International Comparison on Efficiency of Portal Service Providers Using Stochastic Frontier Analysis

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Abstract

In this paper, we identify the industrial characteristics of portal sites by using stochastic frontier analysis and to bit regression. As a result of the analyses, the study proposed that market share and an appropriate level of fixed assets, not human resources, have a positive impact on the efficiency of portal sites. It also revealed that portal sites are no longer an innovative industry, but are showing characteristics more similiar to a traditional industry.

Keywords: Portal Site, Stochastic Frontier Analysis, Tobit Regression

1. Introduction

Portal sites provide a variety of resources (public, media, and entertainment) and service (search engine, e-mail, forum) to a large number of subscribers and generate main profit from corporate advertisements. At the beginning, portal sites provided access to the Web, but it has developed and more services are supplied today[4].As ICT(Information and communication technologies) have also advanced rapidly, portal sites undergo the new changes as they become categorized into SNS, mobile apps, and others. Then they have become more organized and bigger as well as manufacturing. In this regard, and in an environment evolving from PCs to mobiles, this study aims to analyze the business characteristics of portal sites based on an analysis of efficiency [3]. In order to achieve our goal, stochastic frontier analysis and to bit regression were used. The paper structure of the paper is consisted as follows. First, we examine the research background and purpose. Second, describe the methodology that our paper used. Third, we provide results of the analysis. Finally, we discuss the implications of our results and review the limitations of the study.

2. Methodology

This research utilized the Stochastic Frontier Analysis where inefficiency has a probability distribution in production. The log production function associated with the Stochastic Frontier Analysis is as follows:

$$\ln \mathcal{Y}_{it} = f(\mathcal{X}_{it}; \beta) + \nu_{it} - \mu_{\iota} \tag{1}$$
$$i = 1, \cdots, \mathrm{I}, t = 1, \cdots, \mathrm{T}$$

In Formula (1), χ_{it} and ν_{it} signify various uncontrollable probability factors, where χ_{it} follows the input vector and the latter follows $\nu_{it} \sim iid\, N(0, \sigma_v^2)$. The technical efficiency (TE) of the analysis subject number i uses the error term μ_t, and can be expressed in the following formula:

$$TE_i = \exp(-\mu_t) \tag{2}$$

In general, u_i and ν_i are assumed to be mutually independent, and u_i is regarded to follow half-normal distribution or truncated-normal distribution. Half-normal distribution refers to one of the distributions of u_i, which signifies inefficiency. Since u_i has a value larger than '0', it refers to a distribution which is on the right-hand side of a normal distribution with an mean of '0'. The form of this distribution is determined by the single parameter σ_u, which signifies the standard deviation of u_i. The larger the value of σ_u, the more concentrated the probability distribution tends to be near '0'. The truncated-normal distribution is also a distribution of inefficiency u_i, and refers to a distribution of positive u_i in a normal distribution with a mean of μ and standard deviation of σ_u. This distribution is influenced by not only σ_u, but also the value of μ, and can demonstrate a distribution which tends to lean to one side. This can provide a good explanation on the efficiency of minority in a group [1].

3. Empirical Application

3.1. Data

Our research data was collected by Osiris DB, which was provided by Bureau Van Dijk. Portal service is not well defined, and its use, even within the industry, remains problematic [5]. Originally, portal site was defined as web-based applications (such as Yahoo! and Google) that provide organized access to the resources of the Internet through search engines and lists of web sites [5, 4]. The types of portals varied according to the users and the services [7]. Our research analyzed the public portals that are generally available. These bring together information from various sources, applications, and people that offer personalized Web sites (such as Yahoo, Google and Facebook). In terms of data selection, the thirty companies were selected from the GICS code 4510101 (Information Service) group. Of them, 11 companies whose websites focused on e-commerce were eliminated (*e.g.*, Amazon, Alibaba) [1, 5]. Table 1 shows that the statistical value of selected data on portal businesses.

Table 1. Statistical Value of Data on Portal Businesses
(Unit: One thousand dollars)

	Revenue	Employee	Tangible Fixed Assets	Costs of Goods Sold	Market Share (t1)	R&D (t2)	Business Area (t3)
Mean	6,121,309	10,520	3,256,532	1,518,481	27.8%	970,669	0.37
Std.	14,799,966	14,440	6,437,178	4,324,037	31.8%	2,245,736	0.49
Min.	453,795,806	1,414	38,279	3,603	1.2%	1,874,640	0
Max.	66,001,000,000	53,600	23883000	20,711,000	87%	9,832,000,000	1

3.2. Result

The result of the efficiency analysis on portal site service providers is set out in Table 2. The result shows that Tangible Fixed Asset and Cost of Goods Sold have a positive

relation with the performance indicator. The mean efficiency is approximately 70.3 percent.

Table 2. Efficiency Measurement Results

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	11.896	0.74975	15.8673	***
log(employee)	-0.086564	0.092902	-0.9318	0.351454
log(Tangible Fixed Asset)	0.65012	0.073209	8.8803	***
log(Cost of Goods Sold)	0.18598	0.040839	4.5539	***
sigmaSq	0.21324	0.079445	2.6842	0.007271 **
Gamma	1	0.0000055745	179388.68	***
Signif. Codes: 0 '*' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1**				
log likelihood value: -1.767821				
mean efficiency: 0.702761				
	Mean	Std. Error	Min.	Max
Efficiency	**0.7028**	0.212	0.357	0.9998

Table 3 provides result of the efficiency analysis on each portal site service provider. PANDORA MEDIA, YAHOO JAPAN, IAC/INTERACTIVE, and NAVER showed the highest efficiency. This is ranked in order of efficiency.

Table 3. Efficiency Measurement Results on Each Portal Site Service Provider

Provider	Country	Efficiency	Rank
GOOGLE INC.	US	0.799133	9
FACEBOOK, INC.	US	0.745907	11
BAIDU INC.	KY	0.899417	4
YAHOO INC	US	0.556985	12
YAHOO JAPAN CORPORATION	JP	0.998487	2
IAC/INTERACTIVECORP	US	0.948398	3
T-ONLINE INTERNATIONAL AG	DE	0.840095	7
AOL, INC.	US	0.556157	13
NAVER CORPORATION	KR	0.887391	5
LINKEDIN CORPORATION	US	0.47733	15
SOHU.COM INC.	US	0.428993	17
TWITTER, INC.	US	0.357066	19
YANDEX N.V.	NL	0.472827	16
PANDORA MEDIA, INC.	US	0.999245	1
SINA CORPORATION	KY	0.857594	6
SOUFUN HOLDINGS LIMITED	KY	0.408996	18
YOUKU TUDOU INC.	KY	0.797668	10
YY INC.	KY	0.829279	8
DAUM KAKAO CORP.	KR	0.49275	14

In order to identify factors that can cause efficiency, the study conducted the Tobit Regression by defining the independent variable as market share in Table 1 as t1, R&D as t2, and Business Area as t3. Market share refers to the share of the domestic market occupied by the relevant business. R&D costs have been separated from operating expense based on their Annual Reports. As for 'Business Area', domestic sales was defined as '0' and multinational sales as '1'. The results of the Tobit Regression formula are as follows:

$$\text{eff}_i = \beta_0 + \beta_1 t1 + \beta_2 \ln t2 + \beta_3 t3 + \epsilon \tag{3}$$

Table 4. Tobit Regression Analysis Results

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	0.7644	0.6711	1.139	0.2546
t1(market share)	**0.2753**	**0.152**	**1.800**	**0.079***
Log(t2)(R&D)	-0.0056	0.0373	-0.152	0.879
t3(Business Area)	-0.081	0.153	-0.530	0.5964
log(scale)	-1.6314	0.1622	-10.057	***

SignificanceCodes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

As can be inferred from above, the factor affecting the efficiency of portal sites was, unexpectedly, market share. This signifies that, similar to platform players, portal sites can only improve efficiency if they maintain a subscriber-based business.

4. Conclusion

This study used the Stochastic Frontier Analysis and Tobit Regression in order to examine the efficiency and its causes of major portal sites in the world, and primary analysis results are as follows: First, in the efficiency analysis, among three economic factors, Tangible Fixed Asset representing 'land' and a unit price concept Cost of Goods Sold had a significant impact on efficiency. In contrast to expectations that since portal sites are an innovative industry, their R&D costs or human resources development would have an impact on efficiency, it was rather the appropriate size of fixed assets and market share that affects efficiency, similar to the manufacturing industry. According to these results, it may be estimated that portal sites, like the manufacturing industry, are moving towards a 'size'-oriented environment. It may also be inferred that mobile-focused business departments have been separated to further concentrate on human resources. Future research will need to include the mobile industry or benchmark both portal and mobile businesses.

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