The Effect of Financial Restructuring on the Degree of Competition in the Korean Banking Industry

Sun Eae Chun[*]

Department of Economics

Chonnam National University

Bong Han Kim[**]

Department of International Trade and Commerce

Kongju Nation University

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Abstract

This paper investigates the market structure of Korean banking industry during the year of 1994 ~2001 and evaluates whether the monopoly power of banks has been indeed increased along with the increased market concentration after the 1997 financial crisis using the "*H statistic*" by Panzar and Rosse (1987). The estimated H statistics for the whole sample periods are positive ranging from 0.344~0.476 and the Wald test for the market structure of monopoly or perfect competition is rejected implying that the banks earned their revenues in the condition of monopolistic competition. The estimated value of *H statistic* with the interest revenue as a dependent variable shows that the monopoly power of banks has been increased after the crisis even though banks were operating under the monopolistic competition both before and after the crisis. Estimation results with the total revenue as a dependent variable shows that the market structure has been changed from the monopolistic competition to the monopoly after the crisis.

Key words: H-statistics, degree of competition in the banking industry, market concentration

JEL classification: G2

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[*] corresponding author, 300 Yongbong-dong, Puk-gu, Gwangju, South Korea, 500-757, sechun@chonnam.ac.kr, tel: +82-62-530-1456, fax: +82-62-530-1559

[**] 182, Shinkwandong, Konju, Chungnam, South Korea, 314-701, bongkim@kongju.ac.kr, tel: +82-41-850-8391

I. Introduction

Over the last 20 years, the Korean financial industry experienced significant structural changes as the financial liberalization and financial restructuring process were implemented with the goal of enhancing competitiveness in the banking sector. As the 12 banks were newly entered into the banking industry and some of the non baking institutions transformed their businesses into the banking businesses, the number of banks (including commercial banks, agricultural, fishery cooperatives) increased reaching 29 at the end of 1997.

Increased number of banks in the limited domestic market eroded profitability of banks and raised the issue of overbanking problem. Excessive competition in the banking industry forced the banks to take expansionary strategies resulting in over-investment in the corporate sector. The consequent accumulation of non-performing loans in the banking sector has been pointed out as one of the main contributing factor for the outbreak of the 1997 financial crisis.

After the financial crisis, Korean government undertook a comprehensive financial restructuring for the normalization of the banking sector. Insolvent banks were closed or merged and bad loans were transferred to asset management companies. Public funds were injected for the capitalization of the banks, resulting in nationalization of majority of the banks.

The first stage of financial restructuring had yielded substantial consolidation of the industry, bringing the number of banks to 20 by end-1999, down from 29 before the crisis. This stage was also accompanied by substantial downsizing and employment cuts. With the continued merger and establishment of Financial Holding Company (FHC) during the second stage of financial restructuring, the number of banks has further declined to 14 as the end of 2001.

<Table 1> Number of Banks in the Korean Banking Industry

	end of 1980	end of 1990	end of 1997	End of 1999	end of 2001
Number of banks	17	24	29	20	14

Source) Bank of Korea

With the rapid reduction in the number of banks, the average asset size of banks increased making the banking industry heavily concentrated. The most frequently applied measures of concentrations, k-bank concentration ratio (CR_k) and Herfindahl-Herschman Index (HHI) shows that Korean banking industry has become a heavily concentrated market after the crisis. <Table 2>[1] presents the trends of the HHI and CR_k after the 1995 where the total deposits and total

[1] The CR_k takes the market shares of the *k* largest banks in the market and ignores the remaining banks in that market. This index is based on the idea that the behavior of a market is dominated by a small number of large banks. The Herfindahl-Herschman index (HHI) is defined as the sum of the squared market shares of all banks in the market. HHI takes market shares as weights, and stress the importance of large banks by assigning them a greater weight than

loans have been taken as the measure of bank size.

In general, the concentration ratio shows the declining trend until the 1997 during which new banks have entered the market and many of the regional banks substantially grew. Concentration ratio in deposit market before crisis implies a relatively competitive market with CR_3 recording 34% and HHI 654 in the 1997. However in 1998 right after the crisis, concentration ratio went up with CR_3 recording 40% and HHI 866 due to the exit of ailing banks through P&A and merger activities. In 2001 when the FHC was launched comprising 4 commercial banks under its umbrella and Kookmin and Korean Housing banks were merged with each other, CR_3 recorded 547.7% while HHI reached 1367. According to the current screening guidelines in U.S.A, this market could be described as a 'somewhat concentrated market'.[2] The concentration ratio in the loan market shows similar trend with that in the deposit market.

<Table 2> Trends in Concentration in Deposit and Loan Market

		1995	1996	1997	1998	1999	2000	2001.6	Merge of Kookmin&KHB
Deposit Market	HHI	676	682	654	866	830	913	1005	1367
	CR_1	11.4	12.0	11.6	17.0	14.3	15.0	15.2	27.1
	CR_2	33.2	34.0	33.6	39.0	36.9	39.7	42.6	54.7
	CR_3	47.8	48.7	47.1	51.1	51.2	54.7	57.8	70.1
Loan Market	HHI	678	676	693	899	924	1011	1087	1496
	CR_1	12.6	12.6	13.5	15.7	14.8	15.9	16.2	29.5
	CR_2	34.8	34.8	36.3	42.9	42.4	45.9	46.7	57.5
	CR_3	48.4	48.2	49.1	59.4	60.3	62.7	66.6	72.1

Source) Kim (2000)

These significant changes in Korean banking industry raised the important policy concerns that banks in the highly concentrated market would gain market power being able to charge higher than competitive prices for their products, thus inflicting welfare costs that could more than offset any presumed benefit associated with mergers. Other concerns regarding the higher concentration ratio included such problems as the limitation on the effectivenss of the monetary and credit policy, increased probability of systemic risk and reduction in lending to the small

smaller banks.

[2] According to the current screening guidelines in USA , the banking industry is regarded to be competitive market if the HHI is less than 1000, somewhat concentrated market if the HHI lies between 1000 and 1800, very concentrated market if HHI is more than 1800. If the post merger market HHI is lower than 1,800 points and the increase in the index from the pre-merger situation is less than 200 points, the merger is presumed to have no anticompetitive effects and is approved by the regulators. Should those threshold values be exceeded, the regulators will check for the existence of potential mitigating factors. If the mitigating factors are not enough to justify the merger, the regulators may require the divestiture of some branches and offices, in order to bring the concentration ratio to or below the threshold level. If divestiture would not accomplish this goal, the merger application is denied.

and medium corporations.

The view on the relationship between competition and market structure is based on the traditional monopoly power hypothesis, which suggests that more concentrated markets tend to be more collusive, generating market power which allows banks to earn monopolistic profits by offering lower deposit rates and charging higher loan rates.

These arguments, so called 'Structural Models' are challenged by other theoretical approaches. In reaction to the theoretical and empirical deficiencies of the structural models, "Non-Structural Models" of competitive behavior have been developed. These New Empirical Industrial Organization approaches such as the Iwata model, the Bresnahan model, and the Panzar and Rosse (P-R) model measure competition and emphasize the analysis of the competitive conduct of banks without using explicit information about the structure of the market.

In this paper, we employ one of the "Non-Structural Model" approach suggested by Rosse and panzar (1977) and Panzar and Rosse (1982, 1987), so called "*H statistic*", which has been widely employ for the examination of the competitive structure of the banking industry in various countries, in order to investigate the market structure of Korean banking industry during the periods of 1994 to 2001. Furthermore, we evaluate whether monopoly power of banks has been indeed increased along with the increased market concentration after the crisis.

The organization of the paper is as follows. Chapter II presents the literature survey on the development of the theory regarding the relationship between market structure and monopoly power. Chapter III describes in more detail the method suggested by Panzar and Rosse (1987). The method of Panzar and Rosse (1987) is applied to the micro data set of Korean banks in Chapter IV. Besides searching for the market structure of Korean banking industry during the sample periods, *H statistics* are estimated on the pre crisis and post crisis data separately in order to find out whether the banks' market power has increased after the crisis. Chapter V summarizes with the concluding remark.

II. The Literature Survey

In the banking literature, there are two major empirical approaches for assessing competition: the Structural Approach and the Non-Structural Approach (Bikker and Haaf 2000). The structural approach includes the Structure-Conduct-Performance (SCP) paradigm and the Efficient Structure Hypothesis (ESH).

The SCP paradigm was originally developed by Mason (1939) and Bain (1951), which attempts to infer the degree of competition in an industry from its structural features establishing a direct link from industry structure to firm conduct, and from firm conduct to

industry performance. Basically, the SCP implies that concentration in the banking industry can generate market power, allowing banks to earn monopolistic profits by offering lower deposit rates and charging higher loan rates. This view assumes that banks in a concentrated market can ignore potential competitors due to technological and regulatory barriers to entry.

The SCP paradigm is challenged by other theoretical approaches. The first challenge comes from the "efficient structure hypothesis" (ESH) advocated by Demsetz (1973) and Petzman (1977). ESH suggests that the positive relationship is not a consequence of market power but of the greater efficiency of firms with larger market share (Demsetz, 1973). In other words, the superior performance of the market leaders (due to firm specific factors such as technological or managerial skills, etc.) endogenously determines the market structure, implying that higher efficiency produces both higher concentration and greater profitability.

"Non-structural models" suggest an alternative approach to competitive behavior. These models do not infer the competitive conduct of banks through the analysis of market structure, but rather recognize that banks behave differently depending on the market structure in which they operate. The basic tenet of these models concerning competitive conditions is that there is no clear evidence that the use of market power would be greater in more concentrated industries.

Under this framework, the Contestable Markets Theory (CMT), developed by Baumol (1982) stresses that a concentrated industry can behave competitively if the barriers for new entrants to the market are low. CMT assumes that firms can enter or leave rapidly any market without losing their capital and potential competitors have the same cost function as incumbent firms. These features of contestable markets imply that a concentrated banking market can be effectively competitive even if it is dominated by a handful of large banks. Therefore, policymakers should be relatively less concerned about the market dominance of some type of financial intermediaries in a country's financial system, if the financial markets are contestable. Based on these arguments, deregulation and liberalization will make the banking industry more contestable or open to competition.

The empirical evidence for the existence of the market concentration-market power relationship is mixed. Some influential papers have suggested a positive relationship between concentration and the degree of market power. For example, Berger and Hannan (1989) analyzed a cross-section of banking markets in 1983-85. After controlling for various factors affecting price-setting behavior, they find that deposit rates are significantly lower in the most concentrated markets.

Other work compares the time-series behavior of the deposits interest rate (and/or the loan rate) with the benchmark money market rate, which is not controlled by the banks. Hanna and Berger (1991) and Neumark and Sharpe (1992) find evidence of deposit rate rigidity and, thus,

evidence of market power in the U.S. banking industry[3]. Importantly, they find a higher level of rigidity in markets with higher HHIS.

However, recent research casts doubt on the market concentration-market power relationship. Reviewing Berger and Hanna's (1989) results, Jackson (1992) suggests that the market concentration-market power relationship may not be monotonic. He finds that such a relationship already holds at low levels of concentration, but in markets with middle levels of concentration the relationship vanishes, and it actually changes sign in highly concentrated markets.

A lack of strong theoretical foundations and mixed empirical evidence motivates the search for alternative methodologies to investigate firms' competitive behavior. And non-structural models of competitive behavior by the New Empirical Industrial Organization approach, namely Iwata model, the Bresnahan model, and the Panzar and Rosse(P-R) have been developed. Now we turn to the method suggested by Panzar and Rosse (1987) in more detail.

III. The Panzar and Rosse Approach

1. The Panzar and Rosse Approach: *H-statistics*

The Panzar-Rosse approach for testing market power relies on the premise that banks will employ different pricing strategies in response to change in input costs depending on the market structure in which they operate. Therefore, whether a bank operates in a competitive market or exercises some monopoly power can be inferred from the analysis of that bank's total revenue as it responds to changing input prices.

The test is derived from a general banking market model, which determines equilibrium output and the equilibrium number of banks by maximizing profits at both the bank level and the industry level.

First, bank *i* maximizes its profits, where marginal revenue equals marginal cost:

$$R_i'(x_i, n, z_i) - C_i'(x_i, w_i, t_i) = 0 \qquad (1)$$

R_i refers to revenues and C_i to costs of bank i (the prime denoting marginal), x_i is the output of bank *i*, *n* is the number of banks, w_i is a vector of *m* factor input prices of bank *i*,

[3] If banks have market power, they will, for example, quickly lower the deposit rate when the money market rate decreases, but the deposit rate will be sluggish when the money market rate increase. Conversely, in perfect competition one should expect quick reactivity in both cases.

z_i is a vector of exogenous variables that shift the bank's revenue function, t_i is a vector of exogenous variables that shift the bank's cost function.

Secondly, at the market level - in equilibrium- the zero profit constraint holds:

$$R_i^*(x^*, n^*, z) - C_i^*(x^*, w, t) = 0 \qquad (2)$$

Variables marked with asterisk (*) represent equilibrium values. Market power is measured by the extent to which a change in factor input prices (dw_{ki}) is reflected in the equilibrium revenues (dR_i^*) earned by bank *i*. Panzar and Rosse defines a measure of competition, so called "*H statistic*" as the sum of the elasticities of the reduced-form revenues with respect to factor prices:

$$H = \sum_{k=1}^{m} \frac{\partial R_i^*}{\partial w_{ki}} \frac{w_{ki}}{R_i^*} \qquad (3)$$

Panzar and Rosse prove that under monopoly, *H statistics* is less than or equal to zero.[4] This is due to the economic intuition that a monopolist's revenue will respond in the opposite direction to a change in input prices, as a one percent increase in input prices leads to a one percent increase in marginal costs, thus reducing equilibrium output and revenue. Panzar and Rosse further show that the *H statistic* is also negative when the structure is a perfectly colluding oligopoly or a conjectural variations short-run oligopoly

For monopolistic and perfect competition, the analysis is based on the comparative static properties of the Chamberlinian equilibrium model which introduces interdependence into banks' structural revenue equations via the hypothesis that, in equilibrium, free entry and exit results in zero profits.

In the case of monopolistic competition *H statistic* will lie between zero and unity, 0<H<1. Positive values of H indicate that the data are consistent with monopolistic competition but not with individual profit maximization as under monopoly condition. Although banks behave like monopolists, the market entry or exit of other banks that offer imperfect rival products makes them always generate precisely zero profits. In this case, banks produce more and the price is less than would be optimal in each individual case.[5]

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[4] In the case where the monopolist faces a demand curve of constant price elasticity and where a constant returns to scale Cobb-Douglas technology is employed, Panzar and Rosse proved that *H* is equal to e-1. Hence apart from the sign, the magnitude of *H* may also be of importance, as H yields an estimate of the Lerner index of monopoly power L = (e-1)/e = *H*/(*H*-1).

[5] *A priori*, monopolistic competition is most plausible for characterizing the interaction between banks, as it recognizes the existence of product differentiation and is consistent with the observation that banks tend to differ with

In the limit case of the monopolistic competition model, where banks' products are regarded as perfect substitutes of one another, the Chamberlinian model produces the perfectly competitive solution, as demand elasticity approaches infinity. In this perfect competition case, H=1. An increase in input prices raises both marginal and average costs without – under certain conditions–altering the optimal output of any individual firm.

In reaction to the increased input prices, banks will be forced to increase prices (e.g. interest rates on loans) until they cover the increased costs in order to survive the competition. During this adjustment process, the inefficient banks might be acquired by efficient ones or be eventually driven out of the market by competition. Exit of some firms increases the demand faced by each of the remaining firms, leading to an increase in prices and revenues equivalent to the rise in costs. Shafer (1982) shows that the *H statistic* is also unit for a natural monopoly operating in a perfectly conetstable market and also for a sales-maximizing firm that is subject to breakeven constraints. <Table 3> summarizes the different interpretations of the *H-statistic*.

<Table 3> Interpretation of *H statistic*

H statistics	Competitive environment test
$H \leq 0$	Monopoly equilibrium Perfect colluding oligopoly Conjectural variations short-run oligopoly
0<H<1	Monopolistic competition free entry equilibrium
H=1	Perfect Competition Natural monopoly in a perfectly contestable market Sales maximizing firms subject to breakeven constraint
Equilibrium test	
H<0	Disequilibrium
H=0	Equilibrium

Source) Rosse and Panzar(1977), Panzar and Rosse(1982, 1987), Shaffer(1982, 1983), Nathan and Neave(1989), Molyneux et al (1994)

2. Limitation in applying Panzar-Rosse approach in banking data

In applying the above technique to assess banks' market conduct, some care must be taken on the assumptions made, general limitations regarding the scope of model captured by this static approach as well as resulting biases with the estimation.

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respect to product quality variables and advertising, although their core business is fairly homogeneous.

First, assumptions about banks' production activity have to be made since they are only to a limited extent comparable to a "normal" firm. In principle there are two ways how the production process in banking is described in the literature: the "production approach" and the "intermediation approach". The production approach regards the banking firm as an entity producing services which are related to loans and deposit accounts. Therefore, interest payments are not included in the cost function and output is instead measured by the number of deposit accounts serviced and loans originated.

On the other hand, the intermediation approach (Sealy and Lindley 1977) views the bank as a firm collecting deposits and other funds in order to transform them into loans and other assets. For this transformation, labor and physical capital are employed. Thus their costs as well as interest payments on deposits and other funds enter the bank's cost function, the main input here being funds. The output is typically measured by the loans and investments recorded in the balance sheet.

Generally, the Panzar-Rosse statistic was developed on the basis of static (oligopoly) models whereas for dynamic models there are no predictions on the value of the *H-statistics*. As the interpretation of the *H-statistics* is derived for the market equilibrium, the fact that we do observe market entry and exit might question the existence of an overall equilibrium in the market over the investigated time span and, therefore, imposes further limits on the interpretation of such analyses.[6]

The long-run equilibrium test is carried out using the *H-statistic* also, in which case it measures the sum of elasticities of return on assets (ROA) with respect to input prices. Values of the *H-statistic* equal to zero would indicate equilibrium and values less than zero disequilibrium. This empirical test for the market equilibrium is justified on the grounds that competitive capital markets will equalize risk-adjusted rate of returns across banks such that, in equilibrium, rates of return should not be correlated statistically with input prices.

Furthermore, problematic within the Panazr-Roass approach is the assumption of perfect competition in input markets (banks as price takers on input markets) on the one hand and the use of individual, bank specific input prices on the other. Generally, one would find perfect competition in input markets to be an especially demanding assumption in the case of deposits, since there are still good reasons to question the existence of complete competition in the market for deposits; however, there are undoubtedly clear signs that competition has increased since the beginning of the nineties. Furthermore, the use of differing – bank specific input prices for deposits would at first sight seem to contradict this assumption by indicating imperfect

[6] Nevertheless, Panzar and Rosse (1987) stress that to only test the 'monopoly' hypothesis the long-run equilibrium is not a prerequisite. However, to test for the alternative models, i.e. monopolistic or perfect competition, it is necessary for the observations to be generated in long-run equilibrium.

factor markets. However, they may also be interpreted as the result of local (competitive) factor markets. The indirect measurement of factor prices through expenses divided by respective volume might additionally overstate the actual variation in prices.

Moreover, some downward bias in the estimated elasticities results from the maturity structure of banks' asset portfolios. As longer maturities in fixed rate contracts prevent banks from direct price adjustments, even in perfectly competitive markets delayed changes in pricing imply lower elasticities estimated.[7].

Despite the above mentioned drawbacks, an important advantage of Panzar and Rosse's method is that data availability becomes much less of a constraint since revenues are more likely to be observable than output prices and quantities or actual cost data. The estimation of reduced-form revenue equations is often possible even though the structural equations cannot be estimated. This is of special importance in the case of the structural supply equation due to the often encountered lack of data for the supply side. Additionally there is no need for quality corrections as in the case of prices.

Another important advantage is that there is no need to specify a geographic market, since the behavior of the individual banks themselves gives an indication of their market power. The gaining importance of direct banking (via phone or PC) further complicates such market delineations.

3. Literature on Using H-statistics

Many previous studies have examined the competitive structure of the banking industry in various countries by using H-statistics. One of the first applications of the Panzar-Rosse methodology to banking was a series of cross-sectional study by Shaffer (1981a, 1981b, and 1982) which examined the competitive position for sample of unit banks in New York. Shaffer (1982) estimated values of H ranging from 0.32 to 0.36 for the competitive stance test and concluded that competitive conduct of banks cannot be characterized as monopolistic or perfectly competitive in the long run equilibrium.

Similarly, Nathan and Neave (1989) assessed the state of competition in different sectors of the Canadian financial services industry (banks, trust companies and mortgage companies), using cross-sectional data for 1982, 1983 and 1984. They also rejected the hypothesis of monopoly and perfect competition for Canadian banks, trust companies and mortgage companies over the period 1982-1984, and concluded that banking revenues behave as if earned under monopolistic competition. Molyneux et al (1994) used the same analysis in a sample of German, UK, French, Italian, and Spanish banks for each year of the period 1986 to 1989. On

[7]. Further assumptions include normally shaped revenue and cost functions

average, their results suggest monopolistic competition in Germany, France, Spain and UK, and monopoly.

Vesala (1995) applied a similar model to the Finnish banking industry and found monopolistic competition for 1985-88 and 1991-92, and perfect competition for 1989-90. Molyneux et al. (1996) examined the competitive conduct of Japanese commercial banks and found monopoly for 1986 and monopolistic competition for 1988. Coccorese (1998), Rime (1999), and Hondroyiannis et a. (1999) found monopolistic competition for Italian, Swiss, and Greek banking sectors.

In a more recent study, De Bandt and Davis (2000) reported monopolistic competition for large banks and monopoly for small banks for Germany and France, and monopolistic competition for small and large banks in Italy over the period 1992-1996. Bikker and Groeneveld (2000) found monopolistic competition of varying degrees for EU countries for the period of 1989 to 1996.

Finally, in a more comprehensive study, Bikker and Haff (2000) examined competitive conduct of banks in 23 developed countries over the time period 1988-1999. They reported that, in general, the banking markets of industrialized countries could be characterized by monopolistic competition. However, they could not reject the case of monopoly for the samples of small banks in Australia and Greece, and perfect competition for large banks in several countries.

Lee & Kim (1995) was the first to investigate the degree of competition on the Korean banking sector using *H statistics*. They evaluated the effects of Government's permitting new entrants on the banks' competitivenss over the periods of the year of 1978~1992. The estimated *H statistics* shows that the degree of competition has increased over the periods of 1978~1982 and 1983~1989. However for the periods of 1990~91 the *H statistics* was not statistically significant and they were not able to identify the competitive condition in the banking industry.

IV. The Empirical Model and Data

1. The Empirical Model and Data

Following Shaffer (1982, 1985), Nathan and Neave (1989), Molyneux et al. (1994) We estimate the following bank revenue equation in which revenue is explained by factor prices and other bank-specific variables that affect long-run equilibrium bank revenues for Korean banks during the years of 1994~2001.

$$\ln TREVIN = \alpha_0 + \alpha_1 \ln PL + \alpha_2 \ln PK + \alpha_3 \ln PF + \alpha_4 \ln RISKASS + \alpha_5 \ln ASSET + \alpha_6 \ln BR + \varepsilon \quad (4)$$

$$\ln TREV = \alpha_0 + \alpha_1 \ln PL + \alpha_2 \ln PK + \alpha_3 \ln PF + \alpha_4 \ln RISKASS + \alpha_5 \ln ASSET + \alpha_6 \ln BR + \varepsilon \quad (5)$$

and for estimating equilibrium conditions the model is:

$$\ln ROA = \beta + \beta_1 \ln PL + \beta_2 \ln PK + \beta_3 \ln PF + \beta_4 \ln RISKASS + \beta_5 \ln ASSET + \beta_6 \ln BR + \nu \quad (6)$$

where *TREVIN*, total interest revenue to total assets;

TREV, total revenue to total assets;

ROA, net profits to total assets;

PL, personnel expenses to employees (unit price of labor);

PK, capital expenses to fixed assets (unit price of capital)

PF, ratio of annual interest expenses to own funds (unit price of funds);

RISKASS, provisions to total assets

BR, number of branches of each bank to the total number of branches of the whole banking system;

ln, natural logarithm.

In this study two different dependent variables are specified: TREVIN as the ratio of total interest revenue to total assets, and TREV as the ratio of total (gross) operating revenue to total assets. The first specification in which the dependent variable is only the interest part of total revenue is consistent with the approach that financial intermediation constitutes the core business in commercial banking.

Although interest revenues still constitute the principal source of banks' earnings, recent studies on banking activities report an increasing share of non-interest income from fee-based products and services and off balance sheet credit substitutes in total revenues. Given the increased level of competition in financial markets, this can be explained partly by the desire of financial services firms to expand their revenue generating sources without altering their risk and thus their capital structure, materially. For this reason, it will be appropriate to include total revenues in the model in addition to interest revenues.

The independent variables include firm specific variables similar to those used in other studies (Nathan and Neave, 1989; Molyneux et al. 1994). PK, PL and PF represents the factor prices where PK represents the unit price of capital, PL unit price of labor and PF unit price of funds. We follow previous studies assuming (as in the intermediation approach) that all funds

are an input in the bank's production function. This choice is additionally supported by the rising importance of interbank deposits which certainly do not meet the criteria of outputs put forward in the context of customer demand deposits.

<Table 4> Data on Bank Management

(unit: 100 mil won, number, %)

	1994	1995	1996	1997	1998	1999	2000	2001
Total Revenue	7247	9246	10828	17751	29109	31103	33947	33584
Total Asset	122982	158249	189041	233290	269369	330780	341765	427613
Wages	2046	2636	3040	3353	3290	3428	3749	3894
No. Employees	3634	4127	4156	4384	3604	4397	4151	4558
Depreciation	222	482	758	1009	1325	1832	2023	2209
Fixed Capital	3261	4296	4978	6326	8971	8359	8474	9921
Interest Expenses	3701	5361	6279	9260	16299	15277	17066	15331
Own Funds	6984	7566	8042	6978	7598	12738	12980	17533
Loan Provision	840	675	605	1285	2936	4392	6068	3772
No. of Branches	97	114	158	182	196	241	240	275
Interest Income	5129	7329	8702	12266	19784	20598	22693	21669
TREV	0.06	0.06	0.06	0.08	0.11	0.10	0.11	0.08
TRVIN	0.05	0.05	0.05	0.05	0.08	0.06	0.07	0.06
PL	0.88	1.00	1.11	1.20	1.37	0.76	0.89	0.87
PK	0.06	0.10	0.14	0.16	0.15	0.24	0.25	0.24
PF	0.47	0.65	0.73	1.52	5.30	1.48	1.59	1.14
RISKPAA	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.01
BR	0.04	0.04	0.04	0.04	0.05	0.06	0.06	0.07
ROA	0.45	0.32	0.29	-1.26	-4.56	-1.19	-0.82	0.56

Source) FSC

To account for firm specific risk we use the provisions to assets ratio (RISKASS). We expect the RISKASS to be positively correlated to the dependent variables, since higher provisions should lead to higher bank revenue. The ASSET variable is included in our analysis to account for possible scale economies, given the wide range of bank asset sizes in the Korean banking system. Finally, the BR variable is used as a proxy for bank size. All variables are expressed in logarithmic form.

<Table 4> summarizes the average yearly data used in the empirical estimation. The data includes the balances sheet data for city and regional banks together. Because of the exit of the

banks and merger activities, the number of banks varies depending on the year and we run the unbalanced regression. The data are from “Bank Management Statistics” published by Korean Financial Supervisory Commission.

2. Regression Results

Although previous studies generally employs OLS estimation methodology on the cross section yearly data, this could produce the unstable results. In this paper, we employ panel regression methodology combining cross section and time series data. One of the advantages of having panel data is that it allows controlling for heterogeneity bias, or the confounding effects of omitted variables that are stable over time. We used both the fixed and random effects estimators, correcting for the effect of any combination of time-invariant variables that have been omitted, knowingly or not, from the regression model.

The equation is estimated for the sub sample periods of the pre and the post crisis separately as well as for the whole sample periods in order to find out whether the market structure has changed after the crisis. Furthermore, the *H-statistic* is estimated on the cross-section yearly data to get a second indication of changes in the market structure over time.

The estimation results for the competitive position and equilibrium tests for the whole sample periods of 1994~2001 are reported in <Table 5>. All tests confirm the good fit of the models. The estimated regression equations explains 70~82% in the TREVIN and TREV equation and 31~40% of the variability in the ROA.

In the both estimation results where interest revenue TREVIN and total revenue TREV are used as dependent variable, the elasticity of revenue i.e. the coefficients of factor prices such as the unit price of capital PK, unit price of labor PK and unit price of funds funs PF have the positive signs, implying the increased factor costs leading to the higher revenue. These coefficients are everywhere statistically significantly positive in the TREVIN equation, while significantly positive only for the cost of funds in TREV equation.

The sign of the RISKASS variable is positive and statistically significant in both TREVIN and TREV equation indicating that banks with higher provisions to assets in their balance sheet generate higher revenues per unit of assets. The coefficient of the ASSET variable is negative and statistically significant except for the case of fixed effect model in TRV equation, which suggests that size-induced differences between banks may lead to lower total revenue per unit of assets and that larger banks seem to be less efficient compared to smaller banks. The coefficient of the variable depicting size effects in terms of branches, BR, is positive and statistically significant suggesting that banks with greater number of branches generate higher revenue.

<Table 5> Regression results of competitive conditions for Korean banking sector (1994~2001)

$$\ln TREVIN = \alpha_0 + \alpha_1 \ln PL + \alpha_2 \ln PK + \alpha_3 \ln PF + \alpha_4 \ln RISKASS + \alpha_5 \ln ASSET + \alpha_6 \ln BR + \varepsilon$$

	TREVIN		TREV		ROA	
	Fixed Effect	Random Effect	Fixed Effect	Random Effect	Fixed Effect	Random Effect
Ln(PL) [1]	0.092**	0.087***	0.010	0.034	0.286	0.061
	(2.58)	(2.94)	(0.12)	(0.34)	(1.16)	(0.25)
Ln(PK) [1]	0.094***	0.128***	0.063	0.127***	0.328	0.399
	(2.92)	(4.31)	(1.30)	(3.31)	(1.18)	(1.50)
Ln(PF) [1]	0.158***	0.151***	0.181***	0.155***	-0.559	-0.693**
	(8.07)	(8.17)	(4.69)	(6.28)	(-1.48)	(-2.02)
Ln(RISKASS) [1]	0.053***	0.061***	0.107***	0.134***	-0.235*	-0.293**
	(3.33)	(4.15)	(4.15)	(6.83)	(-1.70)	(-2.08)
Ln(ASSET) [1]	-0.152***	-0.228***	-0.045	-0.185***	-0.728	-0.293
	(-2.82)	(-5.51)	(-0.615)	(-3.81)	(-1.61)	(-1.05)
Ln(BR) [1]	0.272***	0.302***	0.167**	0.231***	0.922	0.753**
	(4.17)	(5.31)	(2.16)	(3.35)	(1.632)	(1.90)
R^2	0.82	0.79	0.76	0.70	0.40	0.31
H statistics	0.344	0.366	0.476	0.476	0.055	-0.232
Wald statistic H=1 [2]	24.96	324.28	228.94	228.94		
	(0.00)	(0.00)	(0.00)	(0.00)		
Wald statistic H=0 [2]	72.81***	108.29	48.60	48.60	0.01	0.42
	(0.00)	(0.00)	(0.00)	(0.00)	(0.91)	(0.51)
No. of obs	161	161	161	161	109	109
No. of banks	27	27	27	27	27	27

[1] ( ) represents t-value and

[2] ( ) represents p-value

H statistics in both equations are positive(+) ranging between 0.344~0.476. Models with total revenue as a dependent variable generally yield higher *H-statistics* for both fixed and random effects estimations implying that banks face more fierce competition in the market other than loan market.

The Wald test rejects the hypothesis for the market structure of monopoly or perfect competition at the 1% significance level leading us to conclude that interest revenue and total bank revenues appear to be earned in conditions of monopolistic competition during the sample periods.

In order for the above test results to be valid, the banking industry should be in the long run

equilibrium during these periods. The equilibrium position in the banking industry is assessed by estimating the equation with ROA as a dependent variable which is presented in the last two columns of <Table 5>. The Wald test does not reject the null hypothesis H=0 leading us to conclude that the banking industry was in the long-run equilibrium over the period 1994~2001.

The changes in the market structure after the crisis along with the increased concentration ratio are tested by estimating the equation on the data of pre crisis and post crisis periods separately and their test results are represented in <Table 6> and <Table 7>. In general, tests confirm the good fit of the models with the estimated regression equations explaining 62~96% of the variability in interest revenue and total revenue.

In the equation with interest revenue as dependent variable, unit price of labor and funds affected positively interest revenue and being statistically significant in the case of unit price of unit fund. Differently from the estimation results for the whole sample periods, the sign of the RISKASS variable is not statistically significant. The coefficient of the ASSET variable is negative and statistically significant except for the case of fixed effect model in TREVIN equation. The coefficient of the variable depicting size effects in terms of branches, BR is positive except for the fixed effect model in TREVIN equation but they are not statistically significant.

H statistics is estimated to be positive(+) but falling being 0.187 before the crisis and 0.064 after the crisis for the fixed effect model and 0.245 and 0.064 respectively for the random effect model. The Wald test shows that *H statistics* are statistically different from unit and from zero. Therefore we conclude that even though the banks appear to have earned their interest revenues in conditions of monopolistic competition, the monopoly power of banks has increased after the crisis.

The estimation results where the total revenue is used as a dependent variable are presented in <Table 7>. Before the crisis, the estimated *H statistics* are positive(+) being 0.023 and 0.257 for the fixed effect model and random effect model. And the null hypothesis of H=1 and H=0 are rejected at the 1% significance level implying that the banks earned their total revenue in the market condition of monopolistic competition.

However, the market structure is found to be changed after the crisis. *H-statistics* are estimated to be negative being –0.110 and –0.105 for the fixed effect and random effect model respectively after the crisis. The null hypothesis that H=1 is rejected at the 1% significance level but the null of H=0 is not be rejected.

For these market competitive position tests to be valid, banking market should be in the long run equilibrium and their test results are presented in <Table 8>. The null hypothesis of H=0 is rejected before the crisis but could not be rejected after the crisis leading us to safely conclude that banks after the crisis earned their total revenue in the market condition of monopoly.

Lastly, the equilibrium test and the competitive position test for each of 8 years from 1994 to 2001 are conducted separately using the ordinary least squares method and are reported in the <Appendix 1>, <Appendix 2> and <Appendix 3>. The estimation produced rather unstable results. Most of the estimated coefficients for the unit price of factor costs are not statistically significant. The coefficient of the ASST variable is negative for the both TREVIN and TREV equation and mainly statistically significant for the period of 1994~1998.

<Table 6> Regression results of changes in competitive conditions for Korean banking industry

$$\ln TREVIN = \alpha_0 + \alpha_1 \ln PL + \alpha_2 \ln PK + \alpha_3 \ln PF + \alpha_4 \ln RISKASS + \alpha_5 \ln ASSET + \alpha_6 \ln BR + \varepsilon$$

	TREVIN (1994~1997)		TREVIN (1998~2001)	
	Fixed Effect	Random Effect	Fixed Effect	Random Effect
ln(PL)[1]	0.135	0.081*	0.057	0.050
	(0.77)	(1.81)	(1.33)	(1.07)
Ln(PK)[1]	-0.043	0.055	-0.087	-0.113*
	(-1.36)	(1.65)	(-1.36)	(-1.80)
Ln(PF)[1]	0.094***	0.109***	0.094***	0.089***
	(3.52)	(3.59)	(3.94)	(3.67)
Ln(RISKASS)[1]	-0.009	0.010	0.011	0.008
	(-0.59)	(0.61)	(0.56)	(0.39)
Ln(ASSET)[1]	0.064	-0.098**	-0.618***	-0.150*
	(0.75)	(-2.19)	(-4.48)	(-1.86)
Ln(BR)[1]	-0.115*	0.077	0.150	0.132
	(-1.87)	(1.19)	(0.84)	(1.18)
R^2	0.96	0.90	0.83	0.62
H statistics	0.187	0.245	0.064	0.025
Wald statistic	28.62	249.16	137.39	134.78
H=1[2]	(0.00)	(0.00)	(0.00)	(0.00)
Wald statistic	1.51	26.22	0.65	0.09
H=0[2]	(0.22)	(0.00)	(0.42)	(0.77)
No. of obs	99	99	62	62
No. of banks	26	26	20	20

[1] ( ) represents t-value and

[2] ( ) represents p-value

<Table 7> Regression results of changes in competitive conditions for Korean banking industry

$$\ln TREV = \alpha_0 + \alpha_1 \ln PL + \alpha_2 \ln PK + \alpha_3 \ln PF + \alpha_4 \ln RISKASS + \alpha_5 \ln ASSET + \alpha_6 \ln BR + \varepsilon$$

	TREV (1994~1997)		TREV (1998~2001)	
	Fixed Effect	Random Effect	Fixed Effect	Random Effect
ln(PL)[1)]	0.039	0.083*	-0.86	-0.050
	(0.23)	(1.85)	(-0.81)	(-0.69)
Ln(PK)[1)]	-0.168***	0.016	-0.116	-0.117
	(-4.68)	(0.37)	(-0.99)	(-1.43)
Ln(PF)[1)]	0.152***	0.157***	0.092**	0.062*
	(5.66)	(3.72)	(2.55)	(1.81)
Ln(RISKASS)[1)]	0.056*	0.091***	0.043	0.092***
	(1.95)	(3.92)	(1.04)	(2.90)
Ln(ASSET)[1)]	0.284***	-0.110**	-0.544***	-0.077
	(2.74)	(-1.99)	(-2.89)	(-0.94)
Ln(BR)[1)]	-0.143**	0.128	0.126	0.462
	(-2.21)	(1.60)	(0.53)	(0.41)
R^2	0.89	0.77	0.60	0.36
H statistics	0.023	0.257	-0.110	-0.105
Wald statistic	16.14	164.69	44.72	89.19
H=1[2)]	(0.00)	(0.00)	(0.00)	(0.00)
Wald statistic	0.01	19.66	0.44	0.81
H=0[2)]	(0.92)	(0.00)	(0.51)	(0.37)
No. of obs	99	99	62	62
No. of banks	26	26	20	20

[1)] ( ) represents t-value and

[2)]( ) represents p-value

The coefficient of the variable relating to size effects in terms of branches, BR, was positive through out the sample year and statistically significant during the periods of 1994~1998 for the TREVIN equation and positive except the year 1997 and 2001 for the TREV equation.

The estimated regression equations explained 46%~92% for the TREVIN equation and 20~81% for the TREV equation and 32~95% for the ROA equation. The estimated regression equations suggest that the *H-statistic* value is positive(+) and statistically different from unity and not statistically different from zero for the sample year except the year 1995 and 1996 for the TREVIN equation.

<Table 8> Regression results of equilibrium conditions for Korean banking industry

$\ln ROA. \alpha_0 + \alpha_1 \ln PL + \alpha_2 \ln PK + \alpha_3 \ln PF + \alpha_4 \ln RISKASS + \alpha_5 \ln ASSET + \alpha_6 \ln BR + \varepsilon$

	ROA (1994~1997)		ROA (1998~2001)	
	Fixed Effect	Random Effect	Fixed Effect	Random Effect
ln(PL)[1)]	-3.40**	-0.266	-1.863	-1.316
	(-2.08)	(-1.02)	(-1.29)	(0.37)
Ln(PK)[1)]	-0.040	-0.046	1.807	1.817
	(-0.14)	(-0.17)	(1.74)	(1.55)
Ln(PF)[1)]	-1.272***	-0.066**	-2.231	-0.755
	(-2.71)	(-2.28)	(-1.79)	(-0.98)
Ln(RISKASS)[1)]	-0.431***	-0.412**	-0.473	-0.697
	(-2.85)	(-2.41)	(-0.68)	(-1.86)
Ln(ASSET)[1)]	1.945*	-0.008	1.425	-0.282
	(1.91)	(-0.03)	(0.57)	(-0.43)
Ln(BR)[1)]	0.023	0.228	-2.830	0.868
	(0.04)	(0.52)	(-1.04)	(0.98)
R^2	0.66	0.50	0.63	0.43
H statistics	-4.712	-1.378	-2.287	-0.255
Wald statistic	3.52	8.58	1.07	0.05
H=0[2)]	(0.06)	(0.00)	(0.31)	(0.82)
No. of obs	75	75	34	34
No. of banks	26	26	15	15

[1)] ( ) represents t-value and

[2)] ( ) represents p-value

For the equation TREV, the *H-statistic* value is positive+) only for the year 1997 and 2001 and statistically different from unit and not statistically different from zero. However, *H-statistic* value is negative and statistically different from unit and not statistically different from zero for the year 1994, 1995, 1996, 1998, 1999, 2000, implying that the banks earned total revenue under the market structure of monopoly.

In the ROA equation in <Appendix 3> the H statistic for testing the hypothesis H=0 indicates that we can not reject the null hypothesis of H=0 indicating that the market is under the equilibrium condition each year.

V. Concluding Remarks

With the rapid reduction in the number of banks due to the exit of ailing banks through P&A measures and mergers during the financial restructuring efforts, the average asset size of banks has increased making the banking industry market heavily concentrated. We investigate the market structure of Korean banking industry during the periods of 1994~2001 and evaluate whether monopoly power of banks has been indeed increased along with the increased market concentration after the crisis using the Panzar and Rosses' (1982, 1987), so called "*H statistic*".

The estimated values of *H statistics* for the sample periods of 1994~2001 are positive(+) ranging from 0.344~0.476 during the sample periods. The Wald test for the market structure of monopoly or perfect competition is rejected leading us to conclude that banks earned their revenues in the condition of monopolistic competition.

Estimation results of *H statistics* for the sub sample periods of pre and post financial crisis gave us the different results for different kinds of revenue. In the equation where the interest revenue is used as a dependent variable, *H statistics* is estimated to be positive but declining from 0.187 to 0.064 for the fixed effect model and from 0.245 to 0.064 for the random effect model. Combined the results of rejection of monopoly and perfect competition market structure we conclude that the monopoly power in the banking sector has been increased after the financial crisis as the conventional index on the market concentration ratio would predict.

When the total revenue is used as a dependent variable, H statistics are estimated to have changed from 0.023 to –0.110 for the fixed effect model and from 0.257 to –0.105 for the random effect after the crisis. Since the null of H=1 was rejected while the null of H=0 was not rejected, we conclude that the market structure for the total revenue seems to have been changed from monopolistic competition to monopoly after the crisis.

<Reference>

Bain, J.(1951), "Relation of Profit Rate to Industry Concentration: American Manufacturing 1936-1940," *Quarterly Journal of Economics*, Vol. 65, pp. 293-324.

Baumol, W.J.(1982), "Contestable Markets: An Uprising in the Theory of Industry Structure", *American Economic Review* 72, pp. 1-15

Berger, S.A., and T. Hannan(1989), "The Price-Concentration Relationship in Banking," *Review of Economics and Statistics*, vol 71

Bikker, J.A., and J.M. Groeneveld,(2000), "Competition, Concentration and their Relationship: An Empirical Analysis of the Banking Industry," *Research Series Supervision* No.30, De Nederlandsche Bank, Amsterdam

Bikker, J. A. and Haaf, K(2000), "Competition and Concentration and their Relationship: An Empirical Analysis of the Banking Industry," *Research Series Supervision* No. 30, De Nederlandsche Bank, Amsterdam

Coccorese(1998), "Assessing in the Competitive Conditions in the Italian Banking System: Some Empirical Evidence", *BNL Quarterly Review* No. 205

De Bandt and Davis(1999), "Competition, Contestability and Market Structure in European Banking Sectors on the Eve of EMU", *Journal of Banking and Finance* 24, pp. 1045-1066

Demsetz, H(1974), "Two Systems of Belief about Monopoly", in Goldschmid, Mann and Weston eds. *Industrial concentration: The new learning*: Mass.: Little, Brown.

Hannan, T. H., and A. Berger(1991), "The Rigidity of Prices: Evidence for the Banking Industry," *American Economic Review*, Vol 81(4), pp. 938-945

Hondroyiannis, Lolos and Papatrous(1999), "Assessing Competitive Conditions in the Greek Banking System," *Journal of International Financial Markets, Institutions and Money* Vol. 9, pp 377-391

Jackson, W., III(1992), "The Price-Concentration Relationship in Banking: A Comment," *Review of Economics and Statistics*, Vol 74, May, pp. 373-376

Kim, Wook Jung(2002), "Concentration Trends in Korean Banking Industry," *Financial System Review* Vol 6, Bank of Korea. 21-44 (in Korean)

Lee, Yougn Soo and Sang Gyu Kim(1995), "The Effect of Entrant on the Bank Competitivenss in Korean Banking Industry: Using Rosse-Panzer Test," *Review of Economics*, Vol 43(3), Korean Economic Association, pp. 165-182 (in Korean)

Mason, E.S.(1939), "Price and Production Policies of Large-Scale Enterprise", *American Economic Review*, 29, pp. 61-74.

Molyneux, Thorton and Williams(1996), "Competition, and Market Contestability in the Japanese Commercial Banking Market," *Journal of Economic Business*, 48, pp. 33-45.

Molyneux, Phil, D.M. Lloyd-Williams and John Thornton(1994), "Competitive Conditions in European Banking," *Journal of Banking and Finance* 18, pp. 445-459.

Nathan, A., Neave, E.H.(1989), "Competition and Contestability in Canada's Financial system: Empirical Results", *Can. J. Econ.* 22(3), pp. 576-594

Neumak, D., and S Sharpe(1992), "Market Structure and the Number of Price Rigidity: Evidence from the Market for Consumer Deposits," *Quarterly Journal of Economics* Vol. 107.

Peltzman, S., 1977, "The Gains and Losses from Industrial Concentration", *Journal of Law and Economics*, pp. 229-263.

Panzar, J.C. and J.N. Rosse(1987), "Testing for Monopoly Equilibrium", *Journal of Industrial Economics* 35, pp. 443-456.

_____(1982), "Structure, Conduct and Comparative Statistics," *Bell Laboratories Economic Discussion Paper* N0, 248

Rime, B.(1999), "Mesure de Degree de concurrence dans le Systeme Bancaire Suisse a L'aide du Modele de Panzar et Rosse," *Revue Suisse d"Economie Politique et de Statistique* 135(1), pp.21-40

Rosse, J.N., and J.C. Panzar,(1977), "Chamberlin v.s Robinson: An Empirical Study of Monopoly Rents," *Bell Laboratories Economic Discussion Paper*

Sealey. C.W., Jr. and J.T. Lindley(1977), "Inputs, Outputs and the Theory of Production and Cost at Depository Financial Institutions", *Journal of Finance*, Vol. 32, pp. 1251-1266.

_____(1983), "Non-Structural Measures of Competition," *Economic Letters* 12, pp. 349-53

_____(1982), "A Non-Structural Test for Competition in Financial Markets", in *Bank Structure and Completion, Conference Proceedings*, Federal Reserve Bank of Chicago, Chicago, pp. 225-24.

_____(1981a), "Banking: Competition or Monopoly Power? New York: Banking Studies Department, Federal Reserve Bank of New York

_____(1981b), "Empirical Test for Competitive Conduct," New York: Banking Studies Department, Federal Reserve Bank of New York

Vesala (1995), "Testing Competition in Banking: Behavioral Evidence from Finland", Bank of Finland Studie

<Appendix1> Regression results of competitive conditions for Korean banking sector

$$\ln TREVIN = \alpha_0 + \alpha_1 \ln PL + \alpha_2 \ln PK + \alpha_3 \ln PF + \alpha_4 \ln RISKASS + \alpha_5 \ln ASSET + \alpha_6 \ln BR + \varepsilon$$

TREVIN	1994	1995	1996	1997	1998	1999	2000	2001
Ln(PL)[1]	-0.022	-0.142*	-0.081	-0.010	-0.047	-0.06	0.127	0.318
	(-0.42)	(-1.88)	(-0.97)	(-0.24)	(-0.76)	(-0.23)	(0.44)	(2.79)
Ln(PK) [1]	0.124*	0.160	0.158	0.157	0.136	0.09	0.084	0.105
	(1.82)	(1.55)	(1.02)	(1.70)	(0.84)	(0.68)	(0.37)	(0.50)
Ln(PF) [1]	0.040	-0.170	-0.325	-0.073	0.011	-0.01	0.119	-0.022
	(0.25)	(-1.02)	(-1.44)	(-1.40)	(0.37)	(-0.09)	(1.31)	(-0.23)
Ln(RISKASS) [1]	-0.016	0.067	0.131*	0.093*	0.016	-0.045	-0.017	0.018
	(-0.21)	(0.94)	(1.99)	(2.81)	(0.26)	(-0.89)	(-0.75)	(0.47)
Ln(ASSET) [1]	-0.490***	-0.41***	-0.371***	-0.294***	-0.238**	-0.241	-0.202	-0.174
	(-5.69)	(-5.31)	(-3.92)	(-5.39)	(-2.48)	(-1.54)	(-1.48)	(-1.71)
Ln(BR) [1]	0.664***	0.546***	0.529***	0.476***	0.260*	0.331	0.244	0.133
	(4.73)	(4.55)	(3.37)	(6.00)	(1.97)	(1.70)	(1.38)	(0.99)
R^2	0.77	0.76	0.70	0.80	0.46	0.51	0.70	0.92
H statistics	0.142	-0.152	-0.248	0.074	0.099	0.028	0.330	0.401
Wald statistic H=1[2]	18.11	17.14	11.67	52.58	31.08	15.15	11.67	34.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
Wald statistic H=0[2]	0.50	0.30	0.47	0.34	0.38	0.01	2.83	15.28
	(0.49)	(0.59)	(0.50)	(0.57)	(0.55)	(0.92)	(0.13)	(0.00)
No. of obs	24	23	24	25	18	14	15	15

[1] ( ) represents t-value and

[2] ( ) represents p-value

<Appendix2> Regression results of competitive conditions for Korean banking sector

$$\ln TREV = \alpha_0 + \alpha_1 \ln PL + \alpha_2 \ln PK + \alpha_3 \ln PF + \alpha_4 \ln RISKASS + \alpha_5 \ln ASSET + \alpha_6 \ln BR + \varepsilon$$

TREV	1994	1995	1996	1997	1998	1999	2000	2001
Ln(PL)[1)]	-0.00	-0.088	-0.054	-0.074	-0.083	-0.436	-0.532	0.3342
	(-0.00)	(-1.55)	(-0.89)	(-1.01)	(-0.69)	(-1.62)	(-0.69)	(1.36)
Ln(PK)[1)]	0.053	0.077	0.073	0.209	0.060	0.208	0.248	-0.357
	(1.06)	(0.99)	(0.66)	(1.33)	(0.19)	(1.38)	(0.42)	(-0.76)
Ln(PF)[1)]	-0.056	-0.159	-0.286	-0.086	-0.015	-0.073	0.239	0.114
	(-0.48)	(-1.26)	(-1.76)	(-0.98)	(-0.27)	(-0.64)	(0.99)	(0.53)
Ln(RISKASS)[1)]	0.01	0.088	0.131**	0.148	0.159	0.038	0.056	0.206**
	(0.24)	(1.64)	(2.77)	(2.62)	(1.30)	(0.68)	(0.94)	(2.41)
Ln(ASSET)[1)]	-0.332***	-0.304***	-0.331***	-0.171	-0.019**	-0.340*	-0.326	0.064
	(-5.30)	(-5.32)	(-4.86)	(-1.85)	(-0.10)	(-1.96)	(-0.90)	(0.28)
Ln(BR)[1)]	0.526***	0.450***	0.510***	0.313	-0.00	0.437*	0.323	-0.134
	(5.15)	(4.95)	(4.51)	(2.32)	(-0.00)	(2.02)	(0.68)	(-0.45)
R^2	0.81	0.79	0.78	0.57	0.20	0.50	0.59	0.57
H statistics	-0.003	-0.170	-0.267	0.050	-0.039	-0.301	-0.045	0.099
Wald statistic	46.87	30.84	23.65	19.19	11.06	21.90	4.01	15.80
H=1[2)]	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.08)	(0.00)
Wald statistic	7.02	0.65	1.05	0.05	0.02	1.18	0.01	0.19
H=0[2)]	(0.02)	(0.43)	(1.17)	(0.82)	(0.90)	(0.31)	(0.93)	(0.67)
No. of obs	24	23	24	25	18	14	15	15

[1)] ( ) represents t-value and

[2)] ( ) represents p-value

<Appendix 3> Regression results of equilibrium conditions for Korean banking sector

$$\ln ROA = \alpha_0 + \alpha_1 \ln PL + \alpha_2 \ln PK + \alpha_3 \ln PF + \alpha_4 \ln RISKASS + \alpha_5 \ln ASSET + \alpha_6 \ln BR + \varepsilon$$

ROA	1994	1995	1996	1997	1999	2000	2001
Ln(PL)[1)]	-0.009	-0.651	1.930	1.378	3.766	-4.106	0.277
	(-0.04)	(-1.00)	(0.70)	(0.46)	(0.47)	(-0.73)	(0.18)
Ln(PK)[1)]	0.039	1.385	0.884	-2.304	-4.835	4.077	-0.186
	(0.14)	(1.50)	(1.17)	(-0.91)	(-0.30)	(1.41)	(-0.06)
Ln(PF)[1)]	-0.894	-1.444	0.019	1.113	-0.967	-3.854	1.170
	(-1.39)	(-1.01)	(0.02)	(0.65)	(-0.11)	(-1.06)	(0.82)
Ln(RISKASS)[1)]	-0.572*	-0.491	-1.004	0.438	-0.776	-1.053	-0.418
	(-1.81)	(-0.80)	(-2.95)	(0.69)	(-0.50)	(-0.88)	(-0.88)
Ln(ASSET)[1)]	0.183	-0.209	-0.523	0.884	2.517	-2.476	0.321
	(0.53)	(-0.32)	(-1.10)	(1.43)	(0.464)	(-1.43)	(0.22)
Ln(BR)[1)]	0.408	0.234	0.36	-0.384	-1.357	3.96	0.347
	(0.71)	(0.22)	(0.47)	(-0.44)	(-0.21)	(1.77)	(0.18)
R^2	0.36	0.32	0.49	0.83	0.53	0.95	0.60
-H statistics	-0.86	-0.711	2.834	0.187	-2.036	-3.822	1.262
Wald statistic	1.15	0.09	0.67	0.00	0.01	2.78	0.94
H=0[2)]	(0.30)	(0.77)	(0.42)	(0.98)	(0.93)	(0.34)	(0.36)
No. of obs	23	21	22	8	8	8	14

[1)] ( ) represents t-value and

[2)] ( ) represents p-value