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Concentration and Competition in Banking Sector of Pakistan: Empirical Evidence

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Abstract

The paper measures the degree of competition in the banking sector of Pakistan by using a long-existing structural approach developed by Panzar and Rosse (PR) in context of market contestability. A reduced form revenue equation is estimated by using panel data consisting of 26 banks from 1997 to 2007. The various tests on PR-H Statistics suggest that banking sector of Pakistan as a whole is consistent with a monopolistically competitive market structure. Failure to reject the null of long-run equilibrium of the banking sector, a key assumption of PR-H Statistic, lends more credence to the finding of underlying degree of competition.

JEL Classification: D4, G21

Key Words: Concentration, Competition, Market Contestability, Banking System

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Although banking system in Pakistan is widely acknowledged for its rapid progress in recent years, persistently high banking spreads and concentrated structure of banking industry have raised important policy issues especially related to competition in the banking sector. All time high profitability of banking sector coinciding with low returns to depositors in recent years further aggravates these concerns.¹ Ongoing structural transformation due to consolidation, a process which is expected to continue in response to increased Minimum Capital Requirement to Rs 23.0 billion by 2013 in a phased manner,² has also renewed interest in this issue as it can effect competition by reducing the number of market players.³ Another most striking development in banking sector is the introduction of a minimum rate on PLS savings deposits by the SBP with effect from 1st June 2008.⁴

Recent wave of mergers and acquisitions of financial institutions at international level has also attracted the attention of policy makers and researchers on the issues related to the banking sector. Most of the studies have focused on issues related to concentration, competition, economic efficiency and financial stability of the banking sector, and inter-linkages of these issues. As for concentration and competition, traditional theory of Industrial Organization Economics (IOE), also known as structure-conduct-performance (SCP) hypothesis, assumes a one-way causal relation from market structure (concentration) to price setting behavior of firms and ultimately to profitability through market power channel. The essence of the SCP hypothesis is based on the argument that concentration encourages collusive behavior in market participants by reducing the cost of collusion. It implies that high concentration may impede competition in the sector, while a large number of relatively same size firms (banks) cause them to set their prices competitively. The proponents of this view argue that a profit maximizing bank operating as a price taker in a competitive market will provide credit at the lowest price. As a result, competition will help in maximizing welfare in the economy. However, this approach also entails a number of difficulties. The critics of this approach argue that price setting behavior of firm (especially in banking sector) is not directly observable and concentration is hard to define without specifying a relevant product and geographical markets. The opponents also present a competing hypothesis known as Efficient Structure (ES) Hypothesis. The ES hypothesis states that high productive efficiency of the bank helps in increasing its market share and realizing abnormal profits.

Empirical research on this subject provides mixed results. Claessens and Laeven (2005) using bank-wise data from 50 countries find that measures of competition and concentration are not

¹ For details, see a thematic article titled "Efficiency of Financial Intermediation: An Analysis of Banking Spreads" in Financial Stability Review 2006, State Bank of Pakistan (p 23-34).

² For details, see BSD Circular No. 19 dated September 05, 2008.

³ For details on consolidation of financial sector, please see Financial Stability review 2006, State Bank of Pakistan.

⁴ For details, see BPRD Circular No. 7 dated May 30, 2008.

negatively related to each others, while Bikker and Haff (2002) using data from 23 European countries find that high concentration hurts competitiveness.⁵ Historically, concentration in banking sector is tolerated as some sort of market power is also considered necessary for the stability of banking sector. However, a review of literature by Northcott (2004) suggests that there is no clear trade-off between the bank size and its financial stability. Franklin and Gale (2004) also show that perfect competition and financial stability can coexist.

Given the mixed result on SCP and ES hypothesis, long-existing theory of market contestability states that market structure indicators alone cannot determine the competitiveness of an industry. There are several conditions which can yield competitive behavior in a concentrated markets and collusive behavior can survive in the presence of large number of firms/banks. A number of factors including restriction on entry and competition from non-bank financial institutions, capital market, and insurance companies can play an important role in determining level of competition in the banking sector.⁶ Specifically, the market structure “is determined explicitly, endogenously, and simultaneously with the pricing, output, advertising, and other decisions of the firms...A contestable market is one into which entry is absolutely free and exit is absolutely costless” [Baumol (1982), p.3].

Keeping the wide ranging issues related to concentration, competition, economic efficiency and financial stability of the banking sector in mind, this paper focuses on measuring the degree of competition in the banking system of Pakistan by using a structural approach developed by Panzar-Rosse (1987). The PR H-statistic provides a systematic way to investigate the market structure by using information on observed behavior of firms. The estimated PR H-statistic is mapped to market structure by testing hypothesis related to market structure under monopoly, monopolistic competition and perfect competition.⁷

The paper is organized in five sections. Section I provides background information and motivation of the paper. Section II discusses the structure of Pakistani banking sector along with traditional measures of concentration. Section III briefly explains one of the most widely used technique to measure the degree of competition in the banking sector, i.e. Panzar and Rosse (PR) H statistics. Section IV presents estimated results and tests of hypotheses. This section also comments on the robustness of the results. Section V concludes the paper and references are appended at the end.

⁵ In case of Pakistan, Arby (2003) analyzed various measures of market concentration and noted that “even after financial reforms and liberal licensing policy, the industry is still far from the competitive structure” (p-7).

⁶ For details, see Allen and Engert (2007), and Allen and Liu (2007).

⁷ It may be noted that “a perfectly competitive market is necessarily perfectly contestable, but not vice versa” [Baumol (1982), p. 3].

II. Banking Structure and Measures of Concentration

The banking sector in Pakistan has generally been described by the dominating position of the big 5 banks. The share of these 5 banks in overall assets of banking system was 84.0 percent by the end of 1990-- a year of initiating broad-based financial sector reforms in Pakistan. Since then, the structure of banking sector has evolved substantially. While the total number of banks operating in the country jumped from 31 in 1990 to 45 in 1995, the number of domestic banks more than doubled over the same period (see **Table 1**). This rapid increase in number of banks helped in reducing concentration (according to traditional measures) to some extent, as the asset share of top five banks in overall assets of the scheduled banks declined to 68.9 percent in 1995. However, a number of newly established small-sized banks were unable to provide meaningful competition to the big 5 banks. The financial health of some of these newly established small banks also deteriorated over this period. These developments paved the way for an implicit moratorium on the issuance of new commercial banking license since 1995. This measure, along with implementation of risk-based regulatory capital requirements in 1997 and subsequent increases in minimum paid-up capital requirement (net of losses) set the stage for mergers and acquisition in the financial sector, especially in banking sector.⁸ The SBP also facilitated this process of mergers and acquisition as regulator and supervisor of the banking sector. The impact of these changes on traditional measures of concentrations (namely M-Concentration ratio, coefficient of variation and

Table 1: Number of Banks

End December

	CY90	CY95	CY00	CY01	CY02	CY03	CY04	CY05	CY06	CY07
Public Sector Commercial Banks-PSCBs	6	6	6	6	5	5	4	4	4	4
Domestic Private Banks-DPBs	0	15	14	14	16	18	20	20	24	26
Foreign Banks-FBs	21	20	20	19	16	14	11	11	7	6
Specialized Banks-SBs	4	4	4	4	3	3	3	4	4	4
Total No. of Banks	31	45	44	43	40	40	38	39	39	40

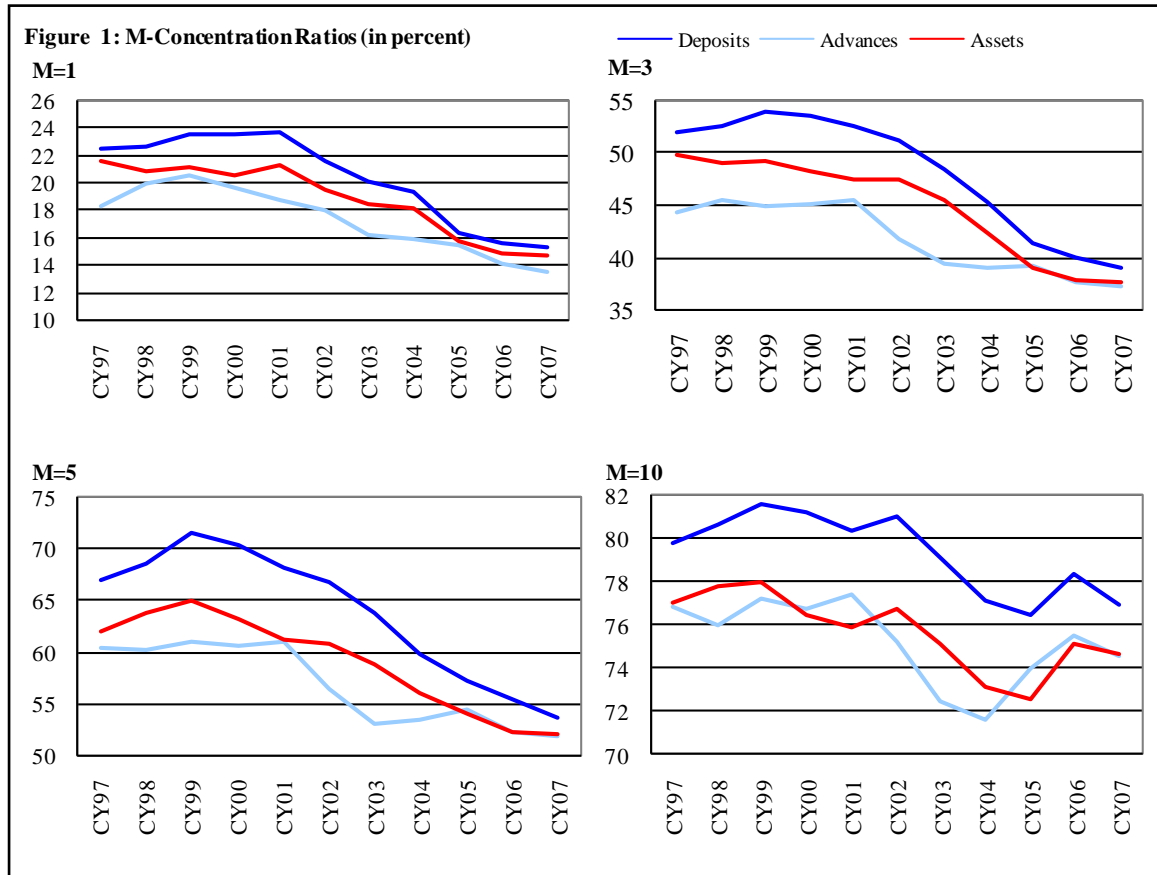
Herfindahl-Hirschman Index) is analyzed in the following discussion.

M-Concentration ratio

The M-Concentration ratios indicate the market share of *M* big participants. A quick view of **Figure 1** shows that market share of the biggest one, three and five banks have witnessed significant decrease since CY00. This decrease in concentration is visible in all three major variables of the banking sector. Specifically, the asset share of the big five banks has declined from 63.2 percent in CY00 to 52.0 percent by end CY07. This decrease of more than 10 percentage points in the share of assets is reflective of the changing market structure of the

⁸ For details, see a thematic article on “Consolidation of the Financial Sector” in FSR 2006.

banking sector. This is more evident from the asset share of top ten banks. Increase in market share of the big ten banks in recent year (CY05-CY07) along with decreasing market share of the big five banks clearly suggests that second tier big five banks are gaining business ground in the banking sector. The prime reason behind this massive change in market structure is the recent



wave of mergers and acquisitions (M&As). Information on M&As reveals that various mid-size banks have joined their hands to remain in banking business in the wake of increased minimum capital requirement.

More importantly, despite a strong wave of mergers and acquisition in the banking sector, only a little decrease in the number of scheduled banks operating in the country is deceptive at face value. In fact, the decline in number of banks due to mergers and acquisition is substantially masked by establishment of Islamic banks through issuance of Islamic banking licenses (exempt from the implicit moratorium) in recent years. The number of Islamic banks operating in the country surged to 6 by end 2007 compared to only one in the year 2000. Had these licenses not issued by the SBP, the number of scheduled banks would have decreased by 6.

Coefficient of Variation

While M-concentration ratio provides useful information about the skewed nature of distribution, it remains silent about the dispersion in the market. This shortcoming is generally overcome by providing information on coefficient of variation. Information in **Table 2** shows that coefficient of variation has declined in recent years for all three major indicators of the banking sector. It means that dispersion around the mean has declined over time.⁹ Both decrease in M-concentration ratio and coefficient of variation jointly suggest that market structure dynamics of banking sector is improving over time.

Table 2: Coefficient of Variation

End December

	CY96	CY97	CY98	CY99	CY00	CY01	CY02	CY03	CY04	CY05	CY06	CY07
Deposits	2.21	2.09	2.11	2.15	2.10	2.05	1.90	1.79	1.63	1.52	1.49	1.45
Advances	1.92	1.80	1.82	1.83	1.77	1.80	1.57	1.47	1.40	1.44	1.40	1.38
Assets	2.03	1.97	1.96	1.95	1.87	1.83	1.72	1.65	1.51	1.42	1.40	1.39

Herfindahl-Hirschman Index (HHI)

Both M-concentration ratios and Coefficient of Variation provide useful information about the market structure, these measures do not take into account the number of banks operating in the banking sector. As is well known, the number of market participants in the industry has a direct bearing on the issue of concentration and competition. Another widely used measure of market concentration which overcomes this problem is the Herfindahl-Hirschman Index (HHI). The HHI takes into account both the relative size and number of banks in the banking sector. Mathematically, HHI is described as follow.

$$HHI = \sum_{i=1}^m S_i^2 * 10,000$$

Where m is the number of banks and S_i is the share of the i th bank

The HHI will assume the value of 10,000, if there is a single bank in the banking sector (a situation of monopoly). Its value approaches to zero when the banking system consists of large number of banks with close to equal size. **Table 3** shows that values of HHI for all major indicators of the banking sector decreased over the period of analysis. In absolute term, the calculated value of HHI is less than 1000 for recent years--a level below which the market structure is considered

⁹ It is generally assumed that a large number of institutions of a relatively similar size have better chances of competing amongst themselves.

competitive.¹⁰ It may be further noted that improvement in HHI is entirely on account of changes in relative size of banks, as the number of banks has either declined or stayed unchanged over the period of analysis. However, the value of HHI for banking sector falls in the range of a moderately concentrated market place during second half of 1990s.

Table 3: Herfindahl-Hirschman Index (HHI)

End December	CY96	CY97	CY98	CY99	CY00	CY01	CY02	CY03	CY04	CY05	CY06	CY07
Deposits	1255	1149	1190	1259	1238	1185	1130	1032	946	833	810	785
Advances	1004	906	941	967	942	965	852	777	764	772	746	732
Assets	1098	1045	1055	1069	1023	993	973	912	850	762	745	741

In sum, all three traditional measures of concentration record visible improvement over the last decade. Moreover, the ownership structure of banking sector indicates that domestic private banks lead the banking sector. The number of local private banks has jumped from zero in 1990 to 26 by end CY07. Two points related to this significant increase are worth noting. First, episode of establishing domestic banks during first-half of 1990s was largely attributed to the liberalization of financial sector initiated in early 1990s. Second, the recent increase in number of domestic private banks is largely due to newly established Islamic Banks and decision of few foreign banks to switch from branch-mode operations in Pakistan to locally incorporated subsidiaries. As a result, the banking sector of Pakistan is now dominated by the private sector banks holding over 75 percent of banking sector assets.

The above developments in market structure of banking sector can be termed impressive. However, it is hard to conclude that competition in banking sector has also increased as empirical literature on concentration and competition provides mixed results. As mentioned earlier, the literature on market contestability suggests that a highly concentrated market structure can be competitive and a collusive behavior can still be observed in a market with large number of market participants. In these settings, the following section explains methodology used in this paper to measure the degree of market contestability in the banking sector of Pakistan.

III. Methodology

One of the most widely used structural techniques to study the competitive conditions in the banking system is the Panzar and Rosse (1987) framework, commonly known as PR-H statistic. The framework primarily studies the impact of changes in factor input prices (change in cost) on the (equilibrium) revenue of the banking system. Specifically, PR-H statistic is the sum of factor

¹⁰ The U.S. Department of Justice has specified three thresholds levels for HHI to determine the market structure in an industry. There are: (1) less than 1,000 suggest a competitive marketplace; (2) a value of 1,000 to 1,800 indicates a moderately concentrated marketplace; and (3) a result of 1,800 or greater suggests a highly concentrated marketplace.

input elasticities of reduced form revenue equation of the bank or the banking system. Mathematically, the revenue function of the banking sector can be written as:

$$R = f(w, X).$$

Where R denotes the revenue, W represents factor input prices, and X is a set of exogenous variables that shifts the revenue and cost functions. The PR-H statistic, the sum of factor input elasticities of revenue, can be derived as follows:

$$H = \sum_{i=1}^m \frac{\partial R}{\partial w_i} \frac{w_i}{R}$$

This measures the percent change in (equilibrium) revenue due to a one percent change in all input factor prices (change in cost). From duality theory, we know that one percent increase in factor prices will lead to one on one percent upward shift in cost function. The impact of this shift in cost function on the (equilibrium) revenue of the banks is directly related to the degree of competition in the banking sector. The following statistical tests will help in determining the underlying market structure of the banking sector.

Two-sided Perfect Competition Test: If banks are operating under perfect competition at their long run equilibrium, a one percent change in cost will lead to a one percent change in revenues. Given the perfectly elastic demand function under perfect competition, output will remain unchanged, output price and cost will increase by the same extent. This implies that under perfect competition, H-statistic will equal to one. Statistically, we will test the following hypothesis.

$H_0: H = 1$ Perfect competition prevails in the banking sector

$H_1: H \neq 1$ There is no perfect competition in the banking sector

Two-sided Monopolistic Competition Test: if banks are operating in monopolistically competitive environment, one percent increase in cost will lead to less than one percent increase in revenue as the bank faces fairly inelastic demand function. Statistically, we will test the following hypothesis.

$H_0: 0 < H < 1$ Banks are operating in a monopolistic competition environment

$H_1: H \leq 0$ or $H \geq 1$ Banks are not operating in a monopolistic competition environment

One-sided Monopoly Test: Standard theory of market structure suggests that the sum of factor input price elasticities should be less than zero if the underlying market structure is monopoly. Statistically, we will test the following hypothesis.

$H_0: H \leq 0$

$H_1: H > 0$

A noteworthy point of this methodology is the fact that the above tests constitute a joint test of underlying theory and competitive behavior. The implicit assumptions of this model are: (1) the profit maximization behavior of banks; (2) banking sector is in long-run equilibrium; and (3) both revenue and cost functions are well-behaved. Bikker et. al. (2007) have shown that PR-model will yield biased results if the reduced form revenue regression is not correctly specified. We follow Bikker et. al. (2007) to specify the reduced form revenue equation as this will yield unbiased estimate of PR-H Statistics.

$$\ln(II) = \alpha + \beta_1 \ln(APF) + \beta_2 \ln(APL) + \beta_3 \ln(APK) + \sum_{i=1}^n f_i + \varepsilon_{it} \quad (1)$$

Where \ln stands for natural log of variables and II represents interest income of banks. APF denotes average price of funding which is proxied by interest expense to interest bearing liabilities (deposits and borrowings). APL represents average price of labor, which is proxied by ratio of expense on salaries and other benefits of employees to number of employees. APK denotes average price of capital expenditures. This is proxied by ratio of other operating expense to fixed assets. Finally, f denotes a number of bank specific factors as control variables (please see **Table A1** in Appendix for details of the variables).

In practice, the banks also earn non-interest income by using same inputs. This non-interest income accounts for around 10 percent of total income of the banking sector over the period of analysis. This fact is taken into account in two ways. First, we follow Bikker et. al. (2007) in which non-interest income to interest income ratio is used as an explanatory variable. Simple algebra shows that $\ln(TI) = \ln(II + OI) \approx \ln(II) + \frac{OI}{II}$. The use of OI/II as explanatory variable encompasses the model. Second, we directly replace interest income in revenue equation by total revenue as dependent variable.

IV. Estimation and Results

We estimated reduced form revenue equations by using panel data of Pakistani banking sector consisting of 26 banks (both domestic and foreign banks operating in the country) over the period of 1997 to 2007. Besides including bank-specific control variables in the each regression, the estimation takes into account bank-specific fixed effects to capture the impact of time un-varying bank characteristics. We also carried out pooled estimation for each regression to take into account other possible estimation options with panel data. This pooled estimation will also help to compare our H-statistic with those of earlier estimates of H-statistic for banking sector of Pakistan in different studies. Theoretically, there is a justification for the presence of bank-specific fixed

effects as the banks operating in the country face similar macroeconomic and supervisory environment. Finally, the results are based on best-fitted regression equations.

While detailed results of regressions are reported in **Table A2** of Appendix, the value of H-statistic from various specifications of revenue equations alongwith probability values (p-values) for the null hypotheses are presented in **Table 4**. We used both interest revenue and total revenue as dependent variables. The results suggest both bank-specific fixed and pooled regressions provide considerably different values for H-statistic. As a first step towards hypothesis testing, we reject the null hypothesis of H-statistic ($H_0: H=0$ and $H_1: H\neq 0$) in both equations at 1 percent level of significance under fixed effect and pooled specifications. In literature, this test is usually considered to be a test of monopoly structure. In second step, we reject the null of perfect competition ($H_0: H=1$ and $H_1: H\neq 1$) in case of pooled estimations at one percent level of significance. In other specification, we fail to reject the null of perfect competition in case of equation estimated with fixed effect even at 5 percent level of significance. However, we reject this null in case of fixed effect at 10 percent level of significance. As mentioned earlier, all banks operating in Pakistan face the same macroeconomic and regulatory environment, the results from fixed effect estimation are more reliable. We conclude that banking structure cannot be characterized as following perfect competition. For monopolistic competition, we conduct two separate tests at boundary value. In first part, we test the null of $H < 0$ against alternative hypothesis of $H \geq 0$. We reject this test at the 1 percent level of significance under fixed effect and pooled specifications. In the second part, we test the null of $H < 1$ against alternative of $H \geq 1$. We fail to reject this null at one percent level of significance in both specifications. Both these tests jointly suggest that banking structure is best described as monopolistically competitive.

Dependent Variable	H-Statistic	Prb. H=0	Prob. H=1	Prob. H<0	Prob. H<1	Adj. R Square
Interest Income						
Fixed Effect	0.868	0.000	0.053	0.000	0.995	0.997
Pooled	0.407	0.008	0.000	0.004	0.999	0.963
Total Income						
Fixed Effect	0.899	0.000	0.085	0.000	0.957	0.997
Pooled	0.418	0.007	0.000	0.004	0.999	0.966

The results from pooled estimation are also used to compare H-statistic from different studies. This comparison shows that qualitative conclusion of monopolistic competition remains unchanged (see **Table 5**), however the values of H-statistic differ because of various factors. Some of these factors include differences in methodologies especially the specification of dependent variable, estimation options like pooled, fixed effect etc., estimation period, and inclusion of control variables. These factors play an important role in undermining the direct comparison of H-statistic.

Table 5: Comparison H-Statistic of Pakistani banks

Studies	H-Statistic	SE (H)	Conclusion
Claessens and Laeven (2004)	0.480		Monopolistic Competition
Bikker et.al. (2007)			
Specification 1*	0.470	0.261	Reject Monopoly & PC
Specification 2	0.724	0.068	Reject Monopoly & PC
Specification 3	0.734	0.064	Reject Monopoly & PC
Specification 4*	0.457	0.261	Reject Monopoly & PC
Specification 5	0.710	0.074	Reject Monopoly & PC
Specification 6	0.719	0.070	Reject Monopoly & PC
This paper			
Specification 1	0.407	0.153	Monopolistic Competition
Specification 2	0.908	0.089	Monopolistic Competition
This paper			
Specification 1	0.868	0.153	Monopolistic Competition
Specification 2	0.908	0.089	Monopolistic Competition

*: denotes preferred estimates of H-statistic

Although this study is strictly focused on Pakistani banking sector, a cross country comparison may be helpful in understanding where we stand viz a viz our neighboring countries. For this purpose, we borrowed results from Claessens and Laeven (2004) and Bikker et.al (2007).¹¹ The results based on pooled estimation from these studies suggest that H-statistic for all regional countries indicate monopolistic competition in the banking sectors of respective countries (Table 6). It may

Table 6: International Comparison of H-Statistic

Countries	Claessens and Laeven (2004)	Bikker et.al. (2007)
<i>Regional Countries</i>		
Bangladesh	0.69(0.13)	0.966(0.064)
India	0.53(0.04)	0.736(0.022)
Pakistan	0.48(0.13)	0.724(0.068)
Philippines	0.66(0.05)	0.715(0.055)
Turkey	0.46 (0.21)	0.651(0.094)
<i>Developed Countries</i>		
UK	0.74(0.04)	0.776(0.035)
USA	0.41(0.01)	0.583(0.008)
Canada	0.67(0.07)	0.792(0.040)
Switzerland	0.67(0.03)	0.555(0.034)

The values of H-statistic for Pakistan based on pooled estimation from this study are 0.407 and 0.418.

be noted that utility of this cross country comparison must be discounted by familiar problems including variation in model specification, differences in sample sizes, and use of estimation procedures.

Robustness of Results

As mentioned in Section III, validity of PR H-statistic rests on certain assumptions. A key assumption which can significantly alter the findings of PR model is the long-run equilibrium.

¹¹ Both studies have estimated Panzar-Rosse H-Statistics for various countries as a part of their broad objectives. Specifically, Claessens and Laeven (2004) estimate PR-H statistics for 50 countries to understand the determinants of competition, while Bikker et.al (2007) estimate PR-H statistics for 101 countries to show how misspecification of revenue equation can yield misleading results about market structure.

This implies there should not be any entry or exit from the banking sector, as the market has attained its equilibrium. Contrary to this, the banking sector of Pakistan has witnessed consolidation in banking sector over the period of analysis, especially in recent years. This situation warrants further investigation.

On this issue, a notable point is the construction of panel data consisting of 26 banks (not all banks) from the year 1997 to 2007. Specialized banks were excluded from the data, as their behavior is significantly different from those of commercial banks. Similarly, newly established small banks were also excluded as they do not have an established presence. These adjustments left us with 26 banks operating over the period of analysis. A key point to note is the fact that 26 banks hold over 90 percent of commercial banks assets over the period of analysis, which shows that there is no significant loss of information from restricting the number of banks to 26. While these adjustments are expected to help reduce the problem of entry or exit of new banks in line with the required assumptions for the PR-H statistic, an indirect effect of the presence of these banks on the behavior of the rest of the banks included for analysis does exist.

In addition to above adjustments, formal test of equilibrium suggested in literature is also used. Theoretically, there should be no relationship between the return on assets (profits) and input prices if the market is in equilibrium. We test this assumption by estimating following regression.

$$\ln(ROA) = \alpha + \beta_1 \ln(APF) + \beta_2 \ln(APL) + \beta_3 \ln(APK) + \sum_{i=1}^n f_i + \varepsilon_{it} \quad (2)$$

Where ROA denotes return on assets. From above regression, we define long-run equilibrium as follows:

$$E = \beta_1 + \beta_2 + \beta_3 = 0$$

The estimated equilibrium statistics E is tested by using a standard F -Test against the alternate hypothesis that E is not equal to zero.¹² The results show that we fail to

Table 7: Test of Equilibrium		
Dependent Variable	E-Statistic	Prob. H=0
Return on Assets		
Fixed Effect	-0.154	0.240
Pooled	0.105	0.463

reject the null of equilibrium ($E=0$) under both the fixed effect and pooled specifications (see **Table 7**).¹³ This lends more credence to our earlier results that market structure of banking sector is characterized by monopolistic competition.

¹² It may be noted that this approach for testing equilibrium is widely used in literature including Claessens and Laeven (2003), and Molyneux et al. (1996).

¹³ Detailed results are reported in **Table A4** of Appendix.

V. Conclusion

The paper explores concentration and competition in banking sector of Pakistan by using bank-wise annual data from 1997 to 2007. Traditional measures of concentration show that level of concentration has been declining since the year 2000. The absolute value of HHI has declined to below 1000 since the year 2004 for all three major indicators of the banking sector. It means that banking sector of Pakistan falls in the range of a competitive market structure. A notable point is the fact that improvement in HHI is entirely on account of improving distribution of major banking sector variable as the number of banks have slightly decreased due to on-going consolidation in the banking sector.

Due to mixed results on relationship between concentration and competition, we used a far more direct approach developed by Panzar and Rosse (1987) to measure the degree of competition in Pakistani banking sector. This approach takes the issue of competition in terms of market contestability. A reduced form revenue equation is estimated by using panel data consisting of 26 banks over the period of 1997 to 2007. The various tests on PR-H statistic suggest that banking sector of Pakistan is consistent with a monopolistically competitive market structure. The null of both monopoly structure and perfect competition were rejected even at 1 percent level of significance.

We also establish the robustness of the results by explicitly testing a key assumption of PR model, i.e. market is in long-run equilibrium. The results show that we fail to reject the null of no relationship between return on assets and factor input prices. This lends more credence to our earlier finding of monopolistic competition in the banking sector of Pakistan.

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Appendix: Data Description and Results of Basic Estimation

Table A1: Data Description

Code	Definition
<i>Dependent Variables</i>	
II	Interest Income
TI	Total Income
<i>Explanatory Variables</i>	
<i>Input Variables</i>	
Lcost	Cost of Labor: Salaries, allowances and other benefits to employees to number of employees
Fcost	Cost of Funding: Interest expense to average interest bearing liabilities (deposits and borrowings)
Kcost	Cost of Capital: Other operating cost to fixed asset ratio.
<i>Bank Specific Variables</i>	
DFB	Ownership dummy: one if a bank is foreign owned bank, zero otherwise.
DPSCB	Ownership dummy: one if a bank is Public Sector Commercial bank, zero other wise
LTAR	Loans to asset ratio
OITII	Other income to interest income ratio
SFD	Share of Fixed deposits in total deposits
SP	Average spread: gap between interest earned on interest bearing assets and interest paid on interest bearing liabilities
NEAS	Non-interest earning assets to total asset ratio
NPLTLR	Non-performing loans to total loan ratios
CAR	Capital To Risk Weighted Asset ratio

Table A2: Interest Income as dependent variables

Variable	Fixed Effect		Pooled Estimation	
	Coefficient	t-statistics	Coefficient	t-statistics
Intercept	8.256	14.729	11.104	10.674
Lcost	0.826	10.297	0.866	8.699
Fcost	0.308	6.208	-0.139	-1.383
Kcost	-0.266	-5.366	-0.319	-6.265
<i>Bank Specific Variables</i>				
DFB	-0.384	-3.365	-0.567	-4.316
DPSCB	0.221	4.145	0.811	5.876
LTAR	0.484	5.206	0.306	1.364
OITII	-0.005	-5.237	-0.006	-4.100
SFD	0.101	2.854	0.210	2.438
SP	0.229	5.410	0.831	12.199
NEAS	-0.397	-3.674	-0.285	-3.0281
NPLTLR	0.059	3.075	0.065	2.737
CAR	-0.095	-1.661	-1.111	-8.249
Adj. R-Square	0.997		0.963	
No. of Obs.	281		281	
H-Statistic	0.868		0.407	

Table A3: Total Income as dependent variables

Variable	Fixed Effect		Pooled Estimation	
	Coefficient	t-statistics	Coefficient	t-statistics
Intercept	8.603	15.308	11.227	11.348
Lcost	0.854	11.355	0.878	9.550
FCost	0.303	6.879	-0.136	-1.501
Kcost	-0.259	-5.476	-0.323	-5.742
<i>Control variables</i>				
DFB	-0.349	-3.479	-0.566	-4.743
DPSCB	0.245	4.319	-0.826	5.973
LTAR	0.456	4.873	0.323	1.504
SFD	0.088	2.602	0.205	2.289
SP	0.199	4.527	0.829	12.046
NEAS	-0.407	-3.915	-0.300	-2.978
NPLTLR	0.057	3.207	0.067	2.418
CAR	-0.112	-1.808	-1.127	-9.676
Adj. R-Square	0.997		0.966	
	281		281	
H-Statistic	0.899		0.418	

Table A4: Return on Assets as dependent variables

Variable	Pooled Estimation		Fixed Effect	
	Coefficient	t-statistics	Coefficient	t-statistics
Intercept	-18.993	-9.560	-14.171	-3.724
Lcost	0.235	2.919	0.305	3.321
FCost	-0.174	-2.602	-0.297	-3.033
Kcost	0.045	0.810	-0.162	-1.799
<i>Control variables</i>				
LATAR	-0.641	-6.012	-0.351	-2.563
SP	0.620	5.218	0.657	4.379
ETTAR	4.420	10.529	3.174	3.460
CAR	0.5025	4.359	0.708	8.898
Adj. R-Square	0.373		0.499	
No. of Obs.	244		244	
E-Statistic	0.105		-0.154	