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# The impact of the degree of competition in IT industry on operating performance during financial crisis

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**Abstract**

This study examines whether competition improves corporate performance in Korean economy. Market competition promotes managerial efforts for cost reduction and innovation, while market concentration enables managers to enjoy a "quiet life". The effect of competition can be substituted, to some extent, by that of financial distress. Financial constraint also puts managers in more efforts for higher efficiency of firm. Our analysis of the 2001-2009 panel data of 1,800 Korean firms supports the hypothesis of positive relationship between competition and performance. The negative effect of financial distress is also more evident in highly concentrated markets such as IT industry.

Keywords :Corporate governance, Market competition, Productivity, Financial crisis, Information technology

## Introduction

Corporate performance is the output of firm's decisions and actions that are affected by such environmental factors as product market competition and financial market distress. These two exogenous factors have been discussed in the economics literature, because they have to be inevitably overcome by firms for sustainable growth.

The economists who support free market mechanism have a common perception of the role of market competition. Market structure shape the competitive framework that conditions the value-maximizing choices of firm and the intensity of competition is an inescapable determinant of corporate performance. A fair number of previous studies state that competitive pressure improves performance on the industry level (Haskel, 1991; Zitzewitz, 2003) or the firm level (Nickell et al., 1992; Nickell, 1996; Disney et al., 2003). Increased competition might reduce sales of the individual firm, worsen its profitability, and furthermore increase the probability of its bankruptcy. However competition, on the other hand, may lead to more efforts of managers and labors because they should try to avoid undesirable fate. Managers are forced to devote themselves to outcompeting competitors and improve performance, as potential entrants come in market and existing rivals expand market share. Competition makes managers behave differently in two aspects; efficiency-enhancing and strategic investment efforts.

*Efficiency-enhancing efforts* can be enhanced by competitive pressure. Competition provides a reason for managers to put in their best efforts and this, in turn, leads to higher productivity and performance of firms (Nickell, 1996). Managerial slack can be reduced in a competitive market and competition can alleviate the managerial preference for the quiet life (Giroud and Mueller, 2008). Moreover, information of comparative performance motivates managers to elevates the efficiency of principal-agent problem (Meyer and Vickers, 1997). Competition does more than just inducing managerial efforts. Firms with a monopolistic or oligopolistic position in market would reinforce the bargaining power of labor union (Steward, 1990) leading to less effort of workers in addition to higher willingness of managers to share the rent with workers (Smirlock and Marshall, 1983).

*Strategic investment efforts* can also be enhanced by competition. Firms confront competitive threats from rivals by making strategic investments including marketing and innovation activities. In a competitive market firms try to increase their sales by strengthening marketing activities. Firms also have to put themselves in more innovative efforts to reinforce existing advantage in current market and nurture new advantage in emerging market. But in a highly concentrated market firms tend to show relatively less efforts of innovation and enhancement of productivity (Geroski, 1990).

Corporate performance is also affected by financial market situation. Firms enter financial distress as the result of economic distress, industry decline, or poor management (Wruck 1990; Whitaker 1999). Financial pressure forces managers to spend more time resolving financial constraint (Wruck 1990) and achieve cost reduction and innovation, which may substitute the effect of competition (Nickell et al. 1997). However, financial pressure leads highly leveraged firm to the loss of market share as customers abandon the firm, competitors reduce price, and managers downsize production. This sales losses are expected to be severe especially in concentrated markets that have high potential for strategic interaction among competitors and in firms that have relatively high R&D expenditures (Opler and Titman 1999).

The above-mentioned effects of competition and financial constraint on performance can be summarized as below.

| | Market structure | | Financial distress | |
|---|---|---|---|---|
| | Competitive market | Concentrated market | Competitive market | Concentrated market |
| *Efficiency-enhancing efforts* | - Strong effort<br>* High productivity<br>* Strong cost advantage<br>* Lower org slack<br>* Low agency problem<br>- sales may increase | - Weak effort<br>* low productivity<br>- sales may decrease | - focus on productivity (downsize)<br>- sales may decrease | - focus on the behavior of customers or competitors<br>- sales may decrease or increase |

| | | | | |
|---|---|---|---|---|
| *Strategic Investment efforts* | - Strong effort<br>* large investment to marketing<br>* large investment to innovation<br>- sales may increase | - Weak effort | - investment activities may decrease<br>- sales may decrease | - investment activities may decrease<br>- sales may decrease |

This paper focuses particularly on three questions about Korean industry. Firstly, we try to test the hypothesis in Korea that competition is really an instrument which contribute to corporate performance. The relationship has been already found in U.K. (Nickell 1996; Disney et al. 2003), in the USA, Europe and Japan (Baily 1993; Baily and Gersbach 1995), and in Bulgaria, Romania, and Poland (Angelucci et al. 2002). However, Nickell(1996)'s finding demonstrate that the relationship is positive, but not quite distinct.

Secondly, we try to focus more on IT industry. It is widely known that IT industry is highly concentrated by a few large firms and many other small firms. We try to test the "quiet life" hypothesis in Korean IT industry at the intra-industry level as well as the inter-industry level. Zitzewitz (2003) identified the hypothesis in the tobacco industry of the USA and U.K..

Thirdly, we are concerned with the effect of financial distress on corporate performance. The global financial crisis of 2007 also froze Korean financial market and brought financial pressure to most Korean firms. We examine whether the degree of competition in IT industry as well as other Korean industries has a different impact on performance during the 2007 crisis.

## Data and Methodology

This study aims to reveal the relationship between competition and performance using the panel data on companies in Korea. The main source to construct the empirical analysis is the Korea Investor Service's financial database, Kis-Value. Samples include about 1800 firms from 2001 to 2009 in several industries as classified by GICS, which is an industry classification method developed by Morgan Stanley Capital International (MSCI) and Standard & Poor's (S&P) to be used by the global financial community. We have excluded the finance industry, which uses a different method in measuring tangible assets and total assets, and the instances in which there was only a single company within the industry. This paper examines an individual firm's performance to identify the industry's characteristics from 2001 to 2009 and finds the difference in properties between IT industry and others.

*Equation*

The analyzing framework of this paper is a modified version of log-linear form of the Cobb-Douglas production function using the constant-returns used by Nickell(1996)[2].

$$y_t = \beta_i + \beta_t + \delta y_{t-1} + (1-\delta)\alpha_i n_t + (1-\delta)(1-\alpha_i)k_t + \gamma_1 HHI_t + \gamma_2 mksh_{t-2} + \gamma_3 size_t + \gamma_4(HHI_t \times \theta_1) + \gamma_5(HHI_t \times \theta_2) + \varepsilon_t$$

where $y_t$ is the dependent variable of log sales of firm i at time t, $\beta_i$ and $\beta_t$ are components of intercept terms representing the firm and year fixed effects, respectively. $\beta_i$ picked out the individual characteristics of the panel, which affects the output but does not change over time and $\beta_t$ picked out the parts that affect all companies chronologically. $n_t$ is the log employment, $k_t$ is the log tangible asset, HHI is the Herfindahl-Hirschman index representing the degree of competition among firms, $mksh_{t-2}$ is the market share based on sales in the industry, size is the size of the firm measured by $10^{-2}(n_t)$. $\theta_i$ is dummy variable treating year, industry. $\theta_1$ is a year dummy on 2001 basis, $\theta_2$ is a industry dummy that equals one in IT

industry, $\varepsilon_t$ is the error tem, which captures all other factors that influence the dependent variable $y_t$.

Because the past values of the lagged variable could affect the current values of the lagged variables, which can lead to the spill-over effect between the past values and the current values, and to control for this, the Dynamic panel model where the past values of the lagged variables were used as the explanation variable. It was hypothesized that the self-correlation of the error term did not exist. On the other hand, the explanation factor and the error term both affect the lagged variable, which makes understanding the independence between the error term and the explanation variable very important and to solve this, the lagged variable of the explanation of the factors that are determine to have a high relevance to the error term was used as the instrument variable. According to the example of Nickell (1996), the factors such as the automation of the production lines may increase the output and decrease the employment, which can have a sufficient relevance to the n and k, the explanation factors, as well as the error terms. Therefore, the n and k will also utilize the values from t-2 period as the instrument factors just as in $y_{t-1}$.

Generalized method of moment estimators (GMM) was used to get congruent estimators in the dynamic panel model using instrumental variables for the lagged value of dependent variable. These estimators follow a method suggested by Arellano and Bond (1991)[20]. These estimators also provide tests on appropriateness on excessive distinction on autocorrelation and instrumental variables of the error factor.

*Definition and Measurement*

*Output*, $(y_t)$. Log sales are used. The reason why sales are used instead of added value is because the added value in the database is not precise and has same parts that have been omitted. Also, as Nickell(1996)[2] mentioned, there could still be a difference between the real number and the added value calculated using accounting data; therefore, sales should be used.

*Competition,* $(HHI_{jt})$. Main measure of market competition is the Herfindahl-Hirschman

index (HHI), which is an indicator of the degree of competition among firms. A higher HHI implies lower competition. The HHI is defined as follow

$$H = \sum_{i=1}^{N} s_i^2$$

where N is the number of firms in corresponding industry, $S_i$ is the market share of firm i. Each industry's HHI is based on the three digit GICS code.

*Employment and Capital Stock,* $(n_t, k_t)$. n and k are one of the production factors. n is the employment and k is the log tangible asset. To determine the increase or decrease in output from factors other than the production input factors, the relationship between production factors and output is analyzed using constant returns of Cob-Douglas production function.

*Competition and Year Effect,* $(HHI_{jt} \; x \; \theta_1)$. To find out what kind of effects the increase in concentration level has on the output in each year with 2001 as its basis, the year dummy variable was introduced. Since financial pressure substitutes competition pressure (Nickell, 1997)[5], financial pressure is assumed to have negative effects on the non-competitive market, and the year dummy are intended to capture the possible effect of financial pressure on the output of the oligopolistic market.

*Competition and Industry Effect,* $(HHI_{jt} \; x \; \theta_2)$. We used an industry dummy to find out whether the output is more negatively affected by the decrease in competition. In IT industry, which is even more concentrated than the other industries, we examine the effect level of the IT industry compared to the non-IT industry.

*Market Share,* $(mksh_{t-2})$. The company's market share within the industry was estimated based on the relative volume of sales. However, the company's market share calculated by the method of industry classification, as Nickell(1996)[2] pointed out, may have some problems. It does not consider competitors abroad and also could not represent the market in reality, which is composed of real competitors. This kind of problem may be reduced significantly, if the time series estimation is continuously used, since the errors can be considerably stabilized. Also, to avoid reverse causality, in which a high productivity leads high market share, we used variables that lag two years.

*Firm Size,* ($size_t$). Firm size is measured by $10^{-2}(n_t)$. We seek to exclude the effects of firm size on output by controlling the size of firms when analyzing the kind of effects the level of market concentration have on the output.

## Result

Examining the effects of independent variables in the case of regression1 of Table 1, the coefficient of $y_{t-1}$ shows a positive value, which means that the output of the year has a direct positive correlation with the output of the previous year, and the coefficients of production factors, $n_t$ and $k_t$ are also positive, which means that the output increases when the company invests more labor and capital. The coefficient of the market share shows an significantly negative value, which means that the relationship between the market possession of t-2 period and the current company output is negatively related. This finding is quite interesting, and can be interpreted that the firm whose relative market share is small make an effort to increase the market share, and it would take approximately two years for the output to be increased due to the effort. In the case of firm size, the coefficient is insignificant, which might be the result of the fact that the effect of the company size might be absorbed by the output increase from the expansion of the production factors, such as the labor or capitals.

The relationship between the market concentration and the output shows that the increase of the industry concentration affects the output negatively, which is consistent with the hypothesis that the output of the company will increase as the competition within the industry increases.

If the non-competitive markets with higher concentrations face financial constraints, the multiplicative joint effect on output might be greater than the effects in the case of the combination between the competitive markets with lower concentration and the financial constraints. Next, the interaction effects between the year dummy and the market concentration level is examined to see if there exist multiplicative effect between financial constraint around 2007 and the different level of market concentration. In other words, the financial constraints of the firm are more likely to occur during financial crises of the economy as a whole, and when

this is combined with the high market concentration, the combination will have more negative effect on output.

The interaction effects of the years and HHI in Table 1 was negative in 2007, the beginning of the financial crisis, and was also negative in 2006, 1 year before the financial crisis, which may indicate that the signs of financial crises started to appear approximately 1 year before.

The IT industry has a relatively higher market concentration than the non-IT industry. When a change in the market concentration occurs in the IT industry, the effect on output might be multiplicatively increased. To investigate the difference between the effects on the firm's output of IT industry and non-IT industries, interaction term between industry dummy, 1 for IT industry and 0 for non-IT industry, and the concentration level is introduced. The IT industry with a lower competition and higher monopolistic factors showed the increased market concentration affected the output more negatively than the non-IT industry.

Table 1

| Independent variables | Dependent variable : $y_t$ | |
|---|---|---|
| | **(1)** | **(2)** |
| $y_{t-1}$ | 0.642*** | 0.645*** |
| | (0.015) | (0.015) |
| $n_t$ | 0.273*** | 0.271*** |
| | (0.016) | (0.016) |
| $k_t$ | 0.086*** | 0.085*** |
| | (0.007) | (0.008) |
| $mksh_{t-2}$ | -0.673*** | -0.597** |
| | (0.232) | (0.235) |
| $size_t$ | -0.001 | -0.002 |
| | (0.002) | (0.002) |
| $HHI_t$ | -3.202*** | -0.223 |
| | (0.886) | (1.495) |
| $Year_{2002} \times HHI_{jt}$ | 0.551 | 0.488 |
| | (0.608) | (0.612) |
| $Year_{2003} \times HHI_{jt}$ | 2.618*** | 2.365*** |
| | (0.494) | (0.507) |
| $Year_{2004} \times HHI_{jt}$ | 0.477 | 0.030 |
| | (0.470) | (0.506) |
| $Year_{2005} \times HHI_{jt}$ | -0.327 | -0.761* |
| | (0.381) | (0.421) |
| $Year_{2006} \times HHI_{jt}$ | -0.888** | -1.398*** |
| | (0.360) | (0.417) |
| $Year_{2007} \times HHI_{jt}$ | -0.827** | -1.010*** |
| | (0.339) | (0.349) |
| $Year_{2008} \times HHI_{jt}$ | -0.138 | -0.259 |
| | (0.325) | (0.330) |
| $HHI_{jt} \times IT\ industry$ | | -6.617** |
| | | (2.666) |
| Year Dummy | Yes | Yes |
| Industry Dummy | Yes | Yes |
| Observations | 11889 | 11889 |

note: *** p<0.01, ** p<0.05, * p<0.1

## Summary and Conclusions

Competition is closely related to performance and productivity of companies. Competition within the industry puts pressure on management to put its efforts into technological innovation and cost reduction to prevent falling behind competitors. Some of the industries existent in Korea are not in fierce competition. Especially IT industry, which has a high level of industrial concentration, tends to form an oligopolistic market structure because only a few companies exist within the industry. This paper aims to examine the effects on productivity and performance of companies as the market goes toward an oligopolistic structure as well as whether such phenomena will become even more evident in special situations like financial crises. In this research, the relationship between the change in the industrial structure and the performance of the company was found through panel data analysis with 1680 companies that were listed from 2001 to 2009 in Korea Stock Exchange. The result showed that the market structure is in a close relationship with the corporate performance. We were able to find the evidence that an increase in the concentration level leads lower performance in the industries with high market concentration levels, like the IT industry, and that it causes a larger decrease in performance than in a more competitive market during the financial crisis in 2006 to 2007.

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