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Assessing competitive conditions in Korea's credit rating industry after the 1997 financial crisis

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Abstract

Investigating the market structure of Korea's credit rating industry during the 1990-2007 period, this paper utilizes t Rosse-Panzar methodology to evaluate the Korean government's financial restructuring policy for fostering the competitive condition in the credit rating industry after the 1997 financial crisis. We find that the degree of market competition in the credit rating industry increased after the implementation of the Korean government's financial restructuring policy. Our analysis indicates that after the financial restructuring process the market structure of Kor credit rating industry became an oligopoly in a contestable market, which is economically equivalent to the structur perfect competition.

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1. INTRODUCTION

In 1997, a series of bankruptcies of the *chaebols* destabilized the financial system of Korea and made the Korean economy vulnerable to a currency crisis. To recover from this unprecedented financial crisis, the Korean government launched critical reforms of the corporate and financial systems. In the financial restructuring process, the Korean government took measures to increase the level of competition in the credit rating industry. Fostering the competitive condition in the credit rating industry is very important because the credit rating system is directly connected to the soundness of the whole corporate system.[1] Hence, the Korean government implemented the "Enforcement Rule of the Use and Protection of Credit Information Act," which lowered the entry barrier to the credit rating industry and allowed foreign companies to hold shares in credit rating firms in Korea. News media and all the parties related with credit rating firms have argued that the credit rating industry became more competitive after the full-scale implementation of this legislation.

However, there have been no studies that have directly addressed the problem of estimating the competitive condition in the credit rating industry. This paper thus examines the competitive condition (i.e., the market structure) of Korea's credit rating industry for the 1990-2007 period. We estimate reduced-form revenue equations on Korea's credit rating firms over this period and utilize the Rosse-Panzar methodology (Rosse and Panzar, 1977; Panzar and Rosse, 1987) to assess competitive conditions in the credit rating industry. To evaluate the effectiveness of the Korean government's financial restructuring policy on the credit rating industry after the 1997 financial crisis, we compare the competitive conditions of the pre-crisis period (1990-1997) and the post-crisis period (1998-2007).

The rest of this paper is organized as follows: Section 2 presents the framework of the Rosse-Panzar test, and Section 3 discusses the data and empirical model of our studies. The estimation results are reported in Section 4, and Section 5 concludes this study.

2. ROSSE-PANZAR METHODOLOGY

Rosse and Panzar (1977) and Panzar and Rosse (1987) develop an empirical method to assess the competitive conditions in a market. It estimates the reduced-form revenue equations of the market participants derived from marginal revenue and cost functions with the zero profit constraint in equilibrium. With this method, we can discriminate the market structure as being *oligopolistic*, *monopolistically competitive*, and *perfectly competitive*. The methodology of Rosse and Panzar (1977) and Panzar and Rosse (1987) stems from a general equilibrium market model. It relies on the premise that firms, depending on the competitive behavior of market participants, will employ different pricing strategies in response to changes in factor input prices. That is, the degree of competition is measured by the extent to which changes in input prices are reflected in firms' equilibrium revenues.

Following Gutierrez de Rozas (2007), let's consider a representative firm i. The

[1] Paul Schott Stevens, the President of the Investment Company Institute, stated in his testimony for the U.S. Senate Committee on Banking, Housing, and Urban Affairs, "I firmly believe that robust competition for the credit rating industry is the best way to promote the continued integrity and reliability of their ratings" (see `http://conferences.ici.org/policy/ici_testimony/05_house_nrsro_tmny`).

twofold profit optimization condition is applied at the industry and the firm levels. At the former level, the zero profit constraint must hold:

$$R_i\left(y_i^*, Z_i^R\right) = C_i\left(y_i^*, W_i, Z_i^C\right), \tag{1}$$

where $R_i(\cdot)$ and $C_i(\cdot)$ refer to the revenue and cost functions of firm i; y_i is the output of the firm; W_i is a K-dimensional vector of factor input prices of firm i (i.e., $W_i = (w_{1i}, ..., w_{Ki})$); Z_i^R is a vector of J exogenous variables affecting the revenue function (i.e., $Z_i^R = \left(z_{1i}^R, ..., z_{Ji}^R\right)$) and Z_i^C is a vector of L exogenous variables that shift the cost function (i.e., $Z_i^C = \left(z_{1i}^C, ..., z_{Li}^C\right)$). At the individual firm level, marginal revenues must equal marginal costs:

$$R_i'\left(y_i^*, Z_i^R\right) = C_i'\left(y_i^*, W_i, Z_i^C\right). \tag{2}$$

From the above two conditions ((1) and (2)), the H-statistic is formulated as follows:

$$H = \sum_{k=1}^{K}\left(\frac{\partial R_i^*}{\partial w_{ki}} \cdot \frac{w_{ki}}{R_i^*}\right). \tag{3}$$

This formula evaluates the elasticity of total revenues with respect to changes in factor input prices. That is, the H-statistic denotes a single figure of the overall level of competition prevailing in the market under consideration. According to Rosse and Panzar (1977) and Panzar and Rosse (1987), the H-statistic ranges from minus infinity to unity. A negative H arises when the competitive structure is a monopoly or a perfect colluding oligopoly. In both cases, an increase in input prices will translate into higher marginal costs, a reduction of equilibrium output and, subsequently, a fall in total revenues. If H lies between zero and unity, the market structure is characterized by monopolistic competition. Under perfect competition, the H-statistic equals to unity. In this particular situation, a proportional increase in factor input prices induces an equiproportional change in revenues without distorting the optimal output of any individual firm.

Table 1: Interpretation of the H-statistic

H-statistic	Competitive Environment
$H \leq 0$	*Monopoly equilibrium* *Perfect colluding oligopoly*
$0 < H < 1$	*Monopolistic competition*
$H = 1$	*Perfect competition* *Oligopoly in a contestable market*

Contestable markets would also generate an H-statistic equal to unity. The contestability theory, first stated by Baumol (1982) and Baumol, Panzar, and Willig (1982), enables the existence of competition in highly concentrated scenarios under very restrictive circumstances, basically free entry and exit of market participants, i.e., neither economic nor legal entry barriers, completely costless exit, and highly price-elastic demand for industry output. On account of these features, the threat of potential new market participants forces firms to price their output in a competitive manner. Importantly, Shaffer (1983) derives the Lerner index as a function of the H-statistic. Hence, we can compare the degree of competition with the relative level

of the H-statistic. That is, we can interpret that the market is more competitive as the H-statistic increases. Interpretations of the H-statistic are summarized in Table 1.

3. DATA AND MODEL SPECIFICATION

There have been three big competing credit rating firms in Korea since 1990: Korea Investors Service, Korea Ratings, and NICE Investors Service. They occupy almost 98% of total sales in Korea's credit rating industry, and thus we tackle these three firms in our analysis.

The Rosse-Panzar test is performed cross-sectionally on the data for individual firms for the years from 1990 to 2007. The accounting data are obtained from the Financial Supervisory Service and NICE Information Service. To test the effectiveness of the Korean government's financial restructuring policy, which fostered the competitive condition in the credit rating industry during the financial crisis period, we decompose the duration as follows: 1990-1997 (pre-crisis period) vs. 1998-2007 (post-crisis period).[2]

The forms of the revenue equations used are as follows:

$$\ln(REV)_{i,t} = \beta_0 + \beta_1 \ln(W_L)_{i,t} + \beta_2 \ln(W_K)_{i,t} + \beta_3 \ln(W_F)_{i,t} + \beta_4 \ln(SL)_{i,t}\,, \quad (4)$$

and

$$\begin{aligned} \ln(REV)_{i,t} = {} & \beta_0 + \beta_1 \left[\ln(W_L)_{i,t} - \ln(W_F)_{i,t}\right] + \beta_2 \left[\ln(W_K)_{i,t} - \ln(W_F)_{i,t}\right] \\ & + (\beta_1 + \beta_2 + \beta_3) \ln(W_F)_{i,t} + \beta_4 \ln(SL)_{i,t}\,, \end{aligned} \quad (5)$$

where i = individual credit rating firm; t = year. REV is the ratio of total revenue to total assets. W_L is the unit price of labor; W_K is the unit price of capital; and W_F is the unit price of funds. That is, W_L, W_K, and W_F are three factor prices. To take account of scale economies (i.e., size effect), we include sales of the firm (SL) as one of the control variables. The measures for the variables in equations (4) and (5) are summarized in Table 2; and Table 3 reports the summary statistics of the variables during the pre-crisis period (1990-1997) and the post-crisis period (1998-2007).[3]

Note that equations (4) and (5) are exactly the same. The H-statistic is calculated by $\beta_1+\beta_2+\beta_3$.[4] We examine the hypothesis whether H is equal to 0 by t-test of the co-efficient $(\beta_1 + \beta_2 + \beta_3)$ from equation (5). Meanwhile, we examine the hypothesis whether H is equal to 1 by F-test of the sum of co-efficients $(\beta_1 + \beta_2 + \beta_3)$ from equation (4). Lastly, to compare the difference between the H-statistics of 1990-1997 and 1998-2007 (i.e., the effectiveness of the Korean government's financial restructuring policy on the credit rating industry during the 1997 financial crisis period), we utilize the Chow breakpoint test (Chow, 1960; Greene, 2003) for checking the change in coefficient $(\beta_1 + \beta_2 + \beta_3)$ of each period from equation (5).

[2] While the sample size seems small, as Shaffer (1993) points out, this sample is comparable to those of other studies of industry competition.

[3] In Table 2, note that "Total Funds" means "Net Worth." In Table 3, we can briefly observe that after the 1997 financial crisis, the values of all variables (i.e., the ratio of total revenue to total assets of a credit rating firm, the unit price of labor, the unit price of capital, the unit price of fund, and the sales of a credit rating firm) increased.

[4] This is the sum of the factor price elasticities, which indicates how responsive revenue is to percentage change in factor prices.

Table 2: Measurement of Variables

Variables	Measures
$\ln(REV)$	$\ln$(Gross Profit / Total Assets)
<Factor Prices>	
$\ln(W_L)$	$\ln$(Personnel Expenses / Total Assets)
$\ln(W_K)$	$\ln$(Depreciation & Interest / Fixed Assets)
$\ln(W_F)$	$\ln$(Other Operating Expenses / Total Funds)
<Other Control Variable>	
$\ln(SL)$	$\ln$(Sales)

Table 3: Summary Statistics of Variables

• Pre-crisis period (1990-1997)

Variables	# of Obs.	Mean	Std. Dev.	Maximum	Minimum
$\ln(REV)$	24	−0.7509	0.3053	−0.1753	−1.5106
$\ln(W_L)$	24	−1.3046	0.1918	−0.8227	−1.6897
$\ln(W_K)$	24	−1.9486	0.4666	−1.0882	−2.9990
$\ln(W_F)$	24	−4.3696	1.2256	−2.5945	−7.9260
$\ln(SL)$	24	15.7527	0.8463	17.4975	14.5655

• Post-crisis period (1998-2007)

Variables	# of Obs.	Mean	Std. Dev.	Maximum	Minimum
$\ln(REV)$	30	−0.6466	0.7617	0.1328	−2.6797
$\ln(W_L)$	30	−1.0932	0.3696	−0.4795	−1.7662
$\ln(W_K)$	30	−1.8694	0.5022	−0.8486	−2.9990
$\ln(W_F)$	30	−4.2979	1.5139	−2.0132	−8.9794
$\ln(SL)$	30	17.1297	0.8241	18.4714	14.6917

4. EMPIRICAL RESULTS

Table 4 gives the estimation results for the competitive condition for the sample periods of 1990 to 2007. H-statistics are calculated for each sub-period: the pre-crisis period (1990-1997) and the post-crisis period (1998-2007). In regressions [**1**] and [**2**], we just use factor prices (i.e., $\ln(W_L)$, $\ln(W_K)$, and $\ln(W_F)$) as independent variables. We add a control variable (i.e., $\ln(SL)$) in regressions [**3**] and [**4**].

From regressions [**1**] and [**2**], we see that the value of the H-statistic has increased from 0.4202 at the pre-crisis period to 0.6832 at the post-crisis period. The

H value of the pre-crisis period is significantly different from zero and also different from unity at the 5% significance level. That is, the market structure of the credit rating industry in the pre-crisis period shows monopolistic competition. The H value of the post-crisis period is significantly different from zero but is not different from unity, which means that the competitive environment is an oligopoly in a contestable market. The Chow breakpoint test shows that these two H values are significantly different from each other, which implies that the competitive condition was dramatically improved after the implementation of the Korean government's financial restructuring policy on the credit rating industry during the financial crisis period.

Table 4: Regression Results of Competitive Condition

Dep. Variable: $\ln(REV)$ Period	[**1**] $1990-1997$	[**2**] $1998-2007$	[**3**] $1990-1997$	[**4**] $1998-2007$
Intercept	0.4736 (0.24)	−0.3743 (−0.71)	0.3336 (0.15)	1.2637 (0.38)
$\ln(W_L)$	−0.0094 (−0.05)	1.3965*** (3.60)	−0.0049 (−0.02)	1.3638*** (3.42)
$\ln(W_K)$	0.3106*** (2.93)	−0.7388** (−2.51)	0.3094*** (2.84)	−0.6413* (−1.80)
$\ln(W_F)$	0.1191*** (3.02)	0.0295 (0.34)	0.1168*** (2.74)	0.0147 (0.16)
$\ln(SL)$	–	–	0.0048 (0.17)	−0.0908 (−0.50)
# of Obs.	24	30	24	30
adj-R^2	0.9677	0.8426	0.9712	0.8717
H-stat	0.4202	0.6832	0.4213	0.7379
$[H=0]$	[0.0262]	[0.0003]	[0.0298]	[0.0008]
$[H=1]$	[0.0022]	[0.3496]	[0.0028]	[0.4645]
W	–	25.63***	–	24.98***

a) The values in parentheses are t-values; and in brackets are p-values.

b) W is the Wald statistic ($\sim F$) to test the difference between H-statistics (1990-1997 and 1998-2007).

c) ***, **, and * indicate the significance at 1%, 5%, and 10% levels respectively.

The result is also consistent when we add a control variable in regressions [**3**] and [**4**]. That is, the H value of the post-crisis period is 0.7379, which is higher than that of the pre-crisis period: 0.4213. Like the results of regressions [**1**] and [**2**], the Chow breakpoint test shows that these two values are significantly different from each other. Overall, the regression results in Table 4 lead us to conclude that

the Korean government's financial restructuring policy for fostering the competitive condition in the credit rating industry after the 1997 financial crisis was effective, and thus the credit rating firms began behaving in a more competitive manner.

5. CONCLUSION

In this paper, we used the Rosse-Panzar methodology to examine the competitive condition of Korea's credit rating industry for the 1990-2007 period. Following the Korean government's financial restructuring policy for increasing the competition level of the credit rating industry in the aftermath of the 1997 financial crisis, the value of the H-statistic has significantly increased, and the market structure has become an oligopoly in a contestable market, which can be economically interpreted as perfect competition. Hence, the empirical results lead us to conclude that the Korean government's financial restructuring process in the credit rating industry was successful.

However, as one of our future potential works, we need to delve into the real effectiveness of improving the competitive condition in the credit rating industry in terms of the quality of the credit rating itself. Examining the U.S. credit rating industry, Becker and Milbourn (2011) find that increased competition lowers quality ratings: the rating levels go up; the correlation between ratings and market-implied yields falls; and the ability of ratings to predict default worsens.[5] In this sense, we do need to re-consider the current political issue in the Korea-U.S. Free Trade Agreement which allows foreign credit rating firms, including S&P and Moody's, to directly enter Korea's domestic credit rating industry only for the purpose of raising the degree of competition in the market.

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[5] However, Becker and Milbourn (2011) do not measure the degree of competition as an H-statistic. They assume the growth of Fitch's market share as the measure of competition faced by other rating firms (S&P and Moody's). In this sense, Becker and Milbourn (2011) do not capture the exact degree of competition/contestability in the U.S. credit rating industry.

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