Characteristics and Economic Efficiency of the Venture Companies in Korea: Comparison with the *Chaebols* and Other Traditional Firms

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This paper focuses on the emergence of a new style of firms in the Korean economy, so-called venture companies, and provides a comparative analysis of the behavior and economic efficiency of the venture companies relative to chaebols and other old firms listed in the Korea Stock Exchange. The paper employs an econometric technique to compare the productive efficiency of ventures, *chaebols* and non-*chaebol* firms in Korea, using panel data covering the 1996-9 period. The paper finds that the average level of productive efficiency of the ventures is the highest among the four types of firms compared, such as *chaebols* and non-*chaebols* in the KSE, and non-ventures in the Kosdaq market. The efficiency comparison suggests the following order of efficiency among the four subgroups of firms from the best to the worst; ventures, non-ventures, non-*chaebols*, and *chaebols*. The paper also finds that the estimated productive efficiency is an important determinant of profitability. When we control for productive efficiency, the capital-labor ratio, the debt-equity ratio, and asset growth, ventures' profitability is shown to be significantly higher than that of others firms.

Keywords: Ventures, Chaebols, Productive efficiency, Stochastic production function

JEL Classification: C23, L11, O12

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I. Introduction

In 1997, the Korean economy experienced the humiliation of the IMF emergence loan following the financial crisis, but it showed quick recovery within two years after the crisis. The economy recorded a remarkable 9 percent real growth in 1999, and the stock price index had risen much higher beyond the pre-crisis level in 1999. But, the recovery was not simply due to the revival of the so-called *chaebols*, namely large family-controlled conglomerates, but was also triggered by the rapid and strong emergence of small and medium sized hi-tech and new-tech firms. Of course, the two are related since substantial restructuring and break-up of former *chaebols* led to the release of financial and human resources, which have contributed to the birth of many new start-ups and spin-offs.

Such strong move toward new business creation was helped by the growth of the KOSDAQ stock market (Korean version of NASDAQ). Only two years after its establishment, KOSDAQ has emerged as the mother of hundreds of small- and medium-sized venture companies and startups. Many ambitious youths are joining KOSDAQ firms straight from universities and many talents are leaving giants conglomerates (*chaebols*) to join these new firms. Unlike the *chaebols*, having financed their investment from stocks rather than from the banks, these new and flexible firms are shown to be much better in terms of their debt structure, and also as often praised to be better toward minority shareholders than chaebols. At the peak of this market, the market value of the Kosdaq listed firms reached close to that of the KSE firms. Referring to this phenomenon, many commented that one of the reason for their high stock prices had to do with their better and more transparent corporate governance, compared to that of the *chaebols* which were notorious for non-transparent governance and weak accountability.

This paper aims to analyze this new form of firms emerging in the Korean economy. We focus on those listed in the Kosdaq stock market, and out of there, on the company classified as "venture" companies. The so-called "venture" companies are usually smaller than non-venture companies listed in the Kosdaq market, and tend to be based on new and/or high technology backed by venture capital. Like several *chaebol* names, Samsung and Hyundai, some of the venture companies are quite famous due to their rapid growth and high stock prices.

We will compare venture companies with non-venture companies listed in the Kosdaq, *chaebol*-affiliated firms and non-*chaebol* firms listed in the Korea Stock Exchange. Although *chaebols* is a more widely used term to refer to big conglomerates in Korea, we think that a more clear term is a business group, since the boundary of a *chaebol* and non-*chaebol* are somewhat obscure.[1] While this problem is more rigorously treated in Lee, Ryu and Yoon (2000), this paper adopts a conventional usage of the term and will simply call the top 30 business groups as *chaebols*, and the other business group-affiliated firm and non-group firms as non-*chaebols*.

Granovetter (1995) defines business groups as a collections of firms bound together in some formal and/or informal ways, characterized by an intermediate level of binding, namely, neither bound merely by short term strategic alliances nor legally consolidated into a single entity. The Korean *chaebols* fit into this definition, and are also consistent with Strachan's (1976) definition as there are strong personal and operational ties among the member or affiliate firms in a *chaebol*.[2] Some people argue that new firms active in the Kosdaq market also form business groups through stock-holdings. But, we think that they are quite different from the *chaebol*-related business groups in terms of the degree of personal and operational ties among related firms. In other words, we do not think of them as qualifying as "business groups." Thus, we feel it safe to use the term business group to refer only to old firms listed in the KSE. In sum, we will be discussing the following

[1]Each year the Korean Fair Trade Commission designates the top 30 business groups in terms of asset size and puts them under special monitoring and restrictions. These 30 groups are perceived as representing the so-called *chaebols*. Then, what are the real differences between the top 30 "*chaebols*" and the "below top 30 business groups," given that most of the other firms are also family-owned and controlled? For example, how can we say the 30th group is a *chaebol* but the 31st is not, simply relying on the criterion of asset size? As a matter of fact, people sometimes talk about the top 60 or 75 business groups in Korea.

[2]This is how Strachan (1976) distinguishes the typical American conglomerate from business groups. In the case of the former, component companies are acquired and divested mainly on financial grounds and there are few operational or personal ties among the member firms. Thus, conglomerates are inherently unstable. Recited from Granovetter (1995).

four types of firms in our paper: (1) top 30 business group-affiliated firms (representing the *chaebols*) listed in the KSE, (2) other firms listed in the KSE (hereafter non-*chaebols*), (3) non-venture firms listed in the Kosdaq market, and (4) venture firms listed in the Kosdaq.

Our hypothesis is that the venture firms in the Kosdaq are a new style of firm in Korea, which are significantly different from both *chaebols* and non-*chaebol* firms listed in the KSE in terms of their behavioral characteristics. To explore this hypothesis, we will discuss the debt structure, growth propensity, productive efficiency, profitability and so on. Given that there are few empirical researcher on the Kosdaq firms, this will be among the first group of empirical research on this newly emerging and important firms in the Korean economy.

The following section discusses the emergence of venture companies in Korea following the 1997 crisis which is perceived as serving as a new engine of growth. Section III explains the data and basic features of venture companies in Korea. Sections IV and V present the estimation methods and results of the regression analysis on productive efficiency. Section VI analyzes financial efficiency of venture companies, comparing *chaebols* with other firms. A summary follows as a final section.

II. From Chaebols to Venture Companies in Korea: The Shifting Engine of Growth

It was just two months before the unfolding of the financial crisis that the Korean government first implemented a special law on the promotion of venture companies. It was during 1999 that the venture companies had their first upsurge, and this coincided with the turnaround of the Korean economy with a 9 percent real growth. It was not just natural growth of new and high tech firms but this growth should be partly attributed to the policy commitments made by the Kim Dae Jung government under the catch-phrase of the transition from the *chaebol*-led to the venture-led economy. In 1998, the office of the small and mediums-sized enterprise promulgated the 5 Year Plan for Vitalization of Venture Companies. The special law stated the 4 criteria to be met for a company to be qualified as a "venture" company. To qualify as a venture, the small and medium size firm should invite venture capital to invest to take at least 10 percent of the total share; spend at least 5 percent of their sales revenue for R&D; have at least half of their revenue coming from products with new patents or new technology, or pass a special review or inspection. The label of "venture" has its advantager, since it carries a lot of tax benefits and also has a less strict requirement to be listed in the Kosdaq market.

According to the Office of the SME, the number of venture companies grew from a mere 304 in May 1998 to 6,004 in March 2000. The product of these venture companies accounted for about 4.8 percent of GDP in 1999, and was hiring 180,000 workers (see Lee, Jae-Hyee 2000). The plan of the government is to increase the share of venture in GDP up to 18 percent with the employment at up to 120 million workers, and thus to have them surpass the share of the top 30 business groups (which constituted 12 percent of 1998 GDP and hired 730,000 workers).

Actually, it was even before the 1997 crisis and the emergence of venture companies that the share of the top 30 business groups started to decrease. In terms of their shares in value-added in the economy, the top 30 business groups continued to claim more and more annually until 1995, when their share was 16.2 percent. But, since then their share decreased to 14.7 percent in 1996, to 13.0 percent in 1997, and to 12 percent in 1998 (see Choi *et al.* 1999; Lee, Jae-Hyee 2000). A similar trend is found in terms of the share in employment by the top 30 business groups.

Since the Kosdaq stock market was first established in 1996, it has grown rapidly. At the end of 1997, there were 359 firms listed in the market, and as of July 2000 there are 479 firms listed in the market (see Table 1). Out of these, 202 firms are officially classified as "venture companies" meeting one of the four specific conditions. The value of the market has grown from 7,068 billion Won (about 5,890 million US dollars) at end of 1997 to 54,271 billion Won (45,226 million US dollars) by July 2000. If we compare the Kosdaq with the KSE, the number of listed firms is relatively large, since there are only 710 firms listed in the KSE. In terms of market value, the aggregate market value of the Kosdaq firms is equal to 21.2 percent of that of the KSE in July 2000.

TABLE 1

COMPARISON OF KOSDAQ AND KSE MARKET (BILLION WON, %)

	1997.12	1998.12	1999.12	2000.07
Firms listed in KOSDAQ				
number of firms	359	331	453	479
(venture)	(52)	(114)	(173)	(202)
contributed capital	3,494	5,407	13,061	14,994
market value	7,068	7,892	106,280	54,271
Firms listed in KSE				
number of firms	776	748	725	710
contributed capital	45,153	54,865	78,090	84,683
market value	70,988	137,503	349,503	256,349
Ratio of KOSDAQ relative to KSE (KOSDAQ/KSE)				
number of firms	46.3	44.3	62.5	67.5
contributed capital	7.7	9.9	16.7	17.7
market value	10.0	5.7	30.4	21.2

Source: Korea Credit Investigation Service, Financial DB 1996-2000.

There are a few of big companies listed in the Kosdaq, like the KT Freetel, the second largest mobile telephone service company in Korea. But, the majority of firms listed in the Kosdaq are those which started as small start-ups. One of the most successful example is the Saerom Company, which invented the world famous “Dialpad” (the free long distance calling card). Its invested capital was only 15 billion Won but its current market value is as high as 961.7 billion Won, with the market value to invested capital ratio at 64 (see Table 2). The ratio of market value to invested capital is only 0.47 in the case of Hyundai Construction company, a firm which symbolized the so-called “growth miracle” period of the Korean economy. Its market value was 642.8 billion Won, which is smaller than Saerom in early 2000. Among internet firms, the so-called dot com companies, the Daum Communication is one of the largest companies. Its invested capital is much smaller than the Saerom at only 6 billion Won, but its market value is currently as large as the Saerom at 782.7 billion Won, which is still bigger than Hyundai Construction Company.

TABLE 2

MARKET PRICE OF THE HIGHEST KOSDAQ FIRM (BILLION WON)

Name	Class	Contributed capital (A)	High market price (B)
Serome Technology	Venture	15.0	5,080.1
Daum Communications	Non-venture	6.0	3,349.3
Haan Soft Inc.	Venture	24.0	2,782.6
Dong Teuk	Non-venture	3.5	2,540.7
Locus Corporation	Venture	5.2	2,292.8
Handysoft	Venture	9.4	1,229.8
Korea Information & Communication	Venture	5.6	2,059.9
Power-Tech	Venture	2.0	1,421.4
Jusung Engineering	Venture	13.3	3,218.4
Internet Auction	Non-venture	6.3	877.2
Hyudai Engineering & Const.	KSE	1,353.2	1,718.5
	Current market price (C)	B/A	C/A
Serome Technology	961.7	338.7	64.1
Daum Communications	782.7	558.2	130.5
Haan Soft Inc.	541.9	115.9	22.6
Dong Teuk	439.7	725.9	125.6
Locus Corporation	460.4	444.3	89.2
Handysoft	530.4	130.8	56.4
Korea Information & Communication	711.0	369.8	127.6
Power-Tech	447.6	721.5	227.2
Jusung Engineering	409.6	242.0	30.8
Internet Auction	367.7	139.9	58.6
Hyudai Engineering & Const.	642.8	1.3	0.5

Note: Current market prices of firms are based on the last price at July 25, 2000.

Source: Korea Credit Investigation Service, Finance DB 1996-2000.

III. The Data Base and Characteristics of the Venture Companies

Our data base consists of a four year panel (1996-9) data of a total of 719 firms. Out of this total, 440 firms belong to the Korea Stock Exchange (KSE) and 279 firms, to the Kosdaq stock market. Out of the 440 firms listed in the KSE, 106 firms belong to the top 30 business groups (so-called *chaebols*) designated by the Korea

Fair Trade Commission as of March 1996, and the remaining 334 firms are non-*chaebol* firms. Out of the 279 firms listed in Kosdaq, 95 firms are officially classified as "venture" companies, and the other 184 firms are non-venture firms.

Table 3 provides an overview of our data base. You can tell the size difference between venture and non-venture firms listed in the Kosdaq. The average asset size of the venture firm is only 26,273 millions Won whereas that of non-venture firm is 85,592 million Won; about three time as large as that of venture company. There is also a big size difference between the KSE and Kosdaq listed firms. The average asset size of the KSE listed firms is about 11 times bigger than that of the Kosdaq firms; 827,210 million Won vs. 66,141 million Won, respectively.

Next, Table 4 provides a basic comparison of the main features of the 4 different types of firms. In this table, we are comparing top 30 business group-affiliated firms (*chaebols*), independent firms (non-*chaebols*) listed in the KSE, venture firms and non-ventures firms. First, it is clearly shown that venture firms are growing fastest in terms of asset, sales, and employment, compared to *chaebols* and non-*chaebols*. The differences turn out to be significant. Second, in profitability too, venture firms are doing best. They are significantly more profitable in every standards. Third, venture firms are shown to maintain lower debt to asset ratios—around 58.9 percent. This level is lowest, among the group, with that of *chaebols* highest at 71.8 percent.

Other research have found that venture firms are spending substantially more on R&D and hiring proportionately more R&D personnel. For example, the Office of the SME (1999) shows that R&D to sales ratio is as high as 33.7 percent in ventures, compared to only 2.1percent in large sized companies and 0.3 percent in traditional SMEs (see Lee, Jae-Hyee 2000).

IV. Methodology to Estimate Productive Efficiency

To compare the productive efficiency of the different firms in our sample, we estimate the following stochastic frontier production function (Aigner *et al.* 1977; Bauer 1990; and Schmidt and Sickles 1984).

$$ln\,Y_{it} = \alpha_0 + \alpha_L ln\,L_{it} + \alpha_K ln\,K_{it} + v_{it} - u_{it}, \quad i=1 \ldots N, \quad t=1 \ldots T. \tag{1}$$

TABLE 3

BASIC STATISTICS OF THE SAMPLE FIRMS (HUNDRED MILLION WON)

	Mean	Median	Maximum
A: Whole sample			
value-added	95,486	15,051	7,565,956
sales	494,895	70,096	37,648,872
asset	563,872	73,343	64,149,428
employment	1,224	308	60,058
B: KSE-listed firms			
value-added	148,534	29,702	7,565,956
sales	777,755	139,124	37,648,872
asset	887,440	164,784	64,149,428
employment	1,839	543	60,058
30 *Chaebol*-affiliated firms			
value-added	334,098	132,894	5,077,804
sales	2,279,067	671,582	37,648,872
asset	2,042,674	818,322	24,709,803
employment	4,094	1,655	59,086
Non-*chaebol* firms			
value-added	89,642	22,827	7,565,956
sales	301,290	104,738	15,516,410
asset	515,406	124,592	64,149,428
employment	1,116	439	60,058
C: KOSDAQ firms			
value-added	11,828	6,094	999,368
sales	48,807	30,204	1,784,877
asset	53,586	26,394	3,673,004
employment	254	156	6,531
Ventures			
value-added	5,964	4,643	30,779
sales	27,182	19,922	399,529
asset	27,324	19,718	232,614
employment	156	118	765
Non-ventures			
value-added	14,856	7,374	999,368
sales	59,972	35,376	1,784,877
asset	67,145	30,800	3,673,004
employment	304	184	6,531

(Table continue)

	Minimum	Standard deviation	No. of observation
A: Whole sample			
value-added	23	410,753	4*719
sales	710	2,202,497	
asset	313	2,541,988	
employment	13	4,233	
B: KSE-listed firms			
value-added	81	517,159	4*440
sales	1,733	2,777,765	
asset	7,542	3,203,772	
employment	26	5,308	
30 *Chaebol*-affiliated firms			
value-added	539	586,402	4*106
sales	6,673	5,030,953	
asset	26,524	3,268,426	
employment	63	7,709	
Non-*chaebol* firms			
value-added	81	478,575	4*334
sales	1,733	1,097,187	
asset	7,542	3,092,619	
employment	26	4,016	
C: KOSDAQ firms			
value-added	23	40,756	4*279
sales	710	100,710	
asset	313	207,225	
employment	13	470	
Ventures			
value-added	53	5,058	4*95
sales	743	28,727	
asset	313	28,399	
employment	13	116	
Non-ventures			
value-added	23	49,797	4*184
sales	710	120,806	
asset	315	253,352	
employment	20	566	

Note: 1996-9 average values.

Source: Korea Credit Investigation Service, Finance DB 1996-2000.

TABLE 4

SIGNIFICANT TEST OF THE MEAN DIFFERENCE

	Chaebols v.s. Venture		Non-*chaebols* v.s. Venture	
	coefficient	t-value	coefficient	t-value
Growth rate				
asset	-0.578	-6.012	-0.600	-6.345
value added	-0.542	-1.791	-0.418	-1.278
sales	-0.319	-3.239	-0.413	-6.121
labor	-0.219	-5.254	-0.198	-4.813
fixed capital	-0.440	-4.738	-0.498	-5.526
Profit rate				
operating income/asset	-0.056	-11.603	-0.053	-11.608
net income/asset	-0.060	-13.290	-0.044	-10.581
operating income/sales	-0.029	-6.056	-0.033	-7.299
net income/sales	-0.054	-10.199	-0.039	-8.309
Leverage				
debt/asset	0.129	10.151	0.012	1.074

Here, i indexes firms and t indexes years. Y_{it}, L_{it}, and K_{it} are output, labor input, and capital input, respectively. A simple Cobb-Douglas production function is assumed.

The function $\alpha_0 + \alpha_L ln L_{it} + \alpha_K ln K_{it}$ is a production frontier that gives us a maximum expected amount of (log) output from a given input vector when there is no technical inefficiency. The disturbance term consists of two components: v_{it} represents pure statistical white noise in production, whereas the term u_{it} represents technical inefficiency, capturing the gap between the frontier and actual production. The bigger the term u_{it}, the lower the technical efficiency. We assume that $u_{it} \geq 0$ with a probability of one.

If v_{it} and u_{it} are independent not only over time but also across firms, then the panel data formulation has no advantage over the cross-sectional formation. But if we make further assumptions about the property of the inefficiency, we find some merits in the panel data analyses. Assuming that u_{it} is time-constant, we obtain

$$ln\, Y_{it} = \alpha_0 + \alpha_L ln\, L_{it} + \alpha_K ln\, K_{it} + v_{it} - u_i, \quad i = 1 \ldots N, \quad t = 1 \ldots T. \tag{2}$$

Equation (2) is the familiar panel data model, except that the mean of the inefficiency term, u_i, is not equal to zero due to the assumption $u_i \geq 0$. So we rewrite equation (2) as follows:

$$\begin{aligned} \ln Y_{it} &= \alpha_0 - E[u_i] + \alpha_L \ln L_{it} + \alpha_K \ln K_{it} + v_{it} - (u_i - E[u_i]) \\ &= \alpha_0 + \alpha_L \ln L_{it} + \alpha_K \ln K_{it} + v_{it} - u_i, \quad i=1 \ \dots \ N, \quad t=1 \ \dots \ T. \end{aligned} \tag{3}$$

Now $(u_i - E[u_i]) = 0$ and we can apply the standard panel data estimation technique. Using panel data has several advantages over cross-section models as pointed out by Schmidt and Sickles (1984). For instance, we can estimate the efficiency level of each firm. Also, we need not assume that the firm-specific level of inefficiency is uncorrelated with the input levels. Later, we will discuss these issues more thoroughly.

If we treat u_i as a firm-specific constant, equation (3) can be estimated by ordinary least squares(OLS) after adding dummy variables for each firm (as in a "fixed effect" model). Alternatively, one can use a "mean-deviation" operator and get the "within estimator," which is exactly the same as the fixed effect estimator. Then, firm specific efficiencies can be derived from the firm specific mean residual values.

Let lower case letters represent log output and log inputs for convenience. Averaging each term in equation (2) over time, we obtain

$$\bar{y}_i = \alpha_0 + \alpha_L \bar{l}_i + \alpha_K \bar{k}_i + \bar{v}_i - u_i \ . \tag{4}$$

By subtracting (4) from (2) we get

$$(y_{it} - \bar{y}_i) = \alpha_L (l_{it} - \bar{l}_i) + \alpha_K (k_{it} - \bar{k}_i) + (v_{it} - \bar{v}_i). \tag{5}$$

Finally we obtain the "within estimator" by applying the OLS estimation method to equation (5).

We can also treat u_i as a random variable and apply the GLS estimation method to equation (3) (a "random effect" model) to get the random effect model estimation.[3] The random effect estimator is

[3]For a detailed description of the estimation method, see Lee, Ryu, and Yoon (2000).

more efficient than the fixed effect estimator under the assumption that the right hand side variables are all exogenous. The fixed effect estimation suffers from a loss of degrees of freedom when there are many cross-sectional units as in our data set. But one crucial difficulty in random effect estimation arises when the right-hand side variables are not all exogenous. Because inputs are chosen in an optimal way by firms, right hand side variables are less likely to be exogenous. If a firm knows its level of efficiency, it is natural to think that the firm should adjust its input choices according to that knowledge, resulting in correlation between inputs and u_i.

We cannot use the rationale suggested by Zellner *et al.* (1966) to interpret the disturbance term in a production function as unexpected shocks. Under their formulation, the disturbance term does not affect the input choices and there arises no endogeneity problem. In our model, Zellner's rationale is applicable only to v_{it} which, as pure white noise, which lies beyond the firm's control. But there is no compelling reason to assume that u_i is uncorrelated with input levels: technical inefficiency of an individual firm doesn't change over time, so a firm is likely to know its inefficiency level and to choose input levels taking into account this information.

Within-estimation has an important advantage in this regard. It does not need to assume that firms' inefficiencies are uncorrelated with the input levels. It is because the within transformation in (5) gets rid of the problematic u_i term. Note that in typical GLS transformed equation, u_i term still exists and potentially causes the endogeneity problem. But the within estimator has some defects. If there are time-constant covariates, such as managerial characteristics or location, the within estimator cannot identify these effects because all time-invariant variables are eliminated by the within transformation. Another defect is the within estimator is not fully efficient since it ignores variation between firms.

In regressions, we also need to control the aggregate size effect since our sample is composed of a few large sized *chaebols*, many small sized non-*chaebol* firms, and much smaller sized Kosdaq listed firms. On average, *chaebols* are much bigger than non-*chaebols*, which are in turn bigger than Kosdaq firms. Due to this difference in firm size, we cannot treat our sample firms as homogeneous. Without adequately controlling the size effect, inefficiency by firm size will be confounded with scale economies or diseconomies.

Let us take an example. Suppose that KSE-listed firms are less efficient than Kosdaq firms, and that the production technology exhibits constant returns to scale in both KSE firm and Kosdaq firms. When we pool the KSE and Kosdaq firms, we may spuriously obtain a production function which shows a decreasing returns to scale. It is because inefficiency of KSE firms may be wrongly captured through scale diseconomies. As a result, KSE firms would not necessarily turn out to be inefficient.

The above example clearly indicates that the size effect and the efficiency level are confounded, creating an identification problem. Then what are the causes of this identification problem? Size has two channels to affect production. One is through production technology. Under decreasing returns to scale, for example, *chaebol* firms produce less output than venture firms per unit input. The other channel is through the efficiency level. In this paper, we allow that *chaebol* and venture firms to differ in their inefficiency levels. In other words, the size difference in inefficiency level is confounded with the size effect due to technology. Given this problem, we have decided to get rid of the size effect associated with technology.[4] We propose to rescale the size of each firm to have a unit size. Let s_i denote the i-th firm's size. The rescaled production function is

$$\frac{y_{it}}{s_i} = \alpha_0 + \alpha_L \frac{l_{it}}{s_i} + \alpha_K \frac{k_{it}}{s_i} + v_{it} - u_i \ . \tag{6}$$

Once all input and output data are divided by firm size, there

[4]This identification issue has not been treated adequately in the literature because most existing studies focus on a single industry: Cornwell *et al.* (1990) on the U.S. airline industry, Kumbhakar (1988) on the U.S. railroad industry, and Ferrier and Lovell (1990) on the U.S. banking industry, for example. Through this re-scaling, we can block out the size effect, and concentrate on the inefficiency comparison between *chaebol* and venture firms. A benefit of our rescaling approach is that the inefficiency estimate of each firm is less sensitive to the economy of scale estimate, $\alpha_L + \alpha_K$. The reason is that *chaebols* or KSE firms are not necessarily bigger in terms of rescaled input levels. Previously, what makes the inefficiency level so sensitive to the size effect was that all *chaebols* are much larger than venture firms. Our approach is particularly useful when the estimate of $\alpha_L + \alpha_K$ is not robust to different estimation methods.

remains only the difference in relative input-output ratios across sample firms. So the systematic size difference between *chaebol* and non-*chaebol* firms is now eliminated. In terms of these rescaled data, *chaebol* firms do not necessarily take larger values of inputs and outputs than non-*chaebol* firms.

Practically, we rescale our data by dividing all inputs and output by the logarithm of asset size averaged over the sample years for each firm. Therefore, our data consists of inputs and output per unit size. Also, this approach has another advantage in alleviating heteroskedasticity of the error terms resulting from size differences.

V. Results with Productive Efficiency Estimation

We have obtained the following result by estimating equation (6). The output is value-added, inputs are labor and capital, and all variables are divided by the logarithm of asset size.

Table 5A above gives the results of regressions using a fixed effect model and a random effect model. But, since the random effect model does not pass the endogeneity test (Hausman-Taylor test), we have resorted to the use of the fixed effect model. The coefficients of labor and capital inputs and the overall constant term are reported. The t-values are in parentheses.

Once we estimate the production frontier, we can derive an estimate of the efficiency component of each firm as

$$\hat{\alpha}_i = \frac{1}{T}\sum_{t=1}^{T}\left(\frac{y_{it}}{s_i} - \hat{\alpha}_L\frac{l_{it}}{s_i} - \hat{\alpha}_K\frac{k_{it}}{s_i}\right). \quad (7)$$

Then

$$\begin{aligned} \text{plim } \hat{\alpha}_i &= \text{plim } \frac{1}{T}\sum_{t=1}^{T}\left(\frac{y_{it}}{s_i} - \hat{\alpha}_L\frac{l_{it}}{s_i} - \hat{\alpha}_K\frac{k_{it}}{s_i}\right) \\ &= \text{plim } \frac{1}{T}\sum_{t=1}^{T}(\alpha_0 + v_{it} - u_i) = \alpha_0 - u_i \end{aligned} \quad (8)$$

since plim $\hat{\alpha}_L = \alpha_L$, plim $\hat{\alpha}_K = \alpha_K$, and plim $\frac{1}{T}\sum_{t=1}^{T} v_{it} = 0$, $i = 1 \ldots N$.

TABLE 5A

PRODUCTION FRONTIER ESTIMATION (DEPENDENT VARIABLE IS VALUE-ADDED)

	OLS	Fixed effect model	Random effect model
Labor	0.565	0.690	0.523
t-value	34.679	16.057	20.162
Capital	0.440	0.286	0.472
t-value	34.680	11.262	25.572
Constant	2.463		2.294
t-value	39.306		26.073

TABLE 5B

THE ESTIMATED LEVEL OF AVERAGE INEFFICIENCY

	By Fixed effect model	
	Inefficiency level	Efficiency ranking
Chaebol-firms	0.141	4
Non-chaebols	0.118	3
Ventures	0.076	1
Non-ventures	0.090	2

TABLE 5C

SIGNIFICANCE TEST OF INEFFICIENCY DIFFERENCE

	Non-chaebols	Ventures	Non-ventures
Chaebols	0.023	0.065	0.051
t-value	7.569	15.656	14.463
Non-chaebols		0.042	0.028
t-value		12.203	10.542
Venture			-0.014
t-value			-3.750

Notes: 1) The t-values are calculated by using White's formula.
2) Significant positive t-values mean that row's group(*eg. chaebols*) are less efficient than column's (*eg.* non-*chaebols*).

The larger $\hat{\alpha}_i$, the greater the efficiency of firm i. Now, define the inefficiency level $\hat{u}_i$ as

$$\hat{u}_i = \max_{1 \le j \le N} (\hat{\alpha}_j) - \hat{\alpha}_i , \quad i = 1 \ldots N. \tag{9}$$

This definition implies that the most efficient firm in the sample is 100% efficient (a zero inefficiency level) and all the other firms have positive inefficiency levels. Using the estimates from our benchmark model, we compute $\hat{u}_i$ using equation (9). Table 5B reports the estimates of the inefficiency level and the efficiency ranking of the firms of different type.

According to Table 5B, the (unweighted) average inefficiency level of the 30 business groups is 0.141 which means that the average business group affiliated firm is about 14.1% less efficient than the most efficient firm. The venture companies turn out to be most efficient with the smallest inefficiency estimates (7.6 percent). To check on the statistical significance of the differences between the various types of the firms, we run regressions of the inefficiency level on a constant term and a group dummy variable, which takes the value of one for firms classified along the columns and zero for firms classified along the rows. We test the significance of the coefficient estimate of the dummy variable using a t-test. To compute robust standard errors of the estimates, we adopt White's heteroscedasticity consistent covariance formula. Table 5C shows our results.

By comparison, we have found that venture companies are most efficient. First of all, the difference between venture firms and top 30 groups turns out to be significant, with a t-value of 15.6. When compared with the non-*chaebols* (or other firms listed in the KSE), venture firms turn out to be significantly more efficient (with a t-value of 12.2). In sum, the efficiency comparison suggests the following order of efficiency among the various subgroups of firms. From best to worst, venture firms, non-venture firms, non-*chaebols*, and *chaebols*.

VI. Linking Productive Efficiency and Financial Efficiency

Finally, we look into the comparative performance of venture firms in terms of their financial efficiency (profitability). Table 6 presents the results of regression analysis of profitability (operating profit/asset) of the sample firms. Explanatory variables include capital-labor ratio, debt-equity ratio, asset growth rates, the estimated inefficiency level, and a venture (*chaebol*) dummy. As is shown, the coefficients of the dummy variable of venture companies

TABLE 6A

DETERMINANTS OF PROFITABILITY

(DEPENDENT VARIABLE IS "OPERATING INCOME/ASSET")

	Constant	Inefficiency	Cap/Lab	Debt/Asset	Asset growth	R-square
estimates	0.154	-0.765				0.278
t-value	29.333	-16.641				
estimates	0.154	-0.767	0.000			0.279
t-value	29.254	-15.590	0.077			
estimates	0.174	-0.712	0.000	-0.042		0.298
t-value	25.894	-14.298	0.155	-4.742		
estimates	0.169	-0.680	0.000	-0.042	0.007	0.302
t-value	23.925	-13.207	0.054	-4.731	2.341	
estimates	0.079		0.000			0.032
t-value	31.771		-5.006			
estimates	0.122		0.000	-0.071		0.098
t-value	19.056		-4.403	-7.298		
estimates	0.115		0.000	-0.068	0.017	0.133
t-value	17.906		-4.204	-7.021	5.439	

TABLE 6B

CASE WITH A VENTURE DUMMY

	Constant	Inefficiency	Cap/Lab	Debt/ Asset	Asset growth	Venture dummy	R-square
estimates	0.064					0.049	0.107
t-value	33.670					9.255	
estimates	0.142	-0.684				0.023	0.297
t-value	24.468	-13.997				4.520	
estimates	0.142	-0.692	0.000			0.023	0.296
t-value	24.460	-13.498	0.520			4.546	
estimates	0.162	-0.635	0.000	-0.043		0.023	0.318
t-value	22.935	-12.266	0.615	-4.889		4.699	
estimates	0.160	-0.624	0.000	-0.043	0.003	0.022	0.318
t-value	22.150	-11.870	0.532	-4.872	1.130	4.214	
estimates	0.070		0.000			0.045	0.118
t-value	27.001		-3.316			8.389	
estimates	0.111		0.000	-0.067		0.043	0.175
t-value	17.678		-2.785	-7.132		8.240	
estimates	0.109		0.000	-0.065	0.010	0.037	0.184
t-value	17.186		-2.861	-6.987	3.018	6.805	

TABLE 6C

CASE WITH A CHAEBOL DUMMY

	Constant	Inefficiency	Cap/Lab	Debt/ Asset	Asset growth	Chaebol dummy	R-square
estimates	0.073					-0.016	0.011
t-value	36.080					-3.035	
estimates	0.158	-0.827				0.015	0.287
t-value	29.355	-16.670				3.191	
estimates	0.158	-0.815	0.000			0.018	0.287
t-value	26.379	-16.022	-1.110			3.378	
estimates	0.181	-0.763	0.000	-0.047		0.021	0.313
t-value	26.303	-15.011	-1.282	-5.265		4.072	
estimates	0.177	-0.733	0.000	-0.046	0.006	0.020	0.316
t-value	24.348	-13.914	-1.337	-5.242	2.180	3.978	
estimates	0.079		0.000			-0.006	0.032
t-value	31.781		-4.073			-0.969	
estimates	0.123		0.000	-0.072		0.002	0.097
t-value	18.845		-4.114	-7.231		0.323	
estimates	0.116		0.000	-0.068	0.017	0.003	0.132
t-value	17.752		-3.992	-6.985	5.445	0.453	

are significantly positive, indicating superior financial performance of venture companies.

Asset growth rates are shown to be significant and positively related to profitability. Given that asset growth rates, like sales growth, represent the growth propensity of the firms, this finding is not surprising and is consistent with the typical results reported in the literature. The estimated productive inefficiency is also shown to be significant, and negatively related to profitability. This result naturally confirms the link between productive efficiency and financial efficiency. Next, the capital-labor ratio turns out to be negative but not significant. This ratio become significant when we omit the inefficiency term, which lowers the overall fitness as measured by the adjusted R square ratios. The debt-asset ratio is negatively related to profitability, and the relationship is significant. The negative relationship between the debt-asset ratio and operating profit—equity capital ratio seem to reflect the “soft” nature of debt in Korea, in the sense that the debt does not play the role of putting pressure to the manager to improve the performance of the firm.

Table 6C presents the results with a *chaebol* dummy. First, quite interestingly the *chaebol* dummy are also shown to be positive and significant. But, we should note that this is so when the inefficiency term is present. In other words, it implies that while the *chaebol*-affiliated firms are subject to productive inefficiency (as the results in the preceding section suggest), this inefficiency are somewhat offset by some sort of group-level "assistance." The results imply that being affiliated to a business group brings affiliated firms some pecuniary gains, which might come from intra-group transactions or debt-guarantee, and so on. These results are in sharp contrast with the results reported in Lee, Ryu and Yoon (2000), where the same technique is applied but significantly negative coefficients for the *chaebol* dummy in profitability regressions is reported. But, one important difference exists; they treat each business group consisting of tens of affiliated firms as a single entity utilizing the consolidated balance sheet. This approach may be regarded as more reasonable since *chaebol*-affiliated firms did not have much autonomy, especially in the 1980s which is the period of their data base.

Here we are comparing ventures and *chaebol*-affiliated firms in the late 1990s when the venture firms began to be listed in the Kosdaq. One interpretation would be that on a group level there are no financial gain of being a big group, but each affiliated firm enjoys some financial gains over other independent firms. This argument implies that this financial gain is a zero sum gain which does not exist at a group level but exists only at an each firm level. Firm-level gains cancel each other out when they are combined in the consolidated balance sheet.

Another interesting finding is that when we take out the inefficiency term, which is more normal profit function specifications, the *chaebol* dummy become insignificant and negative. This is in sharp contrast with the venture dummy in the previous model. When we take out the inefficiency dummy, the estimated coefficients and t-values of venture dummy become larger or "more" significant. We take this as additional indication of financial inefficiency of *chaebol*-affiliated firms, which is consistent with the recent findings by other research comparing firm-level profitability of *chaebol*-firms and non-*chaebol* firms. Only exception is the much earlier work by Chang and Choi (1988), which reported higher profitability of *chaebols* relative to non-*chaebol* firms in the 1970s and early 1980s. More recent studies uniformly show lower

TABLE 7A

DETERMINANTS OF PROFITABILITY IN A SMALL SAMPLE
(*CHAEBOLS* AND VENTURES ONLY)
(DEPENDENT VARIABLE IS "OPERATING INCOME/ASSET")

	Constant	Inefficiency	Cap/Lab	Debt/Asset	Asset growth	R-square
estimates	0.167	-0.762				0.390
t-value	21.043	-11.362				
estimates	0.167	-0.746	0.000			0.388
t-value	20.861	-10.060	-0.157			
estimates	0.195	-0.641	0.000	-0.061		0.406
t-value	14.563	-7.694	-0.416	-2.613		
estimates	0.189	-0.602	0.000	-0.062	0.005	0.407
t-value	13.187	-6.743	-0.405	-2.647	1.205	
estimates	0.096		0.000			0.080
t-value	20.501		-4.290			
estimates	0.172		-0.147	0.017		0.255
t-value	10.890		-6.463	3.879		
estimates	0.171		0.000	-0.134	0.016	0.273
t-value	10.973		-2.464	-5.822	3.534	
estimates	0.192			-0.165		0.202
t-value	12.403			-7.183		
estimates	0.172			-0.147	0.017	0.255
t-value	10.890			-6.463	3.879	
estimates	0.073				0.023	0.102
t-value	17.493				4.866	

Note: Regressions using the panel data of *chaebols* and ventures over the 1996-9.

profitability of *chaebol* firms. For example, Choi and Cowing (1999) and Jo (1998) show such results in comparing individual group-affiliated firms and non-group firms. Lee, Geon Beom (1999) estimates the group-affiliation premium in terms of profitability in the 1980s and 1990s and finds that the premium has decreased from positive values to negative values. Yoon (1998) estimates the long-term trends of profitability of the Korean firms by size (small, medium and large-sized firms), and finds that before the late 1980s, profitability of large sized firms was higher than smaller-sized firms, whereas the opposite has been true since the 1980s. All these findings suggest that while the *chaebols* might have been an effective institutional arrangement in the 1970s and up to the early 1980s, their superiority over non-*chaebols* has declined over the 1980s and 1990s.

TABLE 7B

CASE WITH A VENTURE DUMMY

	Constant	Inefficiency	Cap/Lab	Debt/ Asset	Asset growth	Venture dummy	R-square
estimates	0.057					0.056	0.269
t-value	12.853					8.647	
estimates	0.148	-0.650				0.013	0.394
t-value	10.114	-6.483				1.513	
estimates	0.148	-0.650	0.000			0.014	0.391
t-value	9.609	-6.468	0.090			1.420	
estimates	0.178	-0.560	0.000	-0.059		0.012	0.407
t-value	9.254	-5.317	0.120	-2.526		1.265	
estimates	0.174	-0.533	0.000	-0.060	0.005	0.011	0.408
t-value	8.908	-4.926	0.080	-2.561	1.068	1.134	
estimates	0.057		0.000			0.056	0.266
t-value	8.284		-0.010			7.165	
estimates	0.129		0.000	-0.101		0.043	0.325
t-value	7.167		0.057	-4.303		5.359	
estimates	0.126		0.000	-0.099	0.010	0.037	0.338
t-value	7.039		-0.014	-4.234	2.148	4.490	
estimates	0.130			-0.101		0.043	0.329
t-value	7.467			-4.313		6.215	
estimates	0.126			-0.099	0.010	0.038	0.341
t-value	7.306			-4.246	2.154	5.192	
estimates	0.055				0.010	0.050	0.284
t-value	12.349				2.263	7.192	

Note: Regressions using the panel data of *chaebols* and ventures.

Finally, to make a direct comparison between the *chaebols* and venture firms, we run the same regressions using only the *chaebols* in the KSE and ventures in the Kosdaq. The results are presented in Table 7A, 7B, 7C, and are basically consistent with the preceding argument. As shown in Table 7B, venture dummies are all significant and positive in profitability regressions without the inefficient term and all insignificant but positive in regressions with the inefficiency term. In Table 7C, it is shown that *chaebol* dummies are all significant and negative in profitability regressions without the inefficiency term and all negative but insignificant in regressions with the inefficiency term.

TABLE 7C

CASE WITH A CHAEBOL DUMMY

	Constant	Inefficiency	Cap/Lab	Debt/ Asset	Asset growth	Chaebol dummy	R-square
estimates	0.113					-0.056	0.269
t-value	24.075					-8.647	
estimates	0.162	-0.650				-0.013	0.394
t-value	18.627	-6.483				-1.513	
estimates	0.162	-0.650	0.000			-0.014	0.391
t-value	18.507	-6.468	0.090			-1.420	
estimates	0.190	-0.560	0.000	-0.059		-0.012	0.407
t-value	13.511	-5.317	0.120	-2.526		-1.265	
estimates	0.185	-0.533	0.000	-0.060	0.005	-0.011	0.408
t-value	12.492	-4.926	0.080	-2.561	1.068	-1.134	
estimates	0.113		0.000			-0.056	0.266
t-value	23.552		-0.010			-7.165	
estimates	0.172		0.000	-0.101		-0.043	0.325
t-value	11.824		0.057	-4.303		-5.359	
estimates	0.164		0.000	-0.099	0.010	-0.037	0.338
t-value	10.931		-0.014	-4.234	2.148	-4.490	
estimates	0.172			-0.101		-0.043	0.329
t-value	11.870			-4.313		-6.215	
estimates	0.164			-0.099	0.010	-0.038	0.341
t-value	10.965			-4.246	2.154	-5.192	
estimates	0.105				0.010	-0.050	0.284
t-value	18.089				2.263	-7.192	

Note: Regressions using the panel data of *chaebols* and ventures.

VII. Summary

This paper has focused on the emergence of a new style of the firms in the Korean economy, the so-called venture companies, and has provided a comparative analysis of the behavior and economic efficiency of the venture companies relative to *chaebols* and non-*chaebol* firms listed in the Korea Stock Exchange(KSE). The paper employs an econometric technique to compare the productive efficiency of ventures and non-ventures in the Kosdaq and *chaebols* and non-*chaebol* firms in Korea, using panel data covering the 1996-9 period. We have found that the average level of productive efficiency of ventures is the highest among the four types of the firms compared which include *chaebols*, non-*chaebols*, ventures and non-ventures. The efficiency comparison suggests the following order of efficiency among the various subgroups of firms, from the best to the worst; venture firms, non-venture firms, non-*chaebols*, and *chaebols*.

We have also found that the estimated productive efficiency is an important determinant of profitability. When we control for productive efficiency, capital-labor ratio, debt-equity ratio, and asset growth rates, venture firms' profitability is shown to be significantly higher than that of other firms, including *chaebol* firms.

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References

Aigner, Dennis, Lovell, and Schmidt, Peter. "Formulation and Estimation of Stochastic Frontier Production Models." *Journal of Econometrics* 6 (No. 1 1997): 21-37.

Bauer, Paul. "Recent Development in the Econometric Estimation of Frontiers." *Journal of Econometrics* 46 (No. 1 1990): 39-56.

Chang, S. J., and Choi, U. H. "Strategy, Structure and Performance of Korean Business Groups: A Transaction Cost Approach." *The Journal of Industrial Economics* 37 (No. 1 1988): 141-58.

Choi, Seung No. *The Business Groups in Korea 1999*. The Free Enterprise Institute, 2000.

Choi, J., and Cowing, T. "Firm Behavior and Group Affiliation: The Strategic Role of Corporate Grouping for Korean Firms." *Journal of Asia Economics* 10 (1999): 195-209.

Cornwell, Christopher, Schmidt, Peter, and Sickles, Robin. "Production Frontiers with Cross-Sectional and Time-Series Variation in Efficiency Levels." *Journal of Econometrics* 46 (No. 1 1990): 185-200.

Ferrier, G., and Lovell, K. "Measuring Cost Efficiency in Banking: Econometric and Linear Programming Evidence." *Journal of Econometrics* 46 (1990): 229-45.

Granovetter, Mark. "Coase Revisited: Business Groups in the Modern Economy." *Industrial and Corporate Change* 4 (No. 1 1995): 93-130.

Hausman, J., and W. Taylor. "Panel Data and Unobservable Individual Effects." *Econometrica* 49 (No. 6 1981): 1377-98.

Hausman, J. "Specification Tests in Econometrics." *Econometrica* 46

(No. 6 1978): 1251-71.

Jo, Sung Wook. "A Study on Profitability of the Korean Firms." KDI Working Paper. Seoul: Korea Development Institute, 1998 (in Korean).

Korea Credit Investigation Service. *Financial Data Base 1996-2000*.

Korea Productivity Organization. *Registry of the Firms in Korea*. Seoul, Various Issues (in Korea).

Kumbhakar, Subal. "On the Estimation of Technical and Allocative Inefficiency Using Stochastic Frontier Functions: The Case of U.S. Class 1 Railroads." *International Economic Review* 29 (No. 4 1988): 727-43.

La Porta, Rafael, Lopes-de-Silanies, Florencio, and Shleifer Andre. "Corporate Ownership around the World." NBER Working Paper No. 6625. National Bureau of Economic Research, 1998.

Lee, Geon Beom. *Three Essays on Economic Growth and Income Distribution in Korea*. Ph.D. Thesis, Seoul: Seoul National University, 1999.

Lee, Jae-Hyee. "Venture Businesses, *Chaebol* and South Korean Industrial Policy." Working Paper. Pusan, Korea: Kyungsung University, 2000 (in Korean).

Lee, Keun, Ryu, Keunkwan, and Yoon, Jung Mo. "Productive Efficiency of *Chaebols* and Non-*Chaebols* in Korea: Stochastic Production Frontier Estimation Using the Panel Data." Under Revision for *Journal of Industrial Economics*, 2000.

Lee, Su-Bok, and Han, Sung-Duk. "Diversification and Profitability in the Business Groups in Korea." *Studies in Industrial Organization* 6 (No. 1 1997): 55-69 (in Korean).

Maeil Business News. *Almanac of the Firms in Korea*. Various Issues (in Korean).

Office of the Small and Medium Sized Enterprise of Korea. *A Report on the Status of Venture Companies*. November 1999 (in Korean).

Schmidt, Peter., and Sickles, L. "Production Frontiers and Panel Data." *Journal of Business and Economic Statistics* 2 (No. 2 1984): 367-74.

Strachan, H. *Family and Other Business Groups in Economic Development: The Case of Nicaragua*. New York: Praeger, 1976.

Yoon, Jong In. *A Study on the Return on Stockholders' Equity in Korea*. Ph.D. Thesis, Seoul: Seoul National University, 1998 (in Korean).

Zellner, A., Kmenta, J., and Dreze, J. "Specification and Estimation of Cobb-Douglas Production Function Models." *Econometrica* 34 (No. 4 1966): 786-95.