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CONCENTRATION AND COMPETITION IN NEPALESE BANKING

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ABSTRACT

This paper examines the evolution of market concentration and tests the market competition of Nepalese banking industry for an unbalanced panel of 15-25 banks for the period of 2001-2009. The market concentration is measured by Hirschman-Herfindahl indices and concentration ratios, and market competition is tested under Panzar-Rosse approach. The concentration measures indicate decreasing trend and low level of market concentration in Nepalese banking industry over the sample period. The test of market competition/contestability by using Panzar-Rosse approach rejects both the hypotheses for monopoly and perfect competition indicating monopolistic market behaviors among the Nepalese banks. In addition, the market for interest-based income is found to be more competitive than that of the market for fee-based income. The results further indicate that the size of bank has positive, and equity capitalization has negative impact on revenue generation. The results are robust across different specifications and across different estimation techniques.

1. INTRODUCTION

Nepalese banking industry has changed significantly over the past few decades as a result of liberalization, deregulation, advancement in information technology and globalization. The financial sector liberalization resulted into entry of new banks in the market; deregulation widened the scope of activities and delimited the banking activities; advancement in technology resulted into new ways and tools to perform banking activities; and globalization added more pressure on competitiveness of individual banks. Moreover, the banks, nowadays, are entering into non-banking markets and other financial institutions are entering into the banking markets that have traditionally been served by the banks. These factors have changed the structure and market behavior of Nepalese banking industry. From theoretical perspective, neoclassical organizational economic theories state that the structure of industry affects conducts (pricing behaviors) of firms and conducts, in turn affect the performance. The structure of industry is more subject to number of competing firms within an industry, nature of products and services they are providing, barriers to entry and exit and the likes. The structure-conduct-performance (SCP) hypothesis states that concentration encourages collusive behavior of firms by reducing the cost of collusion. Hence high concentration may impair the competition. In contrast to the SCP hypothesis, the efficient structure hypothesis states the market behavior of firm largely depends on the efficiency of the firm. The efficient firm may have some competitive advantages hence it can increase its market share and realize better performance. From market contestability perspective, the theories further state that, a number of factors such as restrictions on entry, cost of exit, competition from non-banking financial institutions, development of capital markets, play an important role in determining the level of market competition. The collusive behavior may exist and thrive even in the presence of a large number of banks when the market is less contestable.

In literature, there are two empirical approaches to examine the market structure and competition. From structural approach, bank concentration measures such as number of banks, market share of banks etc. are used to explain the market behavior (Bain, 1951). From non- structural approach, different frameworks are developed to assess the market behavior and competition. The main non-structural models are Iwata model (Iwata, 1974), Bresnahan and Lau model (Bresnahan, 1982; Lau, 1982) and Panzar and Rosse model (Rosse and Panzar, 1977; Panzar and

Rosse, 1987). The basic premise of non-structural approach is that the firms within an industry behave differently depending on the market structure in which they operate (Baumol, 1982). With this background, this paper aims at examining the evolution of market structure, particularly market competition in Nepalese banking industry using both structural and non-structural measures. The rest of the paper is organized as follows. The section two provides a brief overview of Nepalese banking industry. Section three briefly reviews some empirical studies on Market competition that used PR model; section four describes the empirical methodology; section five presents and analyzes the empirical results and finally section six concludes the paper.

2. AN OVERVIEW OF NEPALESE BANKING INDUSTRY

Nepal has a short history of the modern banking practices that starts from the establishment of Nepal Bank Limited as a first commercial bank in 1937. The establishment of Nepal Rastra Bank in 1956 as a central bank gave new dimension to Nepalese financial system. Nepal adopted financial sector liberalization process during 1980s. As a result, many joint-venture and private banks entered into the market. By the end of mid-July 2009, 26 commercial banks were in operation in Nepal. Of the 26 commercial banks, 3 were state-owned and 23 were privately owned (17 domestic and 6 foreign joint-ventures). Table 1 provides some selected statistics for Nepalese banking industry. The group share of state, private and foreign owned commercial banks in total assets of the banking sector indicates decrease in the dominance of large state-owned banks as a consequence of financial sector liberalization and reformation (Nepal Rastra Bank, 2009). The relatively high value for the ratio of total banking sector assets to real GDP signifies the importance of banking system in Nepalese economy. Banks are the major lenders to private sectors because Nepalese capital market is at the initial state of development and bank financing is important source of financing for firms (Nepal Rastra Bank, 2009).

TABLE 1. SELECTED STATISTICS FOR NEPALESE BANKING INDUSTRY

Indicators\Year	**2001**	**2005**	**2009**
Number of licensed commercial banks	15	18	26
% Share of Total Assets (No. of banks)			
State	48.35 (2)	40.16 (3[a])	26.69 (3)
Private-Domestic	12.09 (7)	23.51 (9)	42.03 (16[b])
Private-Foreign	39.56 (6)	36.33 (6)	31.28 (6)
Branches per 1,000 sq. km	2.92	2.87	5.11
Branches per 100,000 people	1.86	1.67	2.72
Total bank assets to real GDP (%)	79	102	190
Total bank deposits to real GDP (%)	57	69	132
Asset share of the three largest banks (%)	58	35	25
Bank loans to government (% of GDP)	0.91	0.67	0.61
Bank loans to private sector (% of GDP)	33	44	93

[a] Agricultural Development Bank was promoted as commercial banks in 2005.
[b] KIST Finance Company was promoted as a commercial bank during last quarter of 2009, hence not included.
Source: Nepal Rastra Bank (2009) and Author's calculation

In contrast, the lending is very nominal to government sectors because government sector receives budget, loan or credit from government or other government owned financial institutions like Employment Provident Fund, Nepal Industrial Development Corporation, etc. The cumulative lending to private and government institutions is lower than deposits to GDP ratios, so reflects comparatively low level of credit to the household and firms. The low level of branch network/extension reflects lack of wider access to banking and higher geographic concentration of banks. Most of the banks' head office is located in Kathmandu and their branches are clustered around major cities of the country. Some earlier studies are confined to US and Canadian markets, however latter studies are focused on other economies including EU and developing economies. Shaffer (1982), perhaps first to report the results on banking competition by using the Panzar-Ross model. By using the sample banks from New York for the period of 1979-1980, the authors observed competitive bank market despite the banks in New York City had exercised some market power. In Canadian context, Nathan and Neave (1989) used the PR model to test for competitiveness in the banking, trust, and mortgage industries over three years period from 1982 to 1984. For the banking industry for each of those years, the hypothesis of pure collusion was rejected. Bank revenues behaved as if earned under monopolistic competition for each of the years and perfect competition could not be ruled out for 1982. Tests for the trust and mortgage industries also rejected pure collusion. Similarly, Shaffer (1993) used data from 1965 to 1989 to test Canadian banking market contestability using the BL model. The results indicated that the banking behavior was consistent with perfect competition over this period.

3. LITERATURE REVIEW

This section reviews some of the recent studies that examined competition in banking markets using non-structural approaches. These studies mainly used the Panzar and Rosse (1987) method to investigate competitive conditions. Table 2 below summarizes the major findings.

TABLE 2. REVIEW OF EMPIRICAL STUDIES ON MARKET STRUCTURE – PR MODEL

Study	*Sample period*	*Country*	*Major findings*
Shaffer (1982)	1979	New York (USA)	MC
Nathan and Neave (1989)	1982-84	Canada	MC: 1983, 1994 PC: 1982
Molyneux *et al.* (1994)	1986-89	France, Italy, Spain, Germany, UK	MO: Italy MC: other countries
Bikker and Groeneveld (2000)	1989-96	15 EU countries	MC: all countries
De Bandt and Davis (2000)	1992-96	France, Germany, Italy	MC: large banks in all countries and small banks in Italy MO: small banks in France and Germany
Bikker and Haaf (2002)	1988-98	23 industrialized countries	MC: all countries Competition weaker in small markets and stronger in international markets
Claessens and Laeven (2004)	1994-01	50 countries (both developed and developing)	MC: all countries Largest countries tend to have lower competition level
Casu and Girardone (2006)	1997-03	EU-15 countries	PC: Finland MO: Greece MC: all other countries and EU Single market
Perera *et al.* (2006)	1995-03	4 SAARC countries	MC: all countries

Note: MO= Monopoly, MC=Monopolistic competition, PC=Perfect competition

Looking at the cross-country studies carried out in the EU banking markets, one of the earliest analyses was undertaken by Molyneux et al. (1994) who tested the Panzar–Rosse H-statistic on a sample of banks in France, Germany, Italy, Spain and the UK for the period 1986–89. Results indicated monopolistic competition in all countries except Italy where the monopoly hypothesis could not be rejected. Other cross-country EU studies are more recent. Bikker and Groeneveld (2000) tested the competitive structure in the banking industry in the EU as a whole as well as in individual EU countries and provide evidence that European banking sectors operate under conditions of monopolistic competition, although to varying degrees. De Bandt and Davis (2000) assessed the effect of the Economic and Monetary Union on market conditions for banks operating in the Eurozone over the period 1992–96 and compared the behavior of large and small Economic and Monetary Union banks with a US banking sample. They found that the behavior of large banks was not fully competitive compared with the USA, while the level of competition appeared to be even lower for small institutions especially in France and Germany. Bikker and Haaf (2002) examined competitive conditions and market structure for 23 countries over the 1990s by relating market competitiveness (as measured by the H-statistic) with market structure (the degree of concentration). Although they found that competitiveness was negatively related to concentration, the results were weak. In addition, they found monopolistic competition in all countries. Their estimations also showed that competition was weaker among small banks operating mainly in local markets and stronger in inter-national markets where large banks usually operate. Competition was found to be stronger in Europe than in Canada or USA.

Claessens and Laeven (2004) carried out a major study of competition and concentration that included 50 developed and developing countries' banking sectors. By using panel data for 1994–2001, they constructed H-statistics for 50 countries. Consistent with Bikker and Haaf, imperfect competition described each of the countries to varying degrees; some countries that had a large number of banks exhibited relatively low levels of competition (e.g., the United States).They found the systems with greater foreign bank entry and fewer entry and activity restrictions to be more competitive. They also found no empirical evidence that the competitiveness measure related negatively to the banking system concentration. Casu and Girardone (2006) investigated the impact of consolidation on the competitive conditions and their cross country determinants of the EU banking markets for the period of 1997-2003 assuming a single EU banking market. By using the similar methodology of Bikker and Haaf (2002) and Claessens and Laeven (2004), the authors observed monopolistic market competition in the EU Single Market. At country level, they also found near perfect competition in Finland

whereas monopoly competition in Greece. Furthermore, they found little or no evidence on relationship between competition and concentration which was in contrast to the findings of Bikker and Haaf (2002) and concluded that concentration measures may not be a reliable indicator for bank competitive environment. Perera et al. (2006) examined the nature of competition and structure in South Asian banking markets. The study also assessed whether traditional interest-based product market segments are more competitive than those that also include fee- and commission-based products. The results from Panzar–Rosse specification tests showed that bank revenues appear to be earned under conditions of monopolistic competition during the period 1995 to 2003. In Bangladesh and Pakistan competition is greater in the traditional interest-based product markets while Indian and Sri Lankan domestic commercial banks seem to face more competitive pressure in the fee-based product market from other financial intermediaries. There is scarcity of studies on market structure in Nepalese context. This study is perhaps the first of its type that employs both structural and non-structural measure to assess the market concentration and contestability. The results of this study have significant policy implications to enhance the health of Nepalese banking system.

4. DATA AND METHODOLOGY

4.1 Data

This study considers all the commercial banks operating in Nepal for the sample period of nine years from 2001 to 2009. There are minimum of 15 banks (for 2001) and maximum of 25 banks (for 2009) in each year during sample period. The KIST bank was promoted as commercial banks in 2009. Hence it is not included in study. The nine year sample period is regarded as sufficient to capture characteristics of Nepalese banking industry. The choice of sample period is also confined by the availability of data. Although there are other financial institutions (development banks, finance companies, saving and credit institutions/cooperatives) that provide banking and near banking or limited banking activities, still the share of commercial banks on total financial institutions' asset is more than eighty percent over the sample period (Nepal Rastra Bank, 2009:12). Therefore, the sample used in this study may rightly represent Nepalese banking industry.

This study is mainly based on accounting (secondary) data of commercial banks. The required data have been extracted from annual reports and financial statements of the banks available in Securities Board (SEBO) database and Nepal Rasta Bank (NRB) database.

4.2 Methodology

In line with earlier empirical studies in banking market competition (Molynuex et al., 2006), market concentration, as measured by "k-bank", say largest three banks, largest five banks concentration ratios and the Hirschman-Herfindahl index (HHI), are used as indicators to determine the level of market concentration in Nepalese banking industry. "k-bank" concentration ratio is the sum of "k" largest banks' market share. The higher "k-bank" concentration ratio indicates higher market power of k-banks in market and high degree of concentration and low degree of market competition. This study uses three-bank and five-bank concentration ratios.

Similarly, HHI is computed as the sum of square of market share of each firm within an industry. Generally, increasing HHI indicates a decrease in market competition and increase in the market power of larger firms. A decreasing HHI suggests increase in market competition. HHI captures the number of firms in the industry which is not considered in "k-bank" concentration ratio.

The HHI is computed as,

$$\text{HHI} = \sum_{i=1}^{n} MS^2 \qquad \ldots (1)$$

where, MS is the market share of the bank. As mentioned in US Merger Guidelines[1], a HHI index below 0.01 (or 100 points) indicates a highly competitive market, the HHI index below 0.1 (or 1,000) indicates an unconcentrated market and HHI index between 0.1 to 0.18 (or 1,000 to 1,800) indicates moderate concentration; and a HHI index above 0.18 (above 1,800) indicates high concentration. In this study three HH indices are developed based on three variables – total deposits, total loans and total assets.

[1] http://www.usdoj.gov/atr/public/guidelines/horiz_book/hmg1.html

The Panzar-Rosse method: Following the empirical literature on competition in banking markets (Bikker and Haff, 2002: Casu and Girardone, 2006; Perera *et al.*, 2006), this study employs the reduced-form revenue equation as specified by Panzar and Rosse (1987). The Panzar and Rosse (1987) model is one of the most widely used techniques to study competitive conditions in the banking. Assuming long-run market equilibrium, this approach assesses the impact of changes in factor prices on the revenue under the different market structure. The individual bank prices differently in response to the change in its factor inputs cost. The magnitude of changes helps to determine the degree of market competition in the market.

The reduced-form revenue model[2] is:

$$\ln REVN_{it} = a + b_1 \ln INTC_{it} + b_2 \ln LC_{it} + b_3 \ln OTHC_{it} + b_4 \ln LOAN_{it} + b_5 \ln TA_{it} + b_6 \ln EQUTY_{it} + e_{it} \quad \ldots(2)$$

where *REVN it* is the ratio of total interest revenue to total assets for bank *i* at time *t*, $INTC_{it}$ is the total interest expenses to total deposit, LC_{it} is the ratio of personal/staff expenses to total assets, $OTHC_{it}$ is the ratio of total other operating expenses to total assets, $LOAN_{it}$ is the ratio of total loans to total assets, TA_{it} is total assets, $EQUTY_{it}$ is the ratio of equity to total assets, and e_{it} is the stochastic error term that capture time-varying and bank-specific random components. The first three independent variables are the factor input prices for funds, labor and capital respectively and latter three are bank-specific control variables. Since the PR model follows the log-linear form, the sum of factor price elasticities is termed as "H-statistic". The value of H-statistic depends on the competitive environment and corresponding behaviors of banks. Goddard *et al.* (2001) linked value of H-statistic with competitive environment. Under perfect competition, the value of H-statistic is 1 that means, 1.0 percent change in cost will lead to a 1.0 percent change in revenues. On the other hand, under the monopoly market structure, the value of H-statistic is 0 because in monopoly market, increase in factor inputs' cost increases the marginal cost, reduces the outputs and ultimately decrease in revenue. The value of H between 0 and 1 indicates the monopolistic competition in the market; the higher value indicates higher degree of competition.

In addition, following the Perara *et al.* (2006), second specification of equation (2) is developed for total revenue of banks as dependent variable with same independent variables. And total revenue is the sum of interest income, commission and discount income, forex income and other operating income. Therefore, the original model is regarded as interest-based market model and second specification is regarded as total market model. The equation (2) is estimated using the fixed effects estimators. The use of fixed effect estimator is motivated from the fact that the banks in a country face same supervisory and macroeconomic environment.

5. EMPIRICAL RESULTS AND DISCUSSION

Table 3 summaries the descriptive statistics of variables used in this section. Some interesting reservations exist in Nepalese banking industry. The significant difference between mean and median statistics is the result of high degree of domination of large banks during initial years of sample period. For example, the negative total equity is the result of large amount of negative networth of two government owned banks namely Rastriya Banijya Bank and Nepal Bank Limited. The assets base, deposit base and loan base of these two banks are very high in comparison to other banks; however annual figures (not presented here) indicate decreasing trends.

5.1 Bank Concentration Ratio

The Nepalese banking industry is generally characterized by the dominant position of the five large banks. The share of these five banks in the overall assets of the banking industry was 76.76 percent in 2001. Since then, the structure of the banking sector has evolved substantially. While the total number of banks operating in the country increased from 15 in 2001 to 25 in 2009, all these new banks are domestic private banks. This increase in the number of banks helped in reducing concentration, as the asset share of the top five banks in the overall assets of the banks declined to 39.31 percent by 2009. In Table 4, the CR3 and CR5 depict the market share of three and five largest banks respectively. The three-bank concentration ratio on total assets has declined from 58.08 percent in 2001 to about 25.48 percent in 2009, a more than 50% decline. Similarly, the level of and the trend for concentration ratios on deposit is similar to the assets base concentration ratios. In 2001, the share of these five banks in the total deposit of the banking industry was 75.70 which declined to 41.91 percent in 2009. The five-bank concentration ratio on loan decreased from 67.51 percent in 2001 to 33.61 percent in 2009. Furthermore, the market shares of the largest three and five banks, in terms of total assets, total deposit and total loan have declined

[2] *See* Panzar and Rosse (1987) and Parera et al. (2006) for details of derivation of reduced form revenue function.

significantly over the last few years, in particular since 2005. Moreover, the concentration ratio of loan declined significant in 2002. The significant decrease in the concentration ratios reflects the changing market structure of the banking sector. These evidences suggest increasing market competition in Nepalese banking industry. The rate of change in CR3 is more than that of CR5 suggesting emergence of new larger (dominant) players in the market.

TABLE 3. DESCRIPTIVE BANK STATISTICS

Variables	Mean	Median	St. Dev	Max	Min
Equity	-452	680	6044	13367	-23514
Deposit	15143	10557	134427	68096	113
Investments	4062	1970	4433	18640	3.78
Loan & Advances	8805	7184	6992	36827	0.28
Total Assets	17213	11933	14587	75043	384
Interest Income	1307	758	3869	50244	1.87
Operating Income	734	467	725	3666	-231
Interest Expenses	499	340	451	2571	0.35
Staff Expenses	253	66	496	3249	2.88
Other Expenses	138	104	100	448	2.45
Net Income	115	117	1048	2472	-7083

Note: The values are in Rs. Million and expressed in the nominal term

TABLE 4. BANK CONCENTRATION RATIO

Year	No. of Banks	Deposit		Loan		Assets	
		CR3	CR5	CR3	CR5	CR3	CR5
2001	15	0.57	0.76	0.49	0.68	0.58	0.77
2002	16	0.54	0.66	0.39	0.50	0.53	0.66
2003	17	0.48	0.63	0.33	0.47	0.48	0.62
2004	17	0.44	0.60	0.29	0.43	0.44	0.60
2005	18	0.37	0.50	0.23	0.36	0.35	0.49
2006	18	0.35	0.49	0.23	0.37	0.31	0.47
2007	20	0.33	0.48	0.22	0.35	0.31	0.46
2008	25	0.32	0.47	0.20	0.34	0.27	0.42
2009	26	0.27	0.42	0.20	0.34	0.25	0.40
Average	19	0.41	0.56	0.29	0.43	0.39	0.54

5.2 Hirschman-Herfindahl Index

While three-bank and five bank concentration ratios 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 issues 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 industry. Table 5 summarizes Herfindahl-Hirschman Index on deposit, loan and total assets of Nepalese commercial banks for the period of 2001-2009. HHIdepo, HHIloan and HHIta summarize how deposit, loan and total assets concentration vary over the sample period. The values of HHI for all the major indicators of the banking sector decrease over the period of analysis. The evidences suggest that before 2005, the Nepalese banking industry was moderately concentrated (HHI was above 0.10), particularly in deposit and total assets. The HHI for deposit was 0.1443 in 2001 and decreased by more than half to 0.0595 in 2009, for 9 years period. Similar is the evidence for total assets. The measure was 0.1528 in 2001 and decreased to 0.0571 in 2009.

TABLE 5. HERFINDAHL-HIRSCHMAN INDEX

		Herfindahl-Hirschman Index		
Year	No. of Banks	Deposit	Loan	Assets
2001	15	0.1443	0.1217	0.1528
2002	16	0.1376	0.0982	0.1363
2003	17	0.1247	0.0847	0.1199
2004	17	0.1092	0.0769	0.1081
2005	18	0.0916	0.0775	0.0880
2006	18	0.0839	0.0765	0.0791
2007	20	0.0789	0.0686	0.0750
2008	25	0.0700	0.0587	0.0626
2009	25	0.0595	0.0538	0.0571
Average	19	0.1000	0.0796	0.0976

There is significant decline in HHI for loan from 2001 to 2002, from 0.1217 to 0.0982. The annual figure of HH indices show that that the break point for loan market is 2002 and for deposit and total assets is 2005. Among three segments presented here, the market is less concentrated in loan market segment indicating higher competition in loan market as evident from lower HHI for loan. Figure 1 captures the trend of Herfindahl-Hirschman Indices for the sample period. The overall results suggest less concentrated or unconcentrated (as suggested by US Merger Guidelines) banking market in Nepal. The similar and highly correlated HH indices confirm it[3]. Putting all together, the process of economic liberalization, financial sector liberalization over last decades in economy brought structural changes in the industry. The process of deregulation and reform led to rapid expansion of number of banks, and their assets, deposit and loan bases. In this background, there is a remarkable decline in degree of market concentration in the banking sector, as measured by three-bank and five-bank concentration ratios and the Herfindahl - Hirschman index (HHI) indicating that market competition (competitive market) in Nepalese banking industry has increased over the last decade.

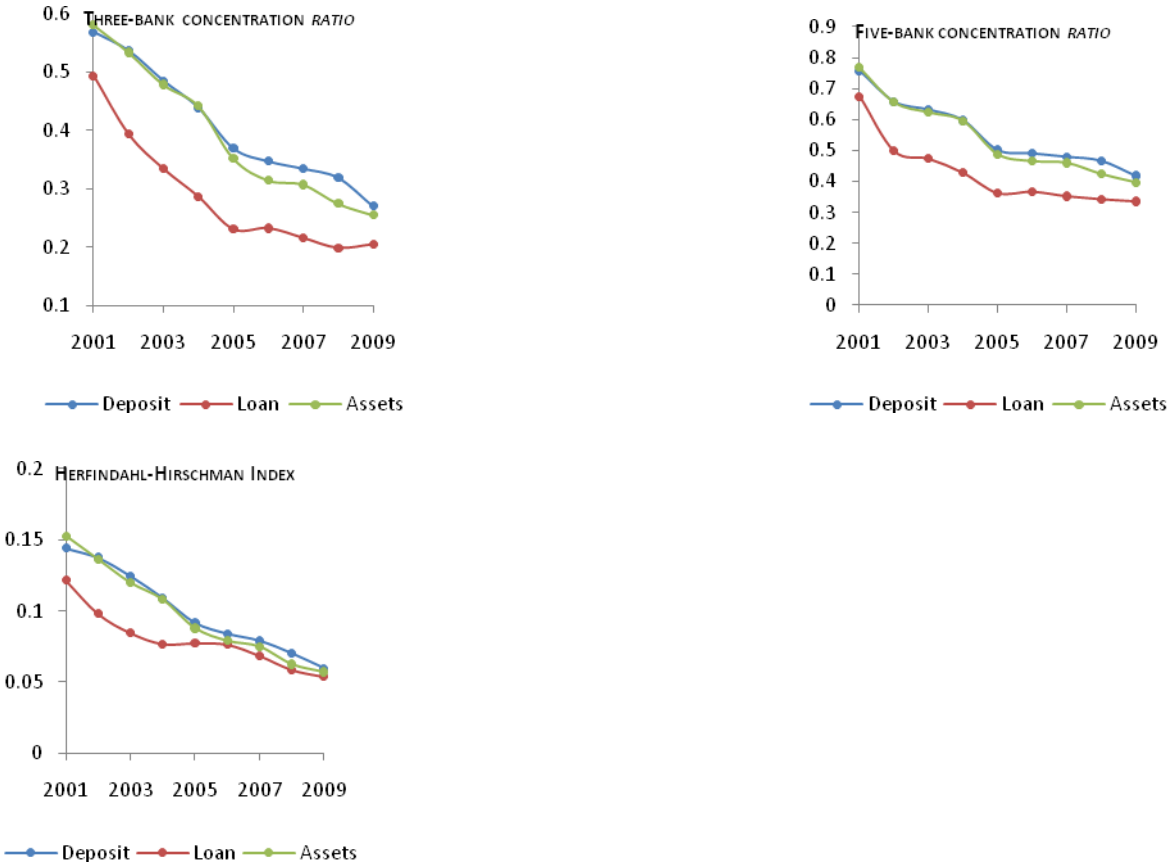

FIGURE 1: TREND OF MARKET CONCENTRATION

5.3 Test of Market Structure: Panzor and Rosse Model

Among the non-structural models, one of the widely used techniques to study competitive conditions in the banking industry is the Panzar and Rosse (1987) model. The Panzar-Rosse (PR) model assesses the impact of changes in factor prices on the revenue under the different market structure. The magnitude of changes helps to determine the degree of market competition in the market. Table 6 presents the Pearson correlation matrix of variables used in Panzar-Rosse model. From the table, it reveals that there is lower correlation among explanatory variables; hence multicolinearity may not be the serious problem while estimating the parameters.

[3] The correlation coefficient of HHI between total assets and deposit is 0.995 and total assets and loan is 0.949.

TABLE 6. CORRELATION MATRIX

	REVN	*INTC*	*LC*	*OTHC*	*LOAN*	*TA*	*EQTY*
REVN	1.00						
INTC	0.49	1.00					
LC	0.44	-0.13	1.00				
OTHC	0.24	-0.11	0.23	1.00			
LOAN	0.22	0.08	-0.12	-0.19	1.00		
TA	-0.12	-0.47	0.11	-0.43	0.25	1.00	
EQTY	-0.19	0.11	0.23	0.06	-0.30	-0.45	1.00

Note: REVN is the ratio of interest income divided by total assets; INTC is the interest expenses divided by total deposit; LC is the staff expenses divided by total assets; INTC is the ratio of interest expenses to total deposit and borrowed funds; LC is the ratio of staff expenses to total assets; OTHC is the ratio of other operating expenses to total assets. LOAN is the ratio of loan to total assets; TA is the total assets; and EQUTY is the ratio of equity to total assets.

The fixed effect estimates for both models are reported in Table 7. The models are statistically significant and have reasonably sound explanatory power evident from adjusted R-square values. All the coefficients, except for the LOAN, are statistically significant. The sum of elasticity of factor prices is 0.685 in Model I and 0.5969 in Model II suggesting monopolistic competition in Nepalese banking industry. The Wald tests for perfect competition (H=1) and for monopoly (H=0) that reject the null hypotheses reconfirms the conclusion. The higher value of H-statistic in Model I indicates that there is higher competition among Nepalese banks in interest income based market than that of in non-interest income market. An analysis of the sign and significance of the regression coefficients, particularly price of inputs in table 6, indicate that the price elasticity of funds, labor and capital are positive and statistically significant in both the models. In interest-based product market (Model I), the impact of cost for funds seems to be high and the labor cost seems to be low. However, these results vary in total market (Model II) where cost of capital seems to be low compared with other input prices. The results are consistent with (Molyneux et al., 1994; Bikker and Haaf, 2002; Casu and Girardone, 2006). In addition, for interest based market, cost of funds has higher influence on revenue (income); the elasticity is 0.3872 for Model I and 0.2297 for Model II.

Regarding other bank-specific variables in regression, the coefficient of lending activities, measured by loan to total assets is positive, suggesting positive effect of lending activities on revenue of the banks. However the coefficient is not statistically significant at normal level.

TABLE 7. FIXED EFFECTS ESTIMATES OF PR MODEL

	Model I			Model II		
	Interest-based product market			Total market		
	Coefficient	S. Error	P-value	Coefficient	S. Error	P-value
INTC	0.387	0.029	0.000	0.230	0.035	0.000
LC	0.128	0.040	0.002	0.196	0.049	0.000
OTHC	0.169	0.042	0.000	0.171	0.051	0.001
LOAN	0.011	0.007	0.110	0.009	0.008	0.270
TA	0.046	0.015	0.003	0.044	0.018	0.015
EQUTY	-0.110	0.023	0.000	-0.090	0.028	0.002
CONSTANT	-1.372	0.272	0.000	-0.942	0.331	0.005
Adj. R-Squared	0.646			0.579		
F-statistic	43.79			14.48		
p-value of F-stat.	0.000			0.000		
H-statistic	**0.685**			**0.597**		
Wald test for H=1						
F-statistic	29.94			33.18		
p-value of F-stat.	0.000			0.000		
Wald test for H=0						
F-statistic	141.5			72.78		
p-value of F-stat.	0.0000			0.000		
No. of observations	130			130		

Note: In Model I, dependent variable is log of total interest income to total assets and in Model II dependent variable is the log of sum of interest income, commission and discount income, and other operating income to total assets. All the independent variables are measured in log scale. The H-Statistic (in bold) is the sum of first three coefficients. In Wald test, the given statement is the null hypothesis. The log-linear function of model and equilibrium test limited the sample size to 130 observations. For variable description *see* Table 6.

The size of the bank plays significant and equal role in generating revenue in interest-based market and total market as signified by the positive and statistically significant coefficient. The marginal propensity of revenue (interest income) with respect to asset base is approximately 4.5 percent (0.045) indicating some scale economies

on revenue generation. The sign of equity capitalization is negative and statistically significant in both models. The result is consistent with banking theories; the bank with higher risk propensity uses less equity hence generates more income (Molyneux et al., 1994); and suggests that revenue propensity decreases as equity ratio increases. The magnitude of equity ratio is greater for interest-based product market than that for total market. The evidences from PR reduced form revenue models confirm the evidences from general measure of market competition, the concentration ratio ("Three-bank", "Five-bank" concentration ratio and HHI), i.e., Nepalese banking industry is competitive, at least monopolistic competitive behavior among banks.

TABLE 8. H-STATISTICS: SOUTH ASIAN COMPARISON

Country	H-Statistic
Sri Lanka	0.7568
India	0.6803
Nepal	*0.5969*
Bangladesh	0.4594
Pakistan	0.3859

Note: H-Statistic for Nepal is extracted from Table 7 above and H-Statistics for Bangladesh, India, Pakistan and Sri Lanka are extracted from Perera et al. (2006) Table 4, 5, 6, and 7 respectively. The H-Statistic is based on fixed effects estimates without time dummies for Total Market.

Meanwhile when comparing the H-Statistic of PR Model for Nepal with similar study in other South Asian banking industries (Perera et al. 2006), the average H-Statistic of Nepal is lower than that is for Sri Lanka and India and higher than that of for Bangladesh and Pakistan suggesting that the Nepalese banking market is less competitive than Sri Lankan and Indian banking markets and more competitive than Bangladeshi and Pakistani banking markets. The average H-Statistics are for the countries are given in Table 8.

5.4 Equilibrium Test and Robustness Check

Equilibrium Test: The basic premise on which PR model rests is the long-run equilibrium where factor prices are not related with industry return (Panzar and Rosse, 1987). To test this proposition empirically, following empirical model is used (Casu and Girardone, 2006; Perera et al., 2006) that validates the PR model results if sum of elasticities of factor costs is equals to zero ($b_1 + b_2 + b_3 = 0$).

$$\ln ROA_{it} = a + b_1 \ln INTC_{it} + b_2 \ln LC_{it} + b_3 \ln OTHC_{it} + b_4 \ln LOAN_{it} + b_5 \ln TA_{it} + b_6 \ln EQUTY_{it} + e_{it} \quad \ldots (3)$$

where, ROA is the net income to total assets and explanatory variables are same as in equation (2). The parameters in above model are estimated by fixed effects estimators. The Wald test for null hypothesis of linear combination, $b_1 + b_2 + b_3 = 0$ is not rejected. The F-statistic is 0.14 with p-value 0.7113. The results states that input prices are not related with industry return. The estimates are reported in Appendix Table A3 for reference. The evidences validate the empirical results presented in Table 7.

Robustness Check: Though the equilibrium test validates the PR fixed effect model estimates, further robustness check is performed to further validate conclusions. The H-statistic is also estimated by using pooled ordinary least square method as well as random effect method. The estimates from both the methods lead to the similar conclusion. Furthermore, Model I and Model II are also estimated using unscaled variables (e.g. interest income instead of interest income divided by total assets). The results are reported in Appendix Table A1 and Table A2 respectively, and the results are similar to results reported in Table 7 above.

6. CONCLUSION

This paper examined the evolution of market structure and revenue behavior of Nepalese banking industry over 9 years period (from 2001 to 2009). Concentration ratios, including Herfindahl-Hirschman Indices, show decreasing market concentration in Nepalese banking industry and decreasing market share of largest banks over the sample period. The evidences suggest that the banking industry is less concentrated that is, more competitive in recent years. Furthermore, revenue behavior of banking industry is studied by using Panzar-Rosse model for both interest based market and total revenue based market. The results from PR model estimate indicate monopolistic competition in Nepalese banking industry. The rejection of monopoly market competition and perfect competition confirms it. The test results indicate that the market is in equilibrium. The value of H-statistic in total revenue based market is lower than that for interest income based market suggesting that there is lower competition among banks in non-interest based or fee based market. The banks managers can develop their strategies accordingly. In addition, there exist scale economies for Nepalese banks i.e. larger banks are better able

to generate more revenue. Therefore the individual banks can take advantage of scale economies. However, there is negative impact of equity capital on revenue generation in Nepalese banking- the banks with higher equity base are likely to generate lower revenue comparing with banks with lower equity capital base. It indicates that there is risk-return trade-off between equity capital and revenue. The results are robust to different model specifications and different estimation techniques. Nevertheless, as indicate by the value of H-statistic, there is room for improvement in competitive behavior of Nepalese commercial banks. Hence, the regulators should give continuity to the ongoing financial sector liberalization and reformation that help to increase competitive market behavior among banks.

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APPENDIX: EQUILIBRIUM TEST AND ROBUSTNESS OF RESULTS

TABLE A1: RANDON EFFESTS AND POOLED OLS ESTIMATES OF PR MODEL

	Random Effect Estimates						OLS Estimates					
	Model I			Model II			Model I			Model II		
	Coefficient	S. Error	P-value	Coefficient	S. Error	P-value	Coefficient	S. Error	P-value	Coefficient	S. Error	P-value
*Ln*INTC	0.3904	0.0293	0.0000	0.2243	0.0345	0.0000	0.3602	0.0358	0.0000	0.1458	0.0403	0.0000
*Ln*LC	0.1898	0.0339	0.0000	0.2603	0.0390	0.0000	0.2656	0.0260	0.0000	0.3287	0.0292	0.0000
*Ln*OTHC	0.1740	0.0413	0.0000	0.1888	0.0484	0.0000	0.1726	0.0462	0.0000	0.2011	0.0519	0.0000
*Ln*LOAN	0.0137	0.0073	0.0600	0.0119	0.0086	0.1650	0.0334	0.0094	0.0010	0.0331	0.0106	0.0020
*Ln*TA	0.0489	0.0152	0.0010	0.0511	0.0179	0.0040	0.0054	0.0220	0.8070	0.0184	0.0248	0.4600
*Ln*EQUTY	-0.1349	0.0229	0.0000	-0.1223	0.0269	0.0000	-0.1645	0.0304	0.0000	-0.1819	0.0342	0.0000
CONSTANT	-1.1900	0.2790	0.0000	-0.8242	0.3288	0.0120	0.0635	0.3841	0.8690	-0.0172	0.4319	0.9680
Adj. R-Squared	0.6874			0.6240			0.7025			0.6415		
Wald Chi-Sq	274.36		0.0000	130.39		0.0000						
F-statistic							51.77		0.0000	39.46		0.0000
H-statistic	**0.7543**			**0.6735**			**0.7984**			**0.6756**		
Wald test for H=1												
Chi-Sq	20.19		0.0000	26.08		0.0000						
F-statistic							9.45		0.0026	83.92		0.0000
Wald test for H=0												
Chi-Sq	190.25		0.0000	110.93		0.0000						
F-statistic							148.18		0.0000	19.35		0.0000
No. of observations	130			130			130			130		

Note: See Table 6 for variable description and Table 7 for model description.

TABLE A2: FIXED EFFESTS ESTIMATES OF PR MODEL WITH UNSCALED VARIABLES

	Model I			Model II		
	Interest-based product market			Total market		
	Coefficient	Std. Error	P-value	Coefficient	Std. Error	P-value
INTC	0.3942	0.0306	0.0000	0.2068	0.0382	0.0000
LC	0.1392	0.0415	0.0010	0.1910	0.0518	0.0000
OTHC	0.1330	0.0433	0.0030	0.1550	0.0540	0.0050
LOAN	0.0060	0.0071	0.3990	0.0068	0.0088	0.4400
TA	0.4152	0.0539	0.0000	0.5370	0.0672	0.0000
EQUTY	-0.0585	0.0243	0.0180	-0.0642	0.0302	0.0360
CONSTANT	-0.8851	0.2899	0.0030	-0.7454	0.3615	0.0420
Adj. R-Squared	0.9845			0.5792		
F-statistic	1780.28			14.48		
p-value of F-stat.	0.0000			0.0000		
H-statistic	**0.6664**			**0.5527**		
No. of observations	130			130		

Note: In Model I, dependent variable is log of total interest income and in Model II dependent variable is the log of sum of interest income, commission and discount income, and other operating income. All the independent variables are measured in log scale. INTC is the interest expenses; LC is the staff expenses; OTHC is the other operating expenses. LOAN is the total loan; TA is the total assets; and EQUTY is the total equity capital. The H-Statistic (in bold) is the sum of coefficients of INTC, LC, and OTHC.

TABLE A3: PR MODEL EQUILIBRIUM TEST

	Coefficient	Standard Error	P-value
INTC	-0.2210	0.3883	0.5700
LC	0.5232	0.5383	0.3330
OTHC	-0.5874	0.5612	0.2980
LOAN	0.0405	0.0921	0.6610
TA	0.4531	0.1964	0.0230
EQUTY	0.3562	0.3081	0.2500
CONSTANT	-14.9108	3.6343	0.0000
Adj. R-Squared	0.2109		
F-statistic	3.84		
p-value of F-stat.	0.0017		
Wald test for H=0			
F-statistic	0.14		
p-value of F-stat.	0.7113		
No. of observations	130		

Note: The dependent variable is log of return on assets (net income/total assets) and for other variables description *see* Table 6.