Performance of Korean Banks and Implications for Regulatory Reforms

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INTRODUCTION

In explaining the relationship between structure and performance in the banking sector, two competing hypotheses have been proposed. The market structure hypothesis postulates that banks in a concentrated market can charge higher loan rates and pay lower deposit rates through their market power, as well as lowering collusion costs, thus generating more profits. On the other hand, the efficient structure hypothesis states that efficient banks can obtain higher profitability, as well as greater market share, because of their efficiency, which will lead to a more concentrated market. Numerous studies have tested these two competing hypotheses for U.S. banks and European banks (to name a few, Smirlock, 1985; Shepherd, 1986; Berger, 1995a; Goldberg and Rai, 1996; Maudos, 1998). In earlier studies (Smirlock, 1985; Evanoff and Fortier, 1988), market share is used as a proxy for efficiency due to lack of available efficiency measures. In many previous studies, a positive relationship between concentration and performance in banks has been inconclusive while a statistically significant positive relationship has been found between market share and bank profitability. As some (e.g., Sherpherd, 1986; Berger, 1995a) questioned the validity of assuming that market share is a proxy for efficiency, direct measures of efficiency have been used in more recent studies (Berger, 1995a; Goldberg & Rai, 1996; Maudos, 1998). These findings support the efficiency structure hypothesis.

To my knowledge, there has been no research done to investigate this relationship in the Korean banking sector. There are a couple of studies on productivity and efficiency of Korean banks. Gilbert and Wilson (1998) investigated the effects of privatization and deregulation on the productivity of Korean banks over the period 1980-1994. Using Malmquist indexes they decomposed productivity change into technical efficiency and changes in technology. They found that Korean banks dramatically changed their mix of inputs and outputs while they were privatized and deregulated during the 1980s and early 1990s. They also concluded that privatization and deregulation enhanced potential output, as well as productivity, among Korean banks by measuring technological change from the perspective of the new mix of inputs and outputs.

Hao, Hunter, and Yang (2001) extended the analysis of Gilbert and Wilson (1998) in order to identify the key determinants of the efficiency gains. Using the stochastic cost frontier approach, they computed efficiency scores for a sample of nine nationwide banks and 10 regional banks for the period 1985-1995. These efficiency scores were then regressed on several independent variables in order to identify the key determinants of the efficiency gains. Banks with higher rates of assets growth, fewer employees per million won of assets, larger amounts of core deposits, lower expense ratios, and classification as a nationwide bank were found to be more efficient. However, they found that financial deregulation of 1991 had little or no significant effect on the level of the sample banks' efficiency.

While the previous two studies on Korean banks focused on productivity or efficiency and their determinants, the purpose of this paper is to identify the major determinants of profitability in the Korean banking sector for the period of 1992-2002 by testing the two competing hypotheses in an integrated model. Since the Korean banking sector has undergone many changes throughout this period which have affected its performance, it is necessary to discuss those changes in detail. In the next section, after a brief history of the Korean banking system, we will discuss financial liberalization in the early 1990s, the financial crisis of 1997-1998, and the post-crisis banking restructuring. Section 3 presents a structural model which is a modified version of Berger (1995a) and an integrated equation in the reduced form to test the competing hypotheses. The data and the variables used in this study are described in section 4. Section 5 presents estimated results and their interpretation. In section 6 a measure of allocative inefficiency or X-inefficiency is introduced and estimated by a distance function. Furthermore, this estimated measure is used in explaining profitability in the Korean banking sector. Finally, the last section summarizes and presents policy implications for Korean banking.

LIBERALIZATION, CRISIS AND RESTRUCTURING

The growth of the Korean banking sector has been matching the rapid growth of the Korean economy since the 1960s. Actually the banking sector has grown faster than the overall growth of the economy in the last twenty years. The total assets of Korean commercial banks increased at an annual growth rate of 22%, compared to an annual nominal GDP growth rate of 14% for the same period. However, the Korean banking sector has undergone many changes including nationalization, privatization, re-nationalization, re-privatization, financial liberalization, financial crisis, and, most recently, restructuring.

1. Pre-liberalization Period

A few modern commercial banks were established in Korea during the Japanese occupation (1910-1945) and Korea inherited these banks when the Japanese colonial rule ended in 1945. After undergoing political instability and chaos prior to, and even after, the establishment of the Republic of Korea in 1948, the Korean government passed two important pieces of legislation in the banking sector in 1950: the Bank of Korea Act authorizing the creation of the central bank and the General Bank Act regulating privately held commercial banks. The General Bank Act of 1950 laid a foundation of sound banking guidelines for modern Korean commercial banks. However, banks were soon nationalized or controlled by the government after the Korean war, which lasted for four years from 1950 to 1953, in order to mobilize scarce financial resources for reconstruction and development of devastated industries. The end of the dictatorial regime of President Rhee and establishment of a new regime by free election in 1960 resulted in a brief period of privatization and autonomy in management. However, a military coup in 1961 and the subsequent regime led by President Park reversed this course.

The government forced nationwide commercial banks, five in total at that time, to sell the major portion of their equity capital to the government. This was done so that the government could channel cheap financing to the targeted industries, initially import substitution industries, and later export promotion industries, and finally heavy and chemical industries, under a series of ambitious 5-year economic development plans. Several specialized banks were also established in the early 1960s to be operated outside of the central bank's authority and to finance government-targeted priority industries.[1] Regional banks which were allowed to do banking business only in their own provinces were introduced in the late 1960s to stimulate regional economic development. Within a few years ten regional banks were established and all of them stayed in business until the Korean financial and currency crisis of 1997-1998. After the crisis, four regional banks were closed or merged with bigger nationwide banks. The government controlled not only allocation of financial resources but also interest rates. They set the interest rates on deposits and loans in such a way that real interest rates on policy loans were usually lower than real rates of return, sometimes becoming negative.

Commercial banks have been the main instrument for carrying out government-initiated economic development plans during the 1960s and 1970s. The proportion of total policy loans to total domestic credit increased from 40% in the 1960s to 50% in the 1970s. It was during this time period, particularly the 70s, that Korean conglomerates, or Chaebols, were formed and expanded under government protection.[2] In order to promote heavy and chemical industries, well-established entrepreneurs with proven records were asked to invest in targeted industries with all kinds of government financial support: allocation of

necessary credits, lower interest rates on policy loans, easy access to foreign exchanges, and tax concessions.

2. Denationalization and Deregulation in the 1980s

Facing financial difficulties and inefficiency, the Korean government introduced a series of reforms during the 1980s. With the revision of the General Banking Act in 1982, the Korean government began gradual privatization and deregulation of the industry, including easing entry requirements, limiting autonomy in setting lending rates, reducing discriminatory restriction on foreign banks, and allowing more permissive banking activities.[3] As a result, the number of nationwide commercial banks increased from five in 1980 to ten in 1990 and fourteen in 1993. With regulatory reforms, the idea was that the government would focus more on indirect control of credit through control of monetary aggregate and reserve requirements instead of direct control of allocation of credit, leaving management and operation of the banking business to individual banks. However, in reality, the government continued to influence credit allocation through informal guidance and through its influence on the appointment of top managers until later financial liberalization in the 1990s.

The formal banking sector has coexisted with an unregulated underground sector since the independence of Korea. Lower interest rates on deposit turned away savers and government allocation of scarce financial resources to its favored industrial sectors prevented ordinary businessmen from getting cheaper loans from banks. Through the 1970s this underground market prospered notwithstanding all kinds of government efforts to curb it. In order to stem the underground market and attract funds into formal sectors, the Korean government allowed creation of merchant banks and short-term finance firms during the 1980s.

3. Financial Liberalization in the early 1990s

In order to cope with global financial liberalization and under the pressure from the OECD and the US to open its financial markets to foreigners, the Korean government initiated financial liberalization with revisions in the General Banking Act in 1991 and subsequent years.[4] This financial liberalization program was initially implemented in 1991 in four phases to be completed by 1997 in order to increase efficiency and competitiveness of the domestic financial markets. The main focus of the program was accelerated deregulation of interest rates throughout all four phases. The program also included phasing out policy loans, improving and eliminating credit control

system, reducing non-performing loans, widening financial market opening at the third stage, deregulating foreign exchange market, introducing a quasi universal banking system, and restructuring bank ownership. Since 1995, an individual shareholder can own up to 12% of a commercial bank's capital equity. The key element in widening financial market opening was opening the securities market to foreigners in phase three.

In the case of deregulation of interest rates, in phase one, which ended in November 1991, loan interest rates on bank overdrafts and discounts on commercial bills as well as interest rates on short-term, large denomination deposits were deregulated. In phase two, which ended in November 1993, interest rates on all loans except for policy loans as well as interest rates on long-term deposits were deregulated. By the end of 1993, the vast majority of interest rates in Korea were deregulated: 87% for loans and 69% for deposits. In phase three, which ended in December 1996, interest rates on all loans and all deposits except for demand deposits, were liberalized. Interest rates on demand deposits, the only item still under regulation in phase three, were finally deregulated in 1997.

With the completion of all four phases, Korean firms are no longer required to obtain government approval when they borrow money from foreign banks or issue securities abroad. Some attribute such financial liberalization without appropriate supervision as a major cause of the Korean financial currency crisis of 1997-1998.

4. Financial and Currency Crisis of 1997-1998

The Korean financial and currency crisis occurred so suddenly, without any warning signs, and so deeply, that many policy makers were in shock without knowing what to do at the onset of the crisis. Although most economists, whether academics or practitioners, failed to predict the event, we can find several underlying causes from the rubble of the currency collapse. First, financial liberalization and deregulation allowed domestic financial institutions and domestic corporations to have easy access to foreign capital to finance domestic investment and financing. Wyplosz (1998) noted that financial liberalization is the best predictor of currency crises as evidenced in Latin America in the 1980s, Europe in the early 1990s, and Asia in 1997. Easy access to foreign capital alone does not make overborrowing possible unless it is matched by overlending by international creditors. Overborrowing and overlending occurred because of asymmetric information or the moral hazard effect. Foreign lenders perceived that their loans to domestic financial institutions were backed by government explicit or implicit bail-out guarantees. A long period of recession and very low domestic interest rates in Japan led to

especially huge capital lending to Asian countries. Although financial deregulation tends to improve the degree of transparency, financial liberalization was not accompanied by appropriate supervision and prudential regulation. Lax supervision not only created a very high level of foreign borrowing, but also allowed the development of serious asset liability mismatches: financing long-term domestic lending through short-term foreign borrowing. Banks borrowed short-term foreign capital at lower rates and made long-term loans at higher rates, with expectation that they could continually renew short-term borrowing. The same mismatches caused the Savings and Loan Association Crisis of 1980s in the US.

Second, overborrowing caused excessive investment in low-return or risky projects. Normally capital inflows can be channeled to productive investment activities, leading to higher economic growth. However, excessive borrowing and the resulting excessive investment beyond the economies' manageable capacity made macroeconomic management more complex and exposed the economies vulnerable to a shift in credit conditions. Excessive borrowing in Korea, which was channeled through financial institutions, mainly financed investment in tradable goods sectors by the conglomerates, the so-called Chaebol, resulting in overcapacity (e.g., automobiles and micro-chips capacity), while excessive borrowing in other countries mainly financed non-tradable sectors, particularly the real estate sector. According to Corsetti, Pesenti and Roubini (1998), the evidence of overinvestment and risky investment can be seen from the high rate of non-performing loans just before the crisis in most Asian countries that experienced the crisis, and very high leverage ratios in the corporate sector of the involved countries. In Korea, cheap financing encouraged the already debt-laden conglomerates (Chaebol) to diversify into many areas unrelated to their specialties, resulting in a very low profitability for the conglomerates. The average leverage ratio for the top 10 conglomerates at the end of 1996 was 383% (see Park, 2003) while Anam group, one of top thirty conglomerates, had the highest leverage ratio as a group at 3,533.9% at the end of 1996. There were five individual corporations whose leverage ratio exceeded 10,000%. Korean conglomerates expected a government bailout if needed because they were too big to be allowed to fail, and this, in turn, encouraged their overborrowing and risk investment, a typical case of moral hazard.

Third, Korean banks not only borrowed too much, but also borrowed in a risky mix. Composition of the capital inflows does really matter. Equity flows through foreign direct investment (FDI) is most stable for sustainability of the current account deficits. This explains why China, with most of its capital inflows in the form of FDI, was able to escape the Asian currency crisis. Short-term capital inflows are most dangerous because hot money flows can reverse at any moment if creditors perceive development of unfavorable market conditions. As far as FDI is concerned, Korea is a net exporter of FDI; in 1996, Korea's FDI

inflows were $2.3 billion while its FDI outflows were $4.4 billion. Korea also relied heavily on short-term debts (65% of total foreign liabilities) because of lower financing costs.

Fourth, the banking system in Korea was in trouble as early as 1996. Many recent studies (see Kaminsky, Lizondo and Reinhart, 1998) show that there exists a high correlation between currency crises and financial crises. Korea was no exception. The Korean banking sector was fragile and poorly regulated. Especially, non-bank intermediaries, the so-called merchant banks that emerged after financial liberalization, were largely unregulated. Lax supervision allowed a mismatch between short-term liabilities and long-term assets, making the banking system vulnerable to financial panic. Weak bond and stock markets in Korea put an extra burden on the banking system to intermediate the current account deficits. Korean banks and non-banks borrowed too much from abroad and then, in turn, lent to domestic firms, mainly conglomerates that effectively control some banks. When domestic banks were ending up with an increasing number of non-performing loans, foreign creditors became less willing to roll over the existing loans, igniting speculative attacks. In Korea, the non-performing loans as a share of total loans reached 16% in June 1997 and then 22.5% in the first quarter of 1998 (see Park, 2003).

Fifth, real exchange rate appreciation and resulting current account deficits preceded the currency crisis. Between 1990 and 1996, real appreciation exceeds 12% for Korea (see Radelet and Sachs, 1998). Slow recovery in Japan, overcapacity in Asia's key export industries (e.g., automobiles, micro-chips, steel, wood products, etc.), and Chinese devaluation in 1994 made the current account deficits worse. The importance of the current account balance cannot be emphasized too much. Since the current account sustainability depends on many factors, there is no clear-cut simple rule to apply. However, Lawrence Summers, the former US Deputy Treasury Secretary, notes that a country should pay attention to any current account deficit in excess of 5% of GDP. Corsetti, Pesenti and Roubini (1998) suggest that a non-increasing foreign debt to GDP ratio is a sufficient condition for external solvency. Korea was surely not meeting this sufficient condition. Some might say that, according to Summers's criterion, Korea was not at risk, because its current account deficit as a share of GDP was 4.76% in 1996. Two qualifications are needed. First, the current account deficit, due mainly to a large trade deficit, almost approached the 5% mark in 1996 with no prospect of reversal. Second, the speed at which the deficit grew was so fast that many expressed concern regarding this matter. Even if a country has problems with the current account deficit, the presence of large foreign exchange reserves can reduce the risk of unsustainability. This enables a country to continuously finance current account deficits through foreign borrowing at lower costs. Traditionally, foreign exchange reserves are needed to finance import demand. However, in globalized financial markets

with easy capital inflows and outflows, a country should be prepared for sudden outflows of speculative hot money. The most commonly used indicator is the ratio of short-term foreign liabilities to foreign exchange reserves. In Korea, the ratio was 2.06 by the end of 1996, which was not small enough. Real appreciation and huge current account deficits make countries with fixed or quasi-fixed exchange rates (e.g., Korea) very vulnerable to the risk of a reversal of capital inflows.

Finally, a contributing factor present in each currency crisis that occurred in the 1990s is the contagion of financial disturbances across countries. Two unique features of contagion effects in the Asian crisis are (1) that real linkages such as trade or investment links among the countries involved are fairly weak, and (2) that the crisis originated in a small country (Thailand) and spread to the whole region including some larger economies (e.g., Korea). Many creditors seemed to see the region as one entity and assumed that if one country was in trouble, the other countries in the region had similar problems. While part of the contagion might be caused by irrational behavior, most of the contagion actually reflected rational market behavior. One channel of the contagion is the "wake-up call" hypothesis. Trouble in one country (Thailand) acted as a wake-up call for international creditors and investors to reassess the creditworthiness of Asian countries, and their reassessment found weaknesses in the other countries similar to those in Thailand (see Goldstein, 1998). Another channel of the contagion is rational behavior responding to competitive devaluations. As one country (Thailand) devalued its currency, other countries experienced a decline in export competitiveness, which in turn made their currencies more susceptible to speculative attacks. As Krugman (1998) puts it, the development of the crisis involved a sort of circular process. When it became clear that governments were going to have to spend a lot of money bailing out the existing creditors of financial institutions, it became unlikely that money could be spent to bail out any new creditors, so the creditors would not renew short-term debts, resulting in credit crunches and currency crises that undermined still more financial intermediaries and so on.

5. Post-crisis Restructuring

The financial crisis of 1997-1998 brought about a significant transformation in the banking sector in Korea. To correct structural weaknesses in the banking sector and to tackle serious insolvency of the financial institutions, the government carried out unprecedented financial restructuring in two stages: the first restructuring immediately following the crisis and the second one in June 2000. The reform measures of the first stage included the nationalization of two banks for later sale to foreigners, closure of five banks with serious

insolvency to be merged later with blue-chip banks, inducement of foreign capital to seven recoverable banks, and injections of public funds into surviving banks to normalize their operations. Korean banks were successful in reducing operational costs by retrenchment of branches and employees, and experienced the fastest disposal rate of non-performing loans among the Asian countries which had suffered from the same financial and currency crisis.

A second stage restructuring process was launched by the government in June 2000, focusing on restoring the profitability of the banking sector. The reform measures this time included the following; encouraging consolidation in the banking sector through voluntary mergers and acquisitions; creation of financial holding company structures to make merger and acquisition easier; clean-up of bank balance sheets by a realistic application of the forward-looking asset classification and provisioning rules to work-out companies and other restructured loans; injecting additional capital into those banks that were most affected by the recognition of these losses.

The restructuring process led to a significant consolidation in the Korean banking sector. The government encouraged consolidation in order to improve the profitability of Korean banks through realization of economies of scale. Mergers have been a main type of consolidation in the banking sector. Concentration before the crisis was moderate, but increased considerably with the consolidation in the sector. However, according to an IMF study (2001), an international comparison suggests that the concentration in the Korean banking sector is not high relative to other OECD countries. During the post crisis period, nationwide commercial banks gained market share both in the deposit and loan markets at the sacrifice of regional banks.

The restructuring process also resulted in an increase in government ownership of commercial banks. Before the crisis, the Korean government had equity shares in only three banks, accounting for less than 18% of total banking sector capital. The recapitalization of troubled banks with public funds, however, led to a significant increase in government ownership in the banking sector. As of the end of 2002, the government owned 56% of total Korean bank equity capital. However the government plans to sell government holdings and recover the public funds injected into banks.

The restructuring of banks has also resulted in an increase in foreign ownership. Until 1999 individual foreign ownership in Korean banks was limited to 50% of equity capital. In the aftermath of the crisis, banks being restructured were exempted from these restrictions. Now foreign ownership represents about 30% of total banking sector assets. For example, 51% of the Korea First Bank is controlled by Newbridge Capital, 30% of the Korea Exchange Bank by Commerzbank.

As the focus shifts from asset growth in the past to profitability in the recent period, bank balance sheets of the banking sector are undergoing a

process of rationalization. Banks are reducing non-earning assets and shifting their loan portfolio away from corporate lending toward household loans. This shift was also encouraged by the government to stimulate domestic consumption to compensate for reduction in exports in the face of the world-wide recession. However, severe competition in the household loans market among banks and accompanying easy financing has resulted in a high default rate of consumer and credit-card debts and brought about a consumer loan crisis in 2003. Despite their shift in focus from asset growth to profitability, the performance of Korean banks in terms of profitability has been poor, due to the high share of nonperforming loans in their total portfolio and deficiencies in pricing credit risk. Many nonperforming loans were inherited from banks' Chaebol guarantees prior to the crisis. In recent years there has been an optimistic sign of profitability, with both the return on equity and the return on assets (which were negative during the first three years after the crisis) changing to positive in 2001 and 2002.

SPECIFICATION OF THE MODELS

In the literature of bank profitability, there are two main contrasting hypotheses: the market structure hypothesis and the efficient structure hypothesis. Under the traditional market structure hypothesis, market structure – either concentration or market share – influences behavior of banks through the pricing of their products in an imperfectly competitive market, and this results in higher profits. Under the efficient structure hypothesis, market power is not the cause of higher profits, but both market power and higher unit profits are the results of efficiency in management, operation and technology (X-efficiency hereafter). Banks with superior efficiency can lower their unit costs and thus increase their profits. Others in the efficient structure hypothesis camp advance the scale efficiency version in that banks have similar levels of management and technology efficiency, but some banks simply produce on a more efficient scale than others, leading to lower unit costs and higher unit profits.

The structural model representing the traditional market structure hypothesis is as follows.

$$\pi_i = f_1 (P_i, Z_{1i}) + \varepsilon_{1i} \quad (1)$$

$$P_i = f_2 (MS_i \text{ or } CONC, Z_{2i}) + \varepsilon_{2i} \quad (2)$$

$$CONC = f_3 (MS_i) \quad (3)$$

Where π_i is a measure of profitability of bank i, P is a vector of output prices, Z is a vector of control variables, and ε is a random error term. MS represents market share while CONC is a measure of market concentration ratio. According to market structure hypothesis, output prices are mainly determined

by market structure. In equation 2, either MS or CONC is used depending on a specific hypothesis modeled. According to the collusion hypothesis (or structure-conduct-performance hypothesis) the degree of market concentration is an important exogenous variable in determining profits while market share is the major determinant of profits according to the relative market power hypothesis. This model does not exclude the effects of X-efficiency or scale-efficiency on profitability through their inclusion in Z vectors. However, this model views market structure or market power has more significant influence on profitability.

On the other hand, the structural model representing a more recent efficient structure hypothesis is as follows.

$$\pi_i = f_4(EFF_i, MS_i, Z_{4i}) + \varepsilon_{4i} \quad (4)$$

$$MS_i = f_5(EFF_i, Z_{5i}) + \varepsilon_{5i} \quad (5)$$

$$CONC = f_6(MS_i) \quad (6)$$

where EFF is a measure of efficiency, either X-efficiency or scale efficiency, depending on the version of the efficient structure hypothesis used. According to this hypothesis, a positive relationship between MS and π is a spurious effect because both MS and π are affected by efficiency.

In the past MS was used to support both the market structure hypothesis and the efficient structure hypothesis. Some argued that the significance of MS supports the relative market power hypothesis according to equations (1) and (2) (for example, Shepherd, 1982; Kurtz & Rhoades, 1991). On the other hand, the supporters of the efficient structure hypothesis also used MS as an intermediary variable between EFF and π because of the difficulty of measuring EFF, and argued that the significance of MS supports their hypothesis (for example, Smirlock, 1985; Evanoff and Fortier 1988; Molyneux and Forbes, 1995). More recent studies have applied several measures of efficiency directly in determining bank profitability (for example, Berger, 1995a; Maudos, 1998).

In order to test these different hypotheses, it is necessary to develop a model that nests all the hypotheses. The following structural model is a combined model of the above two structural models where CONC is operationalized by HINDEX, the Herfindal index.[6]

$$\pi_i = f_7(P_i, EFF_i, MS_i, Z_{7i}) + \varepsilon_{7i} \quad (7)$$

$$P_i = f_8(MS_i \text{ or } HINDEX, Z_{8i}) + \varepsilon_{8i} \quad (8)$$

$$MS_i = f_9(EFF_i, Z_{9i}) + \varepsilon_{9i} \quad (9)$$

$$HINDEX = f_{10}(MS_i) = \Sigma MS_i^2 \quad (10)$$

The reduced form for π can be derived from the above structural model as

$$\pi_i = f_{11}(P_i, EFF_i, MS_i, HINDEX, Z_{11i}) + \varepsilon_{11i} \quad (11)$$

Depending on the hypothesis adopted, one specific variable is important while the other explanatory variables are irrelevant. Under the collusion version of the market structure hypothesis, HINDEX is expected to be statistically significant and have a positive sign. Under the market power

version of the marker structure hypothesis, MS is expected to have a statistically significant and positive effect on profitability. Under the efficient structure hypothesis, EFF, whether X-efficiency or scale efficiency, should be statistically significant while the other variables are irrelevant. Under this hypothesis, MS, in the absence of EFF, may have a spurious effect on profitability because MS is a mediating variable through which effects of EFF are transmitted to profitability. However, MS should be statistically insignificant when EFF is included in the model. Equation 11 allows for the validity of more than one hypothesis.

DATA AND VARIABLES USED

The data is based on the financial statements of Korean banks from 1992 to 2002. As the Korean banking sector went through financial liberalization in the early 1990s, the Korean currency and financial crisis of 1997-1998, and banking restructuring since the crisis, the number of Korean banks rose in the early 1990s, but declined since the crisis due to bank closures, purchase and assumption (P & A) or merger and acquisition (M & A). In 1992, at the beginning of the sample period, there were fourteen nationwide commercial banks and ten regional banks. Just before the crisis twenty-six commercial banks were in existence as two more nationwide banks were added. The number of commercial banks was reduced to seventeen by the end of 1999 and down to fourteen by the end of 2002 (see Appendix for the list of banks).

As a dependent variable representing profits, three variables are used: (1) ROATOT, the ratio of net after-tax income to assets for both banking and trust businesses; (2) ROABANK, the ratio of net after-tax income to assets for banking business only; and (3) ROE, the ratio of net after-tax income to equity for both banking and trust businesses.

P can be measured by MARGIN, the net interest margin, which is the difference between loan interest rate and deposit interest rate. This variable is estimated by the average earning on loans, minus the average interest expenses on deposits. MS is measured in two ways: (1) MS1 is the share of a bank in total assets in both banking and trust businesses; and (2) MS2 is the share of a bank in total assets in banking business only. MS1 is used in explaining ROATOT while MS2 is used in explaining ROABANK. HINDEX represents the degree of market concentration and is measured by the sum of the squares of each bank's market share in total assets (ΣMS_i). HINDEX1 is for both banking and trust businesses while HINEX2 is for banking business only ($HINDEX1 = \Sigma MS1_i$ and $HINDEX2 = \Sigma MS2_i$).

EFF can be measured in many different ways. A frontier function is typically used to estimate efficiency and inefficiency. As a non-parametric approach, data envelope analysis (DEA) is frequently used. This approach has

the advantage of being distribution free. This approach assumes that the distance between the frontier and actual observation is due entirely to inefficiency. On the other hand, a stochastic frontier approach based on parametric estimation separates an inefficiency component and a random component from an error term. There are two stochastic approaches: distribution-free and distribution-specific. However, if a distribution-free approach is to be used as in Berger (1995), then the differences among banks are assumed to be stable over time. This approach requires that banks be in existence for the entire sample period. It is difficult to apply this approach in the case of the Korean banking sector for the period of 1992-2002 because there are many banks that came and went during this time period. If a distribution-specific approach is used as in Maudos (1998), then it is necessary to know the distribution for both components of the error term. Without prior knowledge of the distribution, arbitrary assumptions about distribution were made in most studies.

Alternatively, a simple, though rudimentary, approach is to approximate operating efficiency directly from the financial statements of each bank. We use two alternative proxies for operating inefficiency: LOPEFF1 is the operating expenses per employee (in log) and LOPEFF2 is the operating expenses per branch (in log). Similarly, we use two alternative proxies for asset efficiency: LASEFF1 is total assets per employees (in log) and LASEFF2 is total assets per branch (in log). Later, we also estimate X-inefficiency from a non-parametric distance function and compare the effects of different measures of inefficiency on profitability.

The following three variables are used as control variables. First, the ratio of equity capital to total assets represented by EQRATIO is used to capture the impact of leverage on banking performance. A higher equity ratio reduces the portfolio risk along with the expected costs of financial troubles, thereby increasing confidence among bank customers, leading to higher profitability. According to the signal theory, banks that expect to have better performance credibly transmit this information through a higher equity ratio (see Berger, 1995a). Second, non-performing loans as a percentage of total loans represented by NPLS is used to capture the deficiency in credit risk management and the resultant quality of assets. Inclusion of this variable is essential because loans are the major type of earning assets. Third, a dummy variable, NATIONAL, is defined 1 for nationwide banks and 0 for regional banks. This variable is used to see the different effect of having nationwide networks. Table 1 shows summary descriptive statistics for some major variables used in this study.

EMPIRICAL RESULTS

Table 3 shows the results of the estimation of Equation 11, using ROATOT as the dependent variable. HINEX, MS and EFF variables are introduced progressively. Model 1 shows the estimated results of a model representing the collusion hypothesis. HINEX is expected to have a positive sign. Most of the previous studies found a statistically insignificant positive relationship between market concentration and profits HINEX. By contrast, we found a statistically significant negative effect of market concentration on profitability. This finding is peculiar to Korean banks during this sample period. Ever since the crisis, market concentration has steadily increased because of government restructuring policy to promote P&As or M&As, while returns on assets have been negative due to the crisis and magnitude of non-performing loans, at least until recently (see Table 2). This peculiarity necessitates a breakdown of the sample period into two or three separate periods, which will be done later.

Model 2 shows the estimated results of the relative market power hypothesis. In this specification, we reject the relative market power hypothesis. Model 3, with inclusion of both HINDEX and MS, is commonly used in the previous studies as a direct test of the efficient market structure hypothesis, using market share as a proxy for efficiency. Most of the previous studies found that market share has a statistically significant positive effect on profitability, while the effect of concentration is not significant. Our study confirms the previous findings on MS, but contradicts the previous findings on HINDEX for the reason explained above. In model 4 we included direct measures of efficiency, with LOPEFF1 representing operating inefficiency and LASEFF1 representing asset efficiency. Both of them have their expected signs and are statistically significant. When LOPEFF1 and LASEFF1 are replaced by LOPEFF2 and LASEFF2 in model 5, similar results as in model 4 are obtained, but with further increased statistical significance of efficiency measures.

Now we turn to the three control variables included in the model. First, EQRATIO exhibits a statistically significant positive effect on bank profitability in all five models. Traditionally, a negative relationship between equity ratio and return on capital was hypothesized for two reasons: (1) higher equity ratio results in a smaller tax deduction of interest expenses and (2) investors have lower expected return on their investment because there is less risk on their equity with a higher equity ratio. However, new theories have been developed to support a positive relationship as discussed in the above section after several empirical findings with the U.S. bank data. Second, NPLS has a very strong negative effect on profitability in all five models, though its explanatory power is somewhat lessened with the inclusion of EFF variables. Figure 1 shows the relationship between the average percentage of non-performing loans in total loans and ROA for both banking and trust businesses for nationwide banks, while Figure 2 is for regional banks. Figures 1 and 2 clearly show the inverse

relationship between NPLS and ROATOT. Loans are the major income-earning assets of banks, and higher percentages of non-performing loans during 1997-2000 critically affect bank profitability, resulting in negative returns on assets. It is necessary to explain why nationwide banks experienced a continuous increase in NPLS until 1999 while NPLS of regional banks has continuously declined since the crisis. Two explanations can be provided. First, most of the troubled regional banks after the crisis were closed and merged into a few nationwide banks in 1998. This left relatively sound regional banks while NPLS of nationwide banks increased inevitably. Second, the Financial Supervisory Commission introduced a more strict "forward-looking criterion" in classifying loans with a grading system of evaluating credit risk. This new criterion led to a substantial increase in non-performing loans. Finally the dummy variable differentiating nationwide banks and regional banks is statistically significant in models 1-3, but becomes insignificant when efficiency variables are included in the model. The results of diagnostic test statistics by VIF (variable inflation factor) indicate no serious problem of multicollinearity in all five models.

Table 4 shows the results of the estimation of Equation 11, using ROABANK as the dependent variable. With a change in the dependent variable, some independent variables are adjusted accordingly. MS2 instead of MS1, HINDEX2 instead of HINDEX1 are used. In calculating EQRATIO, assets in banking business instead of total assets are used as the denominator. Similarly, in calculating LASEFF1 and LASEFF2, assets in banking business excluding assets in trust business are used. Three differences from Table 3 can be noted. First, MS2 has a statistically significant positive effect on profitability in model 2 and 3. However, when EFF variables are included, then MS2 becomes statistically insignificant. This result indicates that the spurious association between MS and π disappears as efficiency variables enter into the model, supporting the efficient structure hypothesis. Second, the NATIONAL dummy variable is statistically insignificant, implying nationwide banks have advantages in trust business, but not necessarily in banking business compared to regional banks. Third, compared to table 3, the explanatory power of the model 4 and 5 has increased from .738 or .743 to .793 or .797. We obtained similar results as Table 3 when we estimated Equation 11 using ROE as the dependent variable. So the results are not presented here.

Table 5 and 6 present the results of the estimation of Equation 11 separately for nationwide banks and regional banks. The dependent variable in Table 5 is ROATOT and the dependent variable in Table 6 is ROABANK. A few noteworthy results are found. First, MS is an influential variable for nationwide banks but not for regional banks. For regional banks, MS even has even a negative effect on profitability when the dependent variable is ROABANK. By law, regional banks are allowed to operate only in their own provinces so that their market share in the entire domestic market is not relevant for their

performance and profits. Furthermore, MS is more important for trust transactions than for banking transactions. When Table 1 was presented above, the negative sign of HINDEX was explained by the peculiarity of Korean banks during the sample period. Another explanation for the negative sign of HINDEX can be offered here. Positive, though statistically insignificant, coefficients of HINEX are obtained for nationwide banks, whether ROATOT or ROABANK are used as the dependent variable. This finding is in line with findings from previous studies. However, strong negative coefficients of HINDEX, which are also statistically significant, are found for regional banks. The stronger nationwide banks are as a group, the less competitive regional banks are. This strong negative association between market concentration and profitability of regional banks also affects the sign and significance of HINDEX for the pooled data for both nationwide and regional banks, which is presented in Table 3 and 4. We also note that EQRATIO is a significant variable for nationwide banks, but not for regional banks.

As discussed in the first section, Korean banks have undergone many changes during the sample period, including financial liberalization, a financial crisis and most recently banking restructuring. The sample period is not a homogenous period from which a stable relationship between the dependent and independent variables can be established. As a matter of fact, there exist three distinctively different periods: the pre-crisis financial liberalization period from 1992 to 1996, the crisis period of 1997-1999, and the post-crisis restructuring period of 2000-2002. The currency crisis was over by the middle of 1998, but financial crisis causing closures of banks, injections of public funds to troubled banks, and mergers continued until 1999. Table 7 presents the estimated results of Equation 11 (only model 4 and 5), using ROATOT as the dependent variable. First, for the period of 1992-1996, when the economy was expanding, banking operation was stable, and financial liberalization continued, all the explanatory variables, except for EQRATIO, have their expected signs and are statistically significant. Even the market concentration ratio measured by HINDEX, which previously had the wrong sign or was insignificant, if it had the right sign, with pooled data, turns out to be statistically significant with the right sign. During this time period, all of the competing hypotheses - the collusion hypothesis, the market power hypothesis and the efficient structure hypothesis - seem to be at work. However, during the second period (1997-1999) and third period (2000-2002), there was a change in the stable relationship between the dependent variable and the independent variables. The coefficients of MARGIN, HINDEX, and MS changed from statistically significant to insignificant, while EQRATIO became statistically significant, indicating the importance of the equity ratio in determining profitability. During the early 1990s when the economy grew and bank deposits and loans expanded very rapidly, the equity ratio did not matter for bank profitability. However, when the economy slows down and the

prospects of banking business are bleak, the equity ratio affects the credit rating of banks and their financing costs. The magnitude and significance of the coefficients of operating efficiency and asset efficiency have increased from the first period to the second period and through the third period. The estimated results of Equation 11 for three separate periods, using ROABANK instead of ROATOT as the dependent variable, are not much different from Table 7 and thus are not reported here.

ALTERNATIVE EFFICIENCY MEASURE

In this section we estimate X-efficiency measure by a distance function in DEA and re-estimate Model 4 and 5 of Table 3 by adding this X-efficiency measure and deleting two simple efficiency measures, LOPEFF and LASEFF, as independent variables. Following Fare and Grosskopf (2004), we assume that there are $k = 1, \ldots, K$ banks which employ x^k vector of inputs to produce y^k vector of outputs. The technology for each bank is written as $\{T^k = \{ (x^k, y^k) :$ inputs can produce outputs $\}$. The piecewise linear DEA technology is written as :

$$T = \{ (x,y) : \Sigma z_k x_{kn} \leq x_n , n = 1, \ldots, N, \quad \Sigma z_k y_{km} \leq y_m , m = 1, \ldots, M,$$

$$\Sigma z_k = 1, \quad k = 1, \ldots, K \text{ and } \quad z_k \geq 0, k = 1,\ldots, K\} \qquad (12)$$

The intensity variables, z_k, $k = 1, \ldots, K$, serve to form linear combinations of all observed banks' inputs and outputs. The N+M inequality constraints restrict the technology in that for a particular bank no more output can be produced using no less input than a linear combination of all observed inputs and outputs. Requiring the intensity variables to sum to one allows variable returns to scale so that maximal profits can be positive, negative, or zero. We assume that the first N-1 inputs such as labor, capital, and deposits are variable inputs (x^v) and can be used in greater or lesser amounts at the bank manager's discretion, but that the Nth input, equity capital (e), is fixed exogenously by bank regulators and owners. Therefore, we partition bank k's input vector as $x^k = (x^{vk} ; e^k)$.

Define the directional technology distance function for each bank as

$$D^k_T (x^{vk}, e^k, y^k; g_x , g_e , g_y) = \max \{\beta: (x^{vk} - \beta g_x, e^k - \beta g_e , y^k + \beta g_y) \in T^k\} \qquad (13)$$

where variable inputs are contracted in the direction g_x , equity capital is contracted in the direction g_e , and outputs are expanded in the direction of g_y . For $(x^{vk}, e^k, y^k) \in T^k$

a value of $D^k_T (x^{vk}, e^k, y^k; g_x , g_e , g_y) = 0$ indicates that the bank operates on the frontier of T^k and is efficient for the direction (g_x , g_e , g_y). A value of $D^k_T (x^{vk}, e^k, y^k; g_x , g_e , g_y) > 0$ indicates inefficiency. With the assumption that equity capital (e) is fixed exogenously by bank regulators and owners, $g_e = 0$. For the

DEA technology, the directional technology distance function for bank ќ is estimated as

$$D^{k}_{T}(x^{vk}, e^{k}, y^{k}; g_x, 0, g_y) = \max \beta \quad \text{subject to}$$
$$\Sigma z_k x^{v}_{kn} \le x^{v}_{ќn} - \beta g_x, \quad n = 1, \ldots, N\text{-}1$$
$$\Sigma z_k e_k \le e_{ќ,}$$
$$\Sigma z_k y_{km} \le y_{ќm}, \quad m = 1, \ldots, M$$

$$\Sigma z_k = 1, \quad k = 1, \ldots, K \text{ and } \quad z_k \ge 0, \quad k = 1, \ldots, K \qquad (14)$$

Figure 3 shows how the production technology and inefficiency are estimated from the observed input and output with an example of four banks: A, B, C, and D. The piecewise linear technology, T, is bounded by the lines HB, BD, DA, and the horizontal extension from A. Given a direction vector (g_x , g_e , g_y) where g_e.is assumed to be zero, the directional function is defined as equation 13. g_e is assumed to be zero in our study as stated above. It expands output in the direction g_y, contracts inputs in direction g_x, and is a measure of technical inefficiency (X-inefficiency). Banks A, B, and D produce on the frontier of T are technically efficient. Bank C operates inside the frontier and is technically inefficient. For bank C, when outputs are expanded and inputs are contracted proportionally, $D^{c}_{T}(x,y;x,y) = CG / Og = \beta^{*}$. Given ouput-input prices p and w, profit maximization occurs at A, where bank C could produce y^{*} using input x^{*}. The gain in output from realizing allocative efficiency is $y_T - y$. The gain in output from realizing profit efficiency is $y^{*} - y_T$.

In this study, we measure X-inefficiency by the directional distance between G and C in Figure 3. For estimation, we use three inputs, which are labor, capital, and deposits, and three outputs, which are commercial loans, consumer loans, and securities. Therefore, X-inefficency is determined by lost *y1*, lost *y2*, lost *y3*, excess *x1*, excess *x2*, and excess *x3*, where *y* = output, *x* = input, and directional vector *g* = (*gy1*, *gy2*, *gy3*, *gx1*, *gx2*, *gx3*). The estimated results show that the average X-inefficiency increased mildly in the early 1990s, but has gradually diminished since the financial crisis. Table 8 shows the estimated results of Model 4 or 5 of Table 3 with replacement of LOPEFF and LASEFF by X-EFF. X-EFF has an expected negative sign as X-EFF is an indicator of allocative inefficiency and is statistically significant, though its t-value is not as high as t values of LOPEFF or LASEFF. All the measures of efficiency used in this study - LOPEFF, LASEFF, and X-EFF - are found to be important variables in explaining bank profitability. No multicollinearity problem is detected by the VIF diagnostics.

POLICY IMPLICATION

This paper has investigated the relationship between structure and performance in the Korean banking sector. The results obtained for the pooled data over the period 1992-2002 indicate that market concentration is an insignificant variable in explaining bank performance in Korea while both market share and efficiency measures affect bank profitability positively. Banks with higher market share, greater net interest margin, less operating cost per employee or branch, more assets per employee or branch, less allocative inefficiency measured by a distance function, higher equity capital ratio and less non-performing loan share are found to be more profitable, while market concentration measured by the Herfindal index and classification as a nationwide bank are found to be not important variables in explaining bank profitability. However, when the sample period is broken down into three distinct periods, further insight is obtained. During the stable banking operation period, such as in the first period, all three variables - market concentration, market power, and efficiency - are significant in explaining bank profitability. However, during the crisis and survival periods, the efficiency variable stands out as the primary variable in affecting bank profits. While market concentration and market share became less significant, the importance of the efficiency variable and its magnitude of influence increased as Korean banks went through turbulence. The equity capital ratio is also found to be an important determinant of profitability during both the crisis and survival periods.

This evidence has several policy implications for bank regulation. The first implication is for merger and antitrust policy. Under the collusion hypothesis, mergers might be initiated by banks in order to extract consumer surplus, and the result would be higher prices to consumers and socially inefficient. On the other hand, according to the efficient market hypothesis, banks are motivated to merger in order to achieve efficiency, and the result is socially optimal. Our findings do not support the collusion hypothesis, and enforcement of antitrust policy in the Korean banking sector is not desirable according to our findings. In this sense, recent government policy to encourage mergers in the banking sector may be justified on the grounds of efficiency and international competition.[7] The two most recent mergers, a voluntary merger between Hana Bank and Boram Bank and an involuntary merger between Commercial Bank and Hanil Bank, are also headed in the right direction. An IMF study (2001) found that both merged banks have realized economies of scale by rationalizing their operations or branch networks and employees, but also that mergers are not a sufficient condition for improved profitability if the underlying banks are unsound. The government's increasing emphasis on bank consolidation is to improve profitability through realization of economies of scale. So even if merged banks have not yet improved profitability, their realization of economies of scale will result in higher profitability in the long run.

The second implication is that both banks and regulatory agencies such as the Korea Financial Supervisory Commission (FSC) should focus on how to improve bank efficiency instead of being concerned about market share or market concentration. Korean banks prior to the financial crisis focused on expanding their market shares instead of reducing costs or improving efficiency. Such strategies were based on a philosophy of "too big to fail" and a moral hazard effect coming from perceiving the government as the lender of last resort and implicit bail-out guarantor. However, the financial crisis of 1997-1998 shook the Korean banking sector, and it was a wake-up call to Korean banks to re-evaluate themselves. Though the financial crisis caused much trouble to the Korean economy and particularly Korean banks, one good thing that came out of the financial crisis was the focus on efficiency improvement. The restructuring of the Korean banking sector might not have been possible without the crisis, because inertia against change had prevailed in the Korean banking sector. As bank regulations that limited free competition were gradually removed, the increasing importance of efficiency was clear.

Third, there is a need for banks to improve their credit analysis skill and risk management. Because of asymmetric information between lenders and borrowers about investment opportunities and activities of borrowers, banks are engaged in two information-producing activities, screening and monitoring. In particular, the presence of an adverse selection in loan markets requires that banks screen out the bad credit risks. Effective information collection and well-programmed screening are essential for credit risk management. It is welcome news that the FSC introduced forward- looking criteria to classify assets in place of backward-looking criteria, along with more stringent procedures for valuation and provisioning of impaired assets. However, Korean banks need to improve their skills of information collection and analysis regarding credit and risk to further reduce occurrences of non-performing loans.

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Notes

1. The Korea Development Bank was established in 1954 in order to promote industrial development and facilitate the reconstruction of the national economy after the Korean War. The Industrial Bank was founded in 1961 to specialize in financing small and medium firms. The National Agricultural Cooperative Federation and National Federation of Fisheries Cooperatives were established in 1961 and 1962 respectively for their targeted industries. The Export-Import Bank of Korea was set up in 1976 to provide funds for exports, imports and overseas investments.
2. A Chaebol in Korea is a group of firms owned and controlled primarily by a single entrepreneur and his family.
3. Privatization started with Korea Commercial Bank in 1981, Hanil Bank, Korea First Bank in 1982 and Cho Hung Bank in 1983.
4. OECD members warned that Korea would risk jeopardizing its membership in the OECD which was scheduled to take effect in 1996, unless it speeded up the pace of financial liberalization and deregulation.
5. There were four mergers in total. Two of the mergers have involved relatively sound banks and were voluntary transactions. One of these involved Kookmin Bank and Korea LongTerm Capital Bank, and created the largest bank in Korea. The second involved two smaller banks, Hana and Boram, and Boram was merged into Hana. Two mergers were also undertaken to restructure unsound banks. These transactions involved the purchase of nonperforming loans of the merged banks by the government in exchange for equity ownership. The first was between Hanil Bank and Commercial Bank, creating Hanvit Bank, which became the second largest bank in Korea with 95% government ownership. Later the bank was renamed Woori Bank. The second involved the merger of three small banks with the fourth largest bank in Korea, Chohung Bank, resulting in 90% government ownership.
6. This model is a modified version of Berger (1995).
7. In 1988 the government engineered four mergers of banks in order to restructure relatively unsound banks.

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Table 1 Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
ROATOT	231	-10.190	1.480	-.38542	2.062771
ROABANK	231	-11.4467	2.6200	-.375897	2.3556501
ROE	231	-595.790	34.200	-12.49974	65.443320
MARGIN	232	-.019	.035	.01562	.007649
MS1	234	.002	1.177	.09374	.196101
HINDEX1	234	.0664	.1542	.092276	.0261013
LOPEFF1	232	-1.21	2.69	1.1820	.77573
LOPEFF2	232	2.50	5.47	4.0055	.65042
LASEFF1	234	2.43	5.06	3.8074	.60523
LASEFF2	234	2.67	5.37	6.6303	.54875
EQRATIO	234	-.062	.418	.05364	.038184
NPLS	231	.0010	.2460	.053756	.0426724
Valid N	229				

Ratios and shares are in percentage, and expenses and assets expressed in 100 million Korean won are transformed into natural logarithm.

ROATOT: ratio of net after-tax income to total assets for both banking and trust businesses.
ROABANK: ratio of net after-tax income to assets for banking businesses only.
ROE: ratio of net after-tax income to equity capital for both banking and trust businesses.
MARGIN: net interest margin, which is the difference of loan interest rate and deposit rate
MS1: share of a bank in total assets in both banking and trust businesses.
HINDEX: sum of square of each bank's market share.
LOPEFF1: operating expenses per employee in log (for both banking and trust businesses).
LOPEFF2: operating expenses per branch in log (for both banking and trust businesses).
LASEFF1: total assets per employee in log (for both banking and trust businesses).
LASEFF2: total assets per branch in log (for both banking and trust businesses).
EQRATIO: ratio of equity capital to total assets (for both banking and trust businesses).
NPLS: non-performing loans as a percentage of total loans.

Table 2 Herfindahl Index and ROATOT

YEAR	92	93	94	95	96	97	98	99	00	01	02
HINDEX	.088	.083	.079	.072	.071	.066	.120	.094	.098	.144	.154
ROATOT	.56	.45	.42	.32	.26	-.93	-3.25	-1.31	-.57	.76	.59

Table 3 Regression Results: Alternative Models
Dependent Variable: ROATOT, n=228

	Model 1	Model 2	Model 3	Model 4	Model 5
Constant	-.184 (-.308)	-1.363 (-2.936)	.171 (.289)	-10.995 (-8.22)	-14.211 (-9.338)
MARGIN	69.125 (3.782)	55.553 (3.031)	65.636 (3.66)	81.165 (5.399)	82.117 (6.56)
HINDEX1	-9.892 (-2.727)		-15.825 (-3.962)	-6.308 (-1.622)	-2.327 (-.752)
MS1		.737 (1.568)	1.664 (3.251)	1.26 (2.941)	.631 (2.155)
LOPEFF1				-2.795 (-9.804)	
LASEFF1				3.382 (9.211)	
LOPEFF2					-2.804 (-10.781)
LASEFF2					3.618 (12.374)
EQRATIO	10.323 (2.513)	16.540 (4.15)	11.734 (2.9)	11.383 (2.72)	10.241 (2.88)
NPLS	-27.584 (-11.732)	-25.69 (-10.75)	-26.543 (-11.418)	-9.328 (-3.58)	-9.539 (-3.954)
NATIONAL	.981 (4.045)	.959 (3.9)	.912 (3.826)	.297 (1.368)	-.08 (-1.177)
R^2	.601	.592	.619	.738	.743

t values in parentheses

Table 4 Regression Results: Alternative Models
Dependent Variable: ROABANK, n=228

	Model 1	Model 2	Model 3	Model 4	Model 5
Constant	.280 (.365)	-1.006 (-1.864)	.891 (1.157)	-12.115 (-9.774)	-17.067 (-8.649)
MARGIN	79.520 (4.164)	40.177 (1.861)	45.044 (2.13)	38.328 (2.418)	41.851 (2.662)
HINDEX2	-14.336 (-2.95)		-16.138 (-3.381)	-21.526 (-5.221)	-18.853 (-4.965)
MS2		9.249 (3.033)	10.357 (3.454)	.572 (.242)	-3.265 (-1.268)
LOPEFF1				-4.148 (-13.036)	
LASEFF1				5.111 (12.437)	
LOPEFF2					-4.051 (-12.957)
LASEFF2					5.417 (12.423)
EQRATIO	7.871 (2.493)	15.395 ((5.162)	10.896 (3.4)	11.393 (3.749)	10.535 (3.699)
NPLS	-31.764 (-11.391)	-30.88 (-11.336)	-33.356 (-12.079)	-14.426 (-5.704)	-14.152 (-5.641)
NATIONAL	1.002 (1.654)	.233 (.619)	.128 (.347)	.2 (.715)	-.077 (-.265)
R^2	.608	.609	.628	.793	.797

t values in parentheses

Table 5 Nationwide versus Regional Banks
Dependent Variable: ROATOT

Variable	Nationwide Banks		Regional Banks	
	Model 4	Model 5	Model 4	Model 5
Constant	-9.851 (-5.614)	-12.006 (-5.025)	-13.554 (-7.088)	-19.570 (-5.470)
MARGIN	67.386 (0.926)	65.431 (3.829)	70.876 (2.296)	72.621 (2.332)
HINDEX1	-0.824 (-0.160)	0.347 (0.073)	-18.940 (-3.438)	-15.388 (-2.944)
MS1	1.421 (2.364)	1.288 (2.142)	0.769 (1.441)	0.898 (1.670)
LOPEFF1	-2.575 (-7.252)		-3.904 (-8.203)	
LASEFF1	2.939 (6.400)		5.043 (8.991)	
LOPEFF2		-2.508 (-7.146)		-3.646 (-7.346)
LASEFF2		3.046 (6.828)		5.303 (8.442)
EQRATIO	13.571 (2.133)	13.619 (2.326)	4.827 (0.839)	5.360 (0.888)
NPLS	-5.708 (-1.603)	-5.939 (-1.742)	-14.275 (-4.182)	-13.592 (-3.889)
N	136	136	91	91
R^2	.663	.667	.863	.861

t values in parentheses

Table 6 Nationwide versus Regional Banks
Dependent Variable: ROABANK

Variable	Nationwide Banks		Regional Banks	
	Model 4	Model 5	Model 4	Model 5
Constant	-11.524 (-6.797)	-15.883 (-6.030)	-11.469 (-6.310)	-17.703 (-5.354)
MARGIN	26.082 (1.328)	28.455 (1.463)	73.791 (2.327)	87.125 (2.761)
HINDEX2	-13.312 (-2.311)	-10.291 (-2.101)	-35.810 (-6.054)	-36.126 (-6.197)
MS2	0.836 (0.300)	-2.289 (-0.747)	-11.571 (-0.695)	-30.619 (-1.897)
LOPEFF1	-3.869 (-8.711)		-4.588 (-9.594)	
LASEFF1	4.683 (7.934)		5.539 (10.357)	
LOPEFF2		-3.826 (-8.847)		-4.366 (-8.940)
LASEFF2		4.964 (8.198)		6.042 (9.960)
EQRATIO	12.846 (2.854)	11.524 (2.798)	2.574 (0.464)	1.826 (0.355)
NPLS	-13.043 (-3.593)	-13.115 (-3.721)	-17.197 (-4.691)	-17.460 (-4.861)
N	136	136	91	91
R^2	.711	.717	.892	.894

t values in parentheses
In calculating LASEFF1, LASEFF2 and EQRATIO, assets in banking business are used instead of total assets for both banking and trust businesses.

Figure 1. NPLs of Nationwide Banks

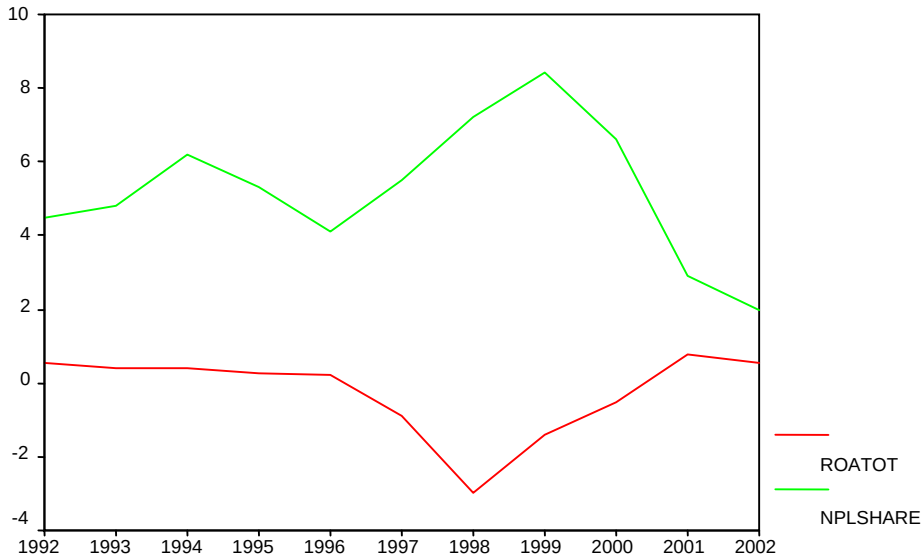


Figure 2. NPLs of Regional Banks

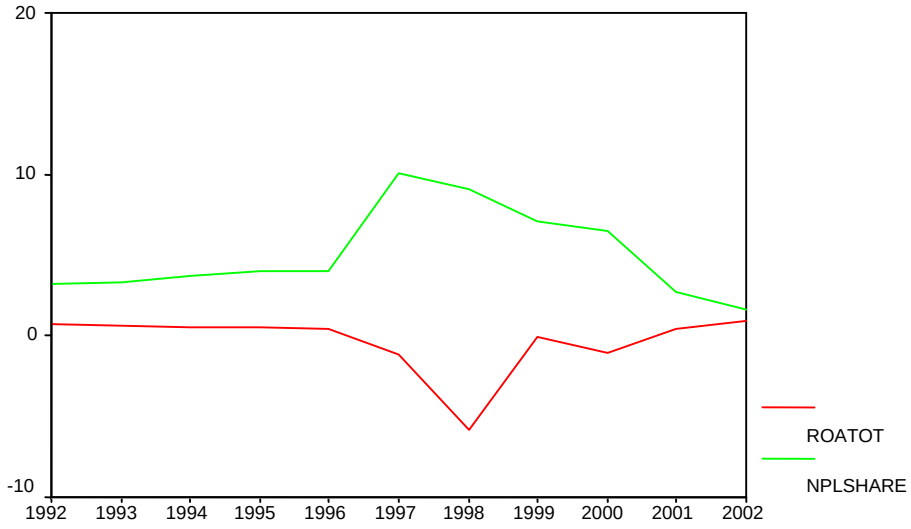


Table 7 Regression Estimates for Three Different Periods
Dependent Variable: ROATOT

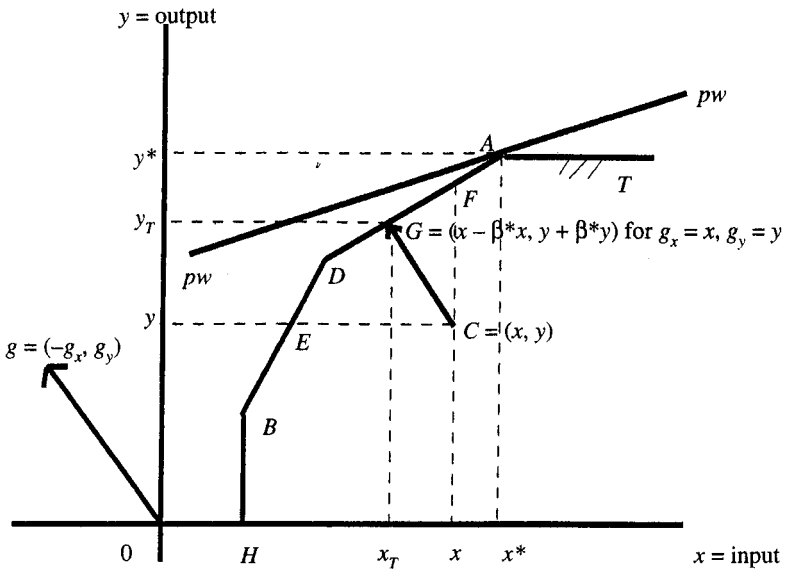
Period	Variable	Model 4		Model 5	
		Coefficient	t	Coefficient	t
1992-1996 (n=120)	Constant	-4.951	-5.234	-6.036	-5.287
	MARGIN	41.949	3.808	45.214	4.108
	HINDEX1	22.235	3.788	17.571	3.819
	MS1	4.472	3.194	3.239	2.032
	LOPEFF1	-.790	-2.813		
	LASEFF1	1.064	3.381		
	LOPEFF2			-.860	-2.390
	LASEFF2			1.194	2.858
	EQRATIO	-.588	-.421	-.263	-.189
	NPLS	-5.793	-3.375	-5.074	-2.887
	National	-.237	-1.701	-.263	-2.033
	R^2	.592		.601	
1997-1999 (n=61)	Constant	-15.308	-4.486	-17.504	-3.025
	MARGIN	29.344	.687	32.397	.750
	HINDEX1	1.342	.092	2.191	.175
	MS1	7.470	.836	6.083	.646
	LOPEFF1	-4.841	-5.195		
	LASEFF1	5.199	5.620		
	LOPEFF2			-4.818	-5.391
	LASEFF2			5.371	5.287
	EQRATIO	29.949	2.332	29.184	2.268
	NPLS	-10.513	-2.087	-10.157	-1.991
	National	-.218	-.250	-.368	-.389
	R^2	.804		.776	
2000-2002 (n=45)	Constant	-3.683	-1.333	-5.523	-1.571
	MARGIN	-17.815	-.790	-16.968	-.734
	HINDEX1	-4.230	-.619	-4.537	-.642
	MS1	.384	1.102	.445	1.261
	LOPEFF1	-2.599	-3.961		
	LASEFF1	1.875	4.406		
	LOPEFF2			-2.464	-3.725
	LASEFF2			2.309	3.997
	EQRATIO	38.083	2.423	40.465	2.528
	NPLS	-8.868	-1.519	-6.706	-1.131
	National	.310	.823	.112	.236
	R^2	.708		.630	

Table 8 Regression Results using X-efficiency
Dependent Variable: ROATOT, n=228

Variable	Model 4 or 5	
	Coefficient	t
Constant	.343	.571
MARGIN	52.164	2.674
HINDEX1	-13.645	-3.373
MS1	1.563	3.05
X-EFF	-1.425	-2.567
EQRATIO	10.491	2.477
NPLS	-25.256	-10.763
National	.741	2.89
R^2	.612	

X-EFF is a measure of allocative inefficiency estimated by a distance function.

Figure 3 Frontier Function and Distance Function



APPENDIX

List of Korean Commercial Banks

Nationwide Banks

1. Cho Hung Bank
2. Commercial Bank of Korea (merged to form Hanvit Bank in 1999)
3. Korea First Bank (nationalized in 1998)
4. Hanil Bank (merged to form Hanvit Bank in 1999)
5. Bank of Seoul (nationalized in 1998)
6. Korea Exchange Bank
7. Shinhan Bank
8. Hanmi Bank (KorAm Bank)
9. Dongwha Bank (acquired by Shinhan in 1998)
10. Dongnam Bank (acquired by Housing and Commercial Bank in 1998)
11. Daedong Bank (acquired by Kookmin Bank in 1998)
12. Hana Bank
13. Boram Bank (merged into Hana bank in 1999)
14. Peace Bank (merged into Woori Holding Co. in 2001)
15. Kookmin Bank (converted from a special bank in 1995)
16. Housing and Commercial Bank (converted from a special bank in 1997 and merged into Kookmin Bank in 2001)
17. Woori Holding Co. (former Hanvit Bank renamed in 2002 when it became a financial holding company)

Regional Banks

1. Daegu Bank
2. Pusan Bank
3. Chung Chong Bank (acquired by Hana Bank in 1998)
4. Kwangju Bank
5. Bank of Cheju
6. Kyungki Bank (acquired by Hanmi Bnk in 1998)
7. Jeonbuk Bank
8. Kangwon Bank (merged into Cho Hung Bank in 1999)
9. Kyungnam Bank
10. Choongbuk Bank (merged into Cho Hung Bank in 1999)