio could not be reduced by merely opening the Credit Control Bureaus. Such bureaus or institutions should perform their due operations and allow commercials banks to

increase credit creation under guidance and supervision. No sector-wise study has conducted before for the Pakistani banking industry; however, this study retrains to certain limitation i.e. microfinance, Islamic, leasing, and other lending institutions were not incorporated in this research to maintain symmetry among the banks' under-sample study. For future research, the effects of other lending institutions can be accounted for. Furthermore, the Lerner index was used as a proxy for market power/competition whereas several other variables may be used to determine the impact of competition on banking stability.

## References

Almarzoqi, R., Naceur, S. B., & Scopelliti, A. D. (2015). How does bank competition affect solvency, liquidity, and credit Risk? Evidence from the MENA Countries. *IMF Working Paper* WP/15/210.

Alam, H. M., Raza, A., & Akram, M. (2011). A financial performance comparison of public vs private banks: The case of commercial banking sector of Pakistan. *International Journal of Business and Social Science* 2, 56-64.

Ayesha A., & Nwazish M. (2012). Size, diversification, and risk: Preliminary evidence from commercial banks in Pakistan. *Pakistan Journal of Commerce & Social Sciences* 6(2), 282-296.

Babar, H. Z, & Zeb, G. (2011). Does "CAMELS" system provide similar ratings as PACRA system in assessing the performance of banks in Pakistan? Master Thesis, Umea School of Business, Sweden.

Beck, T., A. Demirguc-Kunt & R. Levine (2006). Bank concentration, competition, and crises: First results. *Journal of Banking and Finance*. 30 (5), 1581-1603.

Beck T., De Jonghe O. & Schepens G. (2013). Bank competition and stability: Cross-country heterogeneity. *Journal of Financial Intermediation* 22, 218–244.

Berger, A.N., L. Klapper & R. Turk-Ariss (2009). Bank competition and financial stability. *Journal of Financial Services* 35, 99–118.

Bilal, Z., Asif, N., Imran K. & Rizwan A. (2011). The Rapid Growth of Banking Sector in Pakistan and its Impacts on Revenue Generation. Syndicate Group No. 2, Faculty of the DOT Academy, Lahore.

Cheron (2013). Impact of Non-performing Loans on Pakistan Banks' UK essays 2013.

Diana, B. & Moshe K. (2014). Liquidity Risk in Banking: Is There Herding? *European Banking Center Discussion Paper* No. 2012-024.

D. E. Allen, R. J. Powel, (2011). Credit Risk Measurement Methodologies, http://mssanz.org.au/modsim2011

Edward, I. Altman, & Anthony S. (1998). Credit risk measurement: Developments over the last 20 years. *Journal of Banking & Finance* 21, 1721-1742.

Elmas, Y. (2010). Competition-fragility or competition-stability? Evidence from the Turkish banking system. *Working Paper from CIFREM Seminar Presentation*, Turkey.

Elmas, Y. (2011). Market Power and Riskiness in the Turkish Banking System. *Working Paper from CIFREM Seminar Presentation*.

Emiliano, L., & Valter L. (2000). Credit risk measurement for a banks' loan portfolio. SAS Community, SEUGI-2000.

Faisal, M. M., Olvar B. & Isma K. (2016). Measuring the degree of competition in Pakistan's banking industry: an empirical analysis. *Applied Economics* 48(53), 5138-5151.

Franklin, A., Elena C., & Robert M. (2011). Credit market competition and capital regulation. Divisions of Research & Statistics and Monetary Affairs, Federal Reserve Board, Washington, D.C.

Hector, S. B. & Lorenzo E. & Bernal V. (2007). Translog cost function for the Mexican manufacturing Industry. Mexican Working Paper 07-08.

Ijaz, S., Hassan, A., Tarazi, A., & Fraz, A. (2020). *Linking bank competition, financial stability, and economic growth. Journal of Business Economics and Management*, 21(1), 200-221.

Jimenez, G, J. A. Lopez & J. Saurina (2008). How does competition impact bank risk-taking? Working Paper, the Federal Reserve Bank of San Francisco.

Juan, C. C., Lucotte, Y. & Reigl, N. (2020) Banking sector concentration, competition, and financial stability: the case of the Baltic countries, Post-Communist Economies, 32:2, 215-249

Khalil, M. A. (2005). A cross-section estimation of translog production function; Jordanian Manufacturing Industry. *MEEA and LUC* 7, 1-14.

Klaus S., Martin S. & Simone W. (2006). Are more competitive banking sector more stable?" IMF Working paper WP/06/143.

Lapteacru, I. (2014). Do more competitive banks have less market power? The evidence from Central and Eastern Europe. *Journal of International Money and Finance* 46(C), 41-60.

Mantobaye, M., William, S. R, and W. Robert R. (2017), 'Which panel data estimator should I use? A corrigendum and extension', Discussion Paper No. 2017-58

Markus K BrunnerMeier and Laise Hege Pederson (2008), 'Market Liquidity and Funding Liquidity", RFS Advance

Kashif, M., Faizan, S. I., & Khurram I. (2016). Loan growth and bank solvency: evidence from the Pakistani banking sector. *Financial Innovation* 2:22, 1-13.

Farhan, M., Amir, R. (2013). Achieving the optimum level of liquidity is crucial for every bank. *The Romanian Economic Journal,* XVI no. 48.

Tahir, M., Sadaqat, M. A. S., & Asim, M. A. (2016). Assessing nature of competition in banking sector of Pakistan. *The Journal of Finance and Data Science* 2(4), 244-253.

Riaz R. (2009). Concentration and competition in banking sector of Pakistan: Empirical Evidence. SBP Working Paper Series No. 28.

Schaeck, K., M. Čihák & S. Wolfe (2006). Are more competitive banking systems more stable? IMF Working Paper, WP/06/143.

Selvi, Ek K. (2009). Bank competition and banking system stability: Evidence from Turkey. Department of Economics, METU ECON 2009.

Sofronis C., Menthos D., & Sotirois K. (2013). A new dataset on bank competition in National banking market. University of Cyprus, Working paper No. 08-2013.

Zuzana F., Laura S. & Laurent W. (2013). Does bank competition influence the lending channel in the euro area?" BOFIT Discussion Papers No. 17.

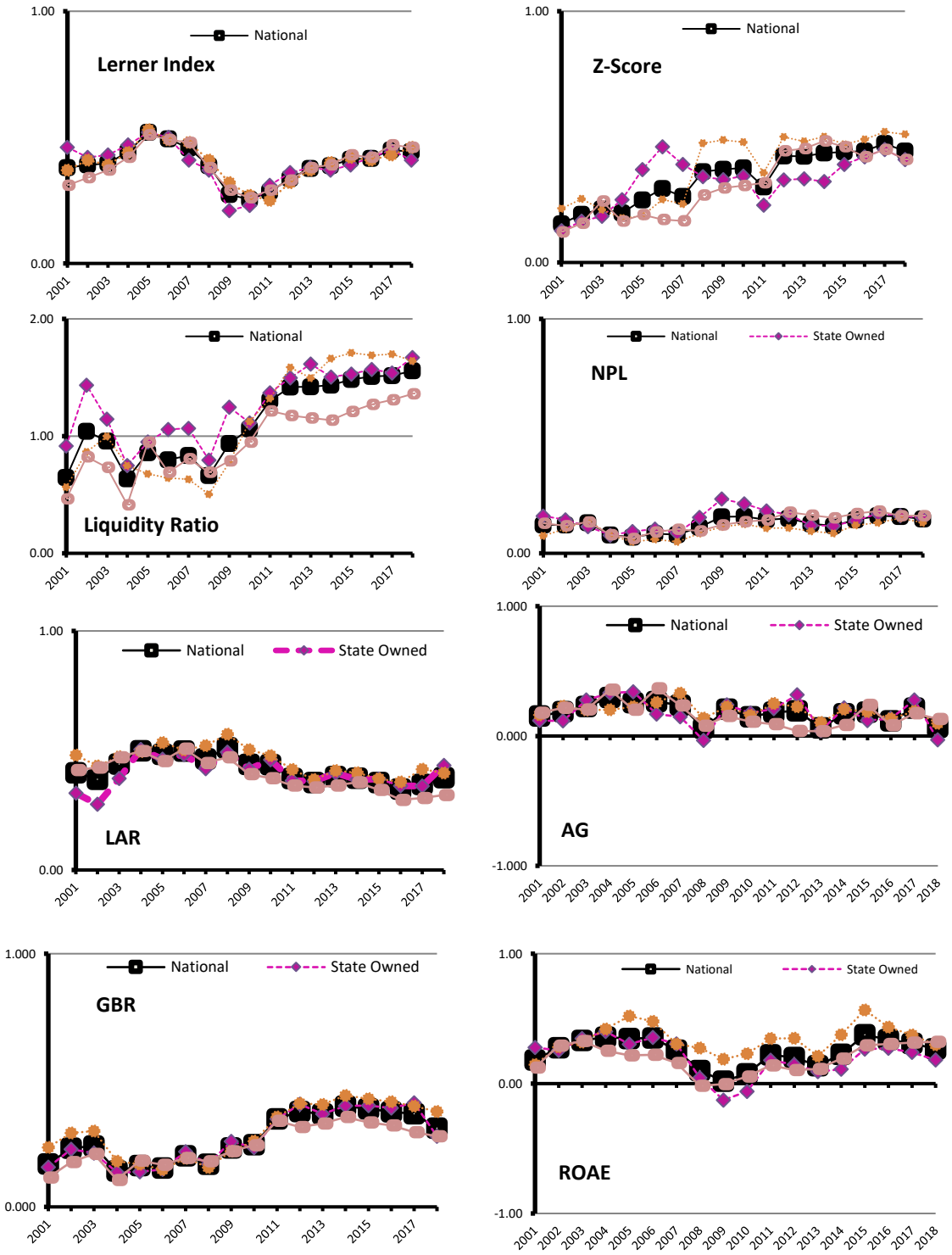
Zuzana F., Anastasiya S., & Laurent W. (2015). Does bank competition reduce cost of credit? Cross-country Evidence from Europe. *Journal of Banking and Finance* 83, 104-120.

**Appendix I**: List of Banks

| | | |
|---|---|---|
| State owned Banks | 1) Bank of Punjab | September 19, 1994 |
| | 2) Bank of Khyber | 1994 |
| | 3) First women Bank | November 21, 1989 |
| | 4) National Bank of Pakistan | 1961 |
| | 5) Sindh Bank | October 29, 2010 |
| Foreign Banks | 1) Atlas Bank Limited | July 17, 2003 |
| | 2) The Bank of Tokyo-Mitsubishi UFJ Limited | 1996 |
| | 3) Barclays Bank PLC | July 23, 2008 |
| | 4) Citi Bank N.A. | April 1992 |
| | 5) Habib Metropolitan Bank Limited | August 3, 1992 |
| | 6) Royal Bank of Scotland | September 30, 1991 |
| | 7) Bank Alfalah Limited | June 21, 1992 |
| | 8) SAMBA Bank Limited | February 12, 1980 |
| | 9) Deutsche Bank AG | October 7, 2011 |
| | 10) Faysal Bank Limited | October 3, 1994 |
| | 11) HSBC Bank Middle East Limited | 2008 |
| | 12) HSBC Bank Oman | November 01, 2008 |
| | 13) NIB Bank Limited | October 2, 2003 |
| | 14) Silkbank Limited | April 4, 1994 |
| | 15) Standard Chartered Bank Limited | July 19, 2006 |
| Domestic (Private) banks | 1) Allied Bank Limited | August 14, 1947 |
| | 2) Askari Bank Limited | October 09, 1991 |
| | 3) ABN AMRO Bank N.V. | September 30, 1991 |
| | 4) Bank Al Habib Limited | October 15, 1991 |
| | 5) Habib Bank Limited | August 14, 1947 |
| | 6) MCB Bank Limited | July 9, 1947 |
| | 7) JS Bank Limited | July 13, 1987 |
| | 8) Mybank Limited | October 7, 1991 |
| | 9) Soneri Bank Limited | September 28, 1991 |
| | 10) Summit Bank Limited | December 9, 2005 |
| | 11) United Bank Limited | March 15, 1959 |

Source: State Bank of Pakistan

**Appendix II**: Graphical representation of the variables



**Appendix III**: Cross-section dependence test

| Methods | Solvency Model | Liquidity Model | Credit Model |
|---|---|---|---|
| Breusch Pagam LM | 467.45 | 393.05 | 422.91 |
| Pesaran Scaled LM | 0.08 | 02.351 | -1.379 |
| Pesaran CD | 3.678 | 2.939* | 1.269 |

*p*-values ***p<0.01, **p<0.05, *p<0.1

**Appendix IV**: Unit root test

| Variable | Levin, Lin & Chu | Im, Pesaran and Shin | ADF test | PP test |
|---|---|---|---|---|
| Leaner Index | -3.833*** | -1.624* | 75.67** | 82.80*** |
| | (0.000) | (0.052) | (0.027) | (0.007) |
| Z-score | -4.188*** | 0.843 | 45.76* | 77.45** |
| | (0.000) | (0.207) | (0.079) | (0.034) |
| Liquidity ratio | -2.244** | 0.091 | 61.98 | 75.82** |
| | (0.012) | (0.536) | (0.119) | (0.017) |
| NPL ratio | -10.50*** | -2.212** | 78.151** | 82.62*** |
| | (0.000) | (0.016) | (0.011) | (0.004) |
| Loan to Asset ratio | -29.91*** | -0.014*** | 84.86*** | 96.71*** |
| | (0.000) | (0.000) | (0.004) | (0.000) |
| Non-interest income | -5.28*** | -2.44*** | 81.89*** | 98.84*** |
| ratio | (0.000) | (0.007) | (0.008) | (0.000) |
| Asset growth | | | | |
| | (0.000) | (0.007) | (0.008) | (0.000) |
| Return on average | -2.23*** | -2.71*** | 81.42*** | 119.5*** |
| equity | (0.009) | (0.003) | (0.000) | (0.000) |
| Govt. bond ratio | -5.9*** | -0.935* | 52.26** | 45.27** |
| | (0.000) | (0.082) | (0.038) | (0.066) |

*p*-values are in parenthesis. ***p<0.01, **p<0.05, *p<0.1

**Appendix V**: Serial correlation test

| **Tests** | **Solvency Model** | **Liquidity Model** | **Credit Model** |
|---|---|---|---|
| | F-Stats | F-Stats | F-Stats |
| Breusch Godfrey LM Test | 77.29*** | 41.32*** | 101.61*** |

p-values ***p<0.01, **p<0.05, *p<0.1

**Appendix VI**: Heteroskedasticity tests

| **Tests Summary** | **Solvency Model** | **Liquidity Model** | **Credit Model** |
|---|---|---|---|
| | F-Stats | F-Stats | F-Stats |
| Breusch Pagan Godfrey Test | 1.478 | 0.557 | 4.94*** |
| Harvey Test | 4.34*** | 0.751 | 3.88*** |
| Glejser Test | 3.07*** | 0.434 | 6.191*** |
| **ARCH Test** | 63.5*** | 9.82*** | 58.67*** |
| **White Test** | 1.93* | 5.65*** | 2.65*** |

p-values ***p<0.01, **p<0.05, *p<0.1