한국항만경제학회 2006년 학술대회 발표논문, 인하대학교, 2006. 8. 8 - 9

A Trend Analysis of Competition Positioning in Korean Seaport by Using BCG Matrix*

Park, Ro-Kyung**

목 차

Key Words : Competition positioning, Korean seaport, BCG Matrix, Growth rate, Market share, Scale efficiency CCR, BCC efficiency

Abstract

This paper has shown the trend of competition positioning of 26 Korean ports in 1994, 1999, and 2003 by using BCG matrix which consists of relative market shares, growth rate of cargo handling, and also growth rate and CCR and BCC efficiency scores with scale efficiency scores in the vertical and horizontal axes. The empirical main results are as follows. First, Incheon Port, Pyungtag Port, Gwangyang Port, Busan Port, Pohang Port and Woolsan Port have shown their competitive positioning in terms of market share and growth rate. Second, Pyungtag Port, Wando Port, Tongyoung Port, Gohyun Port, Samcheog Port, and Okgae Port have their competitive positioning in terms of growth rate and scale efficiency scores. The main policy implication of this paper is to emphasize that BCG matrix method using in this paper can give seaport manager the basic information for planning the future port management for enhancing the competitive positioning among Korean seaports.

* This paper is prepared only for the presentation in the 2006 summer international conference which will be held on August 8-9, 2006 at Inha University by Korea Port Economic Association. Author expresses thanks to Mr. Jun, Young-Sam of KT&G for his good graphic job of BCG Matrix.

** Professor of Chosun University, (nkpark@chosun.ac.kr) Phone: (062) 230-6821

I. Introduction

The Korean government is keen on making use of the nation's geoeconomic edge - being in the center of Northeast Asia - and the well- developed logistics networks which bridge China and Japan as the economic engines for the next generation. Korea seeks to play the role as the main logistic hub of the Northeast Asian economy, and take the initiative in the region's economic evolution. For this, the government plans to transform Korea's major ports(The Port of Busan, and The Port of Gwangyang) from simple transit centers to the value-added international logistics centers, and further promote those ports as intermediary junctions between the continent and the sea.[1)]

However, because of the construction of great/little deep sea port in Shanghai, and the development project for super mega hub ports in Japan, the positions of Korean ports including the Port of Busan, and Port of Gwangyang are seriously challenged. Under these circumstances, Korean port authorities should make great efforts to improve services such as port facilities, cost reduction and increasing competition to preoccupy rapidly improving seaborne cargo traffic, especially cargo traffic from China through the increase of port competitiveness.[2)]

In evaluating the competition positioning of firms, products and so on, it is common practice to use BCG(Boston Consulting Group) matrix which consists of relative market share(horizontal axis) and real growth rate in the industry(vertical axis) and is divided into star, cash cow, question mark, and dog according to the levels of two variables.

In order to support trade oriented economic development, port authorities have increasingly been under pressure to improve port efficiency by ensuring that port services are provided on an internationally competitive basis. Ports form a vital link in the overall trading chain and, consequently, port efficiency is an important contributor to a nation's international competitiveness. Thus monitoring and comparing one's port with other ports in terms of overall efficiency has become an essential part of many countries' microeconomic reform programmes.[3)]

---

1) http://www.momaf.go.kr

2) Sung-woong, Lee, " Competition among Hub Ports and the Strategy for Co-opetition of Gwangyang Port," *Proceedings of the 4th International Gwangyang Port Forum*, April 19-21, 2006, p.39.

The purpose of this paper is to investigate the trend of competition positioning of 26 Korean ports in 1994, 1999, and 2003 by using relative market shares, growth rate of cargo handling in Korean seaports, CCR[Charnes, Cooper and Rhodes(1978)] and BCC[Banker, Charnes and Cooper(1984)] efficiency scores with scale efficiency scores in DEA (Data Envelopment Analysis) and finally is to suggest policy implications to enhance the competition positioning in Korean ports.

The paper is organized as follows. Secton II presents the survey of previous studies briefly according to the scholars. Section III proposes the basic concept of BCG matrix, CCR, BCC, and scale efficiency and analyzes the result of empirical analysis. Section IV concludes with the brief summary of this paper.

II. Survey of Previous Studies

Few studies by using BCG matrix for measuring the seaport competition are found in Korea. Chul-hwan Han(2002a) shows the dynamic shift of 21 Asian container ports' competitive position during the 20 years using two empirical methodologies, Portfolio analysis(BCG Matrix) and Total Shift Analysis. Chul-hwan Han(2002b) evaluates the competitive position of 11 Asian container ports using the dynamic portfolio analysis, and total shift analysis. Haezndock(2001) used and developed the BCG matrix for measuring the strategic positioning of seaport industry.

Previous studies, by using DEA for measuring efficiency of seaport, which dealt with productivity and efficiency of seaports have been vividly published during the recent 10 years. Y. Roll and Y. Hayuth(1993), Jose Tongzon(2001), Valentine and Gray(2002), K. Cullinane, D.W. Song, and R. Gray(2002), T.F. Wang, K. Cullinane, and D.W. Song(2005) have shown the productivity of container ports. In Korea, Oh,Sung-dong and Park,Ro-Kyung(2001), Han, Chul-Han(2002c) presented the meaurement of productivity with international competition power. Y. Roll and Y. Hayuth(1993), Tongzon(2001) and Valentine and Gray(2002) used the DEA method for measuring the efficiency and productivity of Australian and other international

---

3) J. Tongzon, " Efficiency Measurement of Selected Australian and Other International Ports Using Data Envelopment Analysis," *Transportation Research Part A*, Vol.35, 2001, pp.113-114.

ports. Recently, as the most in depth analysis, Wang, Cullinane and Song(2005) shows the application way of the several DEA models[basic DEA, FDH(free disposal hull), Window, alternative DEA] and stochastic frontier approach to the measurement of container port efficiency by using cross-sectional and panel data.

The limitations of previous studies are as follows.

First, Han(2002) did not use the efficiency scores of each port for measuring the competition positioning.

Second, other studies using DEA method did not deal with competition positioning using BCG matrix.

This paper will overcome the limitation of previous studies by adopting the above two elements for measuring the competition positioning of Korean seaports by using the BCG matrix.

III. An Empirical Analysis by Using BCG Matrix

Efficiency can simply be expressed as a ratio of output to input provided that the product only produces one output. Therefore, if multiple inputs and outputs cases, efficiency then begins to resemble the sum of weighted outputs over the sum of weighted inputs.[4)]

When we define productivity(Productive Efficiency) as the ratio of input-output, productivity and efficiency have the same meaning. Recently, total productivity, partial productivity, total factor productivity are suggested for measuring productivity and efficiency. However, because of several factors which should be considered, the limits on the productivity of a container terminal may be imposed by either physical or institutional factors or a combination of both. Dowd and Leschine(1990, p.111) shows the general components for measuring the productivity of container ports. Also, Wang, Cullinane, and Song(2005,pp.81-87) defines the input and output variables more carefully after reviewing the previous studies critically.

The theoretical summaries of the BCG matrix, CCR and BCC models, and Scale efficiency are introduced in this section.

---

4) V.F. Valentine, and R. Gray (2002), p.167.

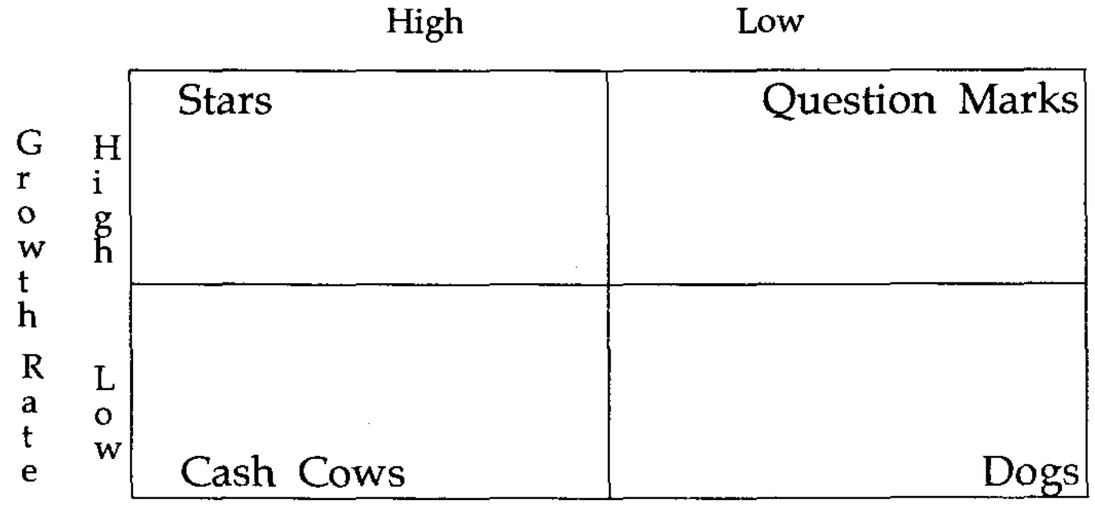
1.BCG Matrix[5]

The BCG Growth-Share Matrix is a portfolio planning model developed by Bruce Henderson of the Boston Consulting Group in the early 1970's. It is based on the observation that a company's business units can be classified into four categories based on combinations of market growth and market share relative to the largest competitor, hence the name "growth-share". Market growth serves as a proxy for industry attractiveness, and relative market share serves as a proxy for competitive advantage. The growth-share matrix thus maps the business unit positions within these two important determinants of profitability.

This framework assumes that an increase in relative market share will result in an increase in the generation of cash. This assumption often is true because of the experience curve; increased relative market share implies that the firm is moving forward on the experience curve relative to its competitors, thus developing a cost advantage. A second assumption is that a growing market requires investment in assets to increase capacity and therefore results in the consumption of cash. Thus the position of a business on the growth-share matrix provides an indication of its cash generation and its cash consumption.

(1) 4 Categories of BCG Matrix[6]

[Figure 1] BCG Growth-Share Matrix



5) http://www.netmba.com/stratey/matrix/bcg/
6) http://www.valuebasedmanagement.net/methods_bcgmatrix.html

1) Stars(=high growth, high market share) use large amounts of cash and are leaders in the business so they should also generate large amounts of cash, and frequently roughly in balance on net cash flow. However, if needed any attempt should be made to hold share, because the rewards will be a cash cow if market share is kept.

2) Cash Cows(=low growth, high market share) means that profits and cash generation should be high, and because of the low growth, investments needed should be low. It should keeps the profits high. It will be the foundation of a company.

3) Dogs(=low growth, low market share) avoid and minimize the number of dogs in a company. It should be beware of expensive "turn around plans" and should deliver cash, otherwise liquidate.

4) Question Marks(=high growth, low market share) have the worst cash characteristics of all, because high demands and low returns due to low market share. If nothing is done to change the market share, question marks will simply absorb great amounts of cash and later, as the growth stops, a dog. It either invests heavily or sells off or invests nothing and generates whatever cash it can. Increase market share or deliver cash.

(2) Limitation of BCG Matrix

The weaknesses of BCG matrix are as follows.

First, market growth rate is only one factor in industry attractiveness, and relative market share is only one factor in competitive advantage. The growth-share matrix overlooks many other factors in these two important determinants of profitability.

Second, the framework assumes that each business unit is independent of the others. In some cases, a business unit that is a "dog" may be helping other business units gain a competitive advantage.

Third, the matrix depends heavily upon the breadth of the definition of the market. A business unit may dominate its small niche, but have very low market share in the overall industry. In such a case, the definition of the market can make the difference between a dog and a cash cow.

While its importance has diminished, the BCG matrix still can serve as a simple tool for viewing a corporation's business portfolio at a glance, and may serve as a

starting point for discussing resource allocation among strategic business units.

2. CCR, BCC Models and Scale Efficiency [7]

The DEA method enables the derivation of relative efficiency ratings within a group of analysed units by applying a mathematical programming technique. It describes a kind of "efficiency envelope" which contains the most efficient units in the group. The efficiency of all other units is then compared with this envelope.[8] The DEA model are classified into CCR(Charnes, Cooper, and Rhodes, 1978) and BCC(Banker, Charnes, and Cooper, 1984) models.[9] The main feature of CCR model assumes the constant returns to scale(CRS), and BCC model does the variable returns to scale(VRS). And also, BCC model can show the scale efficiency which comes from the CCR efficiency score divided by BCC efficiency score.

The deterministic non-parametric methods, which originate from the seminal contribution of Farrell(1957), are based on piecewise linear frontiers calculated using mathematical programming techniques. This approach(DEA) enables the derivation of relative efficiency ratings within a group of analysed units by applying a mathematical programming technique. It describes a kind of efficiency envelop which contains the most efficient units in the group. The efficiency of all other units is then compared with this envelope.[10]

A Basic DEA equation is as follow:

$$C(y)^{DEA} = [\, c \mid Y^t z \geq y, C^t z \leq c, \quad I^t{}_k z = 1, z \in R^k{}_+ \,] \qquad (1)$$

where Y is the k x n matrix of observed outputs,

C is the k × 1 vector of observed costs,

z is a k × 1 vector of intensity or activity variables,

I_k is a k × 1 unit vector,

---

7) B.D. Borger and K. Kerstens, " Cost Efficiency of Belgian Local Governments: A Comparative Analysis of FDH, DEA, and Econometric Approaches," *Regional Science & Urban Economics*, Vol.26, 1996, p.148.

8) For the main advantages of DEA with detailed explanation, refer to Roll and Hayuth, (1993), *op.cit.*, p.154.

9) For more detailed explanation about CCR and BCC models, refer to the Tonzon (2001), pp.116-119.

10) Y. Roll and Y. Hayuth(1993), p.154.

y is an n×1 vector of outputs,

c is a scalar representing a cost or budget level

This dual or indirect correspondence denotes the set of budget or cost levels, c , which allow us to produce the output vectors, y.

3. Empirical Analysis and Explanation

This paper focused on the trend analysis of competition positioning by using BCG matrix which consists of market share ratio, market growth rate, CCR, BCC and scale efficiency scores. Therefore, raw data which are used for an empirical analysis of this paper come from *Statistical Year Book of Maritime Affairs and Fisheries* by Ministry of Maritime Affairs and Fisheries. In this section, First, BCG matrix in 1994, 1999, and 2003 using market share(horizontal axis), and market growth rate(vertical axis) are shown. Second, BCG matrix in 1994, 1999, and 2003 using market growth rate(horizontal axis) and CCR, BCC and Scale efficiency scores(vertical axis) are shown to figures. Third, a trend analysis concerning 4 categories of BCG matrix is done for measuring the trend changes of 26 Korean seaports.

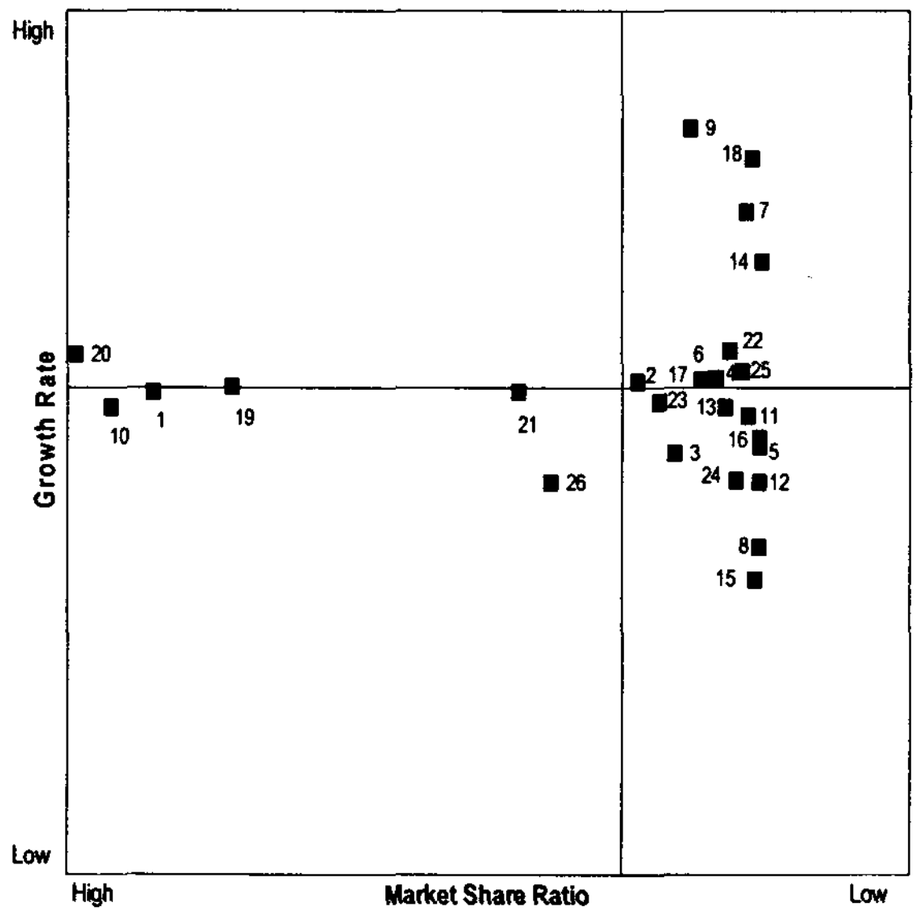
(1) Market Share and Growth Rate Analysis

<Table 1> represents the market share and growth rate of 26 Korean ports in the years of 1994, 1999, and 2003. [Figure 2], [Figure 3], and [Figure 4] show BCG matrixes concerning market share and growth rate in the years of 1994, 1999, and 2004. In this <Table 1>, cross sectional data are used instead of averaged accumulative data(for example, 1994 instead of 1994-1998), because this paper is to analyze the trend of competition positioning in 26 Korean seaports during 10 years from 1994 to 2003.

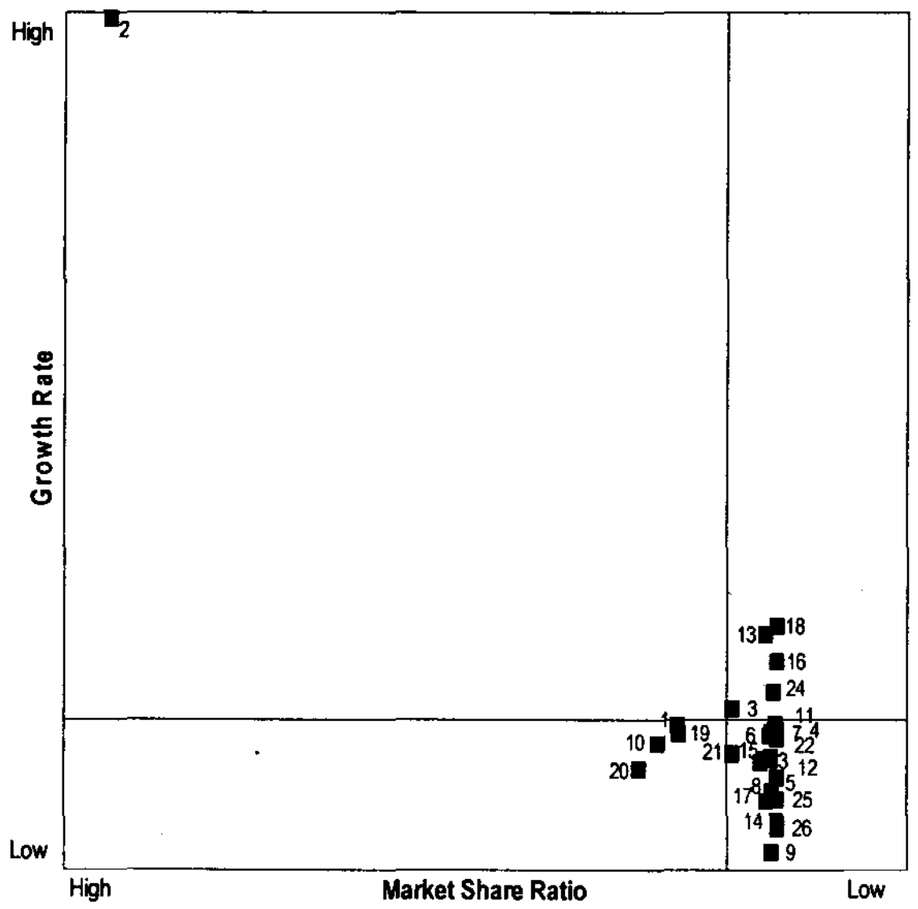
<Table 1> Market Share and Growth Rate

	1994		1999		2003	
	Market Share	Growth Rate	Market Share	Growth Rate	Market Share	Growth Rate
1. Incheon	0.166705	1.119977	0.075835	1.112459	0.148684	0.880718
2. Pyungtag	0.033888	1.142954	0.514747	2.885006	0.050734	0.922225
3. Daesan	0.23902	0.976012	0.034717	1.153174	0.046994	0.994059
4. Boryung	0.012737	1.148711	0.005672	1.085979	0.009302	1.230206
5. Janghang	0.001056	0.993277	0.000436	0.977492	0.00124	1.021958
6. Gunsan	0.013028	1.15002	0.00806	1.024691	0.01796	1.046443
7. Mogpo	0.004264	1.532057	0.004146	1.09515	0.00788	0.901786
8. Wando	0.000888	0.76	0.000233	0.924925	0.000362	0.902821
9. Yeasu	0.019612	1.72719	0.00473	0.792741	0.004289	0.443768
10. Gwangyang	0.177982	1.081246	0.091833	1.064223	0.187348	1.047224
11. Jeju	0.003921	1.061566	0.001671	1.116981	0.003163	0.827054
12. Seoguipo	0.001038	0.909402	0.000394	1.076377	0.000702	0.696284
13. Samcheonpo	0.010422	1.082098	0.009502	1.342552	0.021806	1.051782
14. Tongyoung	0.000186	1.419048	0.000102	0.868966	0.000241	0.84434
15. Gohyun	0.02173	0.683007	0.000683	1.097436	0.002321	1.063081
16. Okpo	0.001099	1.011309	0.00066	1.273885	0.001466	1.069659
17. Masan	0.017061	1.14473	0.007932	0.9197	0.013059	1.088207
18. Jinhae	0.002851	1.656912	0.000369	1.361217	0.001072	0.930159
19. Busan	0.144994	1.131709	0.075505	1.087902	0.212487	1.173687
20. Woolsan	0.187268	1.206599	0.105888	0.999663	0.166752	1.096789
21. Pohang	0.066897	1.120525	0.034417	1.041024	0.061421	1.040168
22. Samcheog	0.008666	1.214052	0.004302	1.031759	0.00815	0.931913
23. Donghae	0.02834	1.096461	0.011961	1.018922	0.022637	0.997493
24. Mookho	0.007315	0.9124	0.002561	1.195622	0.002791	0.910939
25. Okgae	0.005718	1.164235	0.003615	0.943594	0.006944	0.960778
26. Sogcho	0.057989	0.908868	0.000028	0.85	0.000193	0.952941
Average Ratio	0.038462	1.129014	0.038462	1.128517	0.038462	0.962557

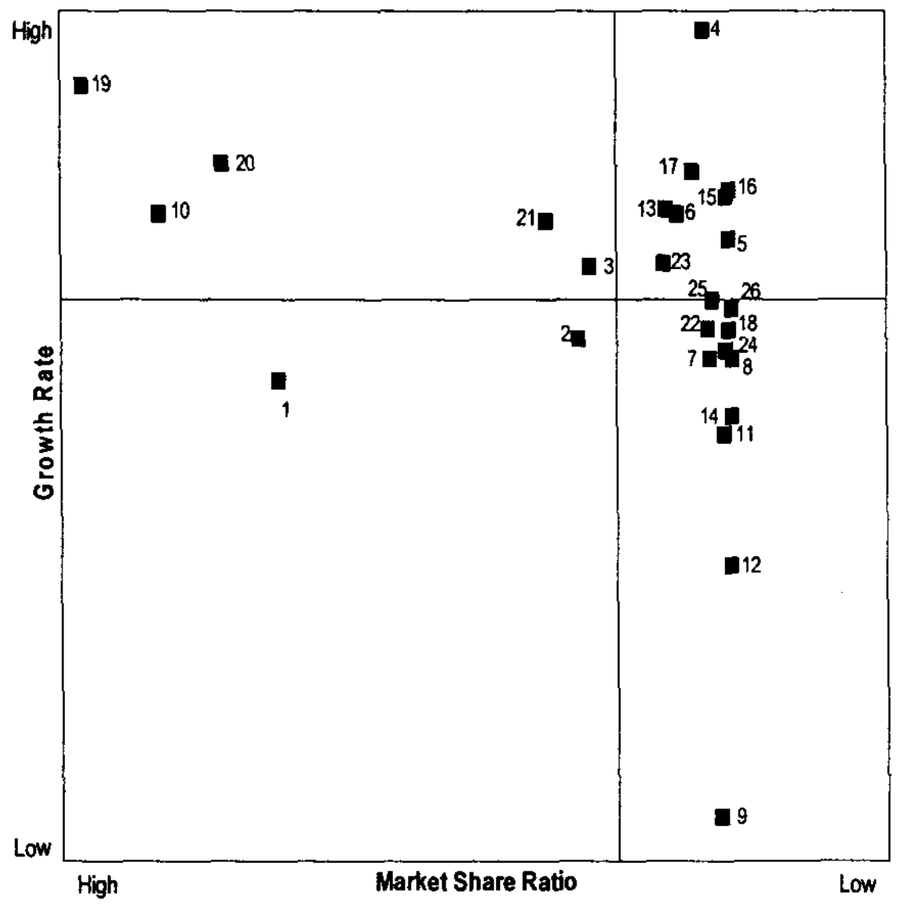
[Figure 2] BCG Matrix concerning Market Share and Growth Rate in 1994



[Figure 3] BCG Matrix concerning Market Share and Growth Rate in 1999



[Figure 4] BCG Matrix concerning Market Share and Growth Rate in 2003



(2) Growth Rate and DEA Efficiency Score Analysis

1) DEA Efficiency Score

① Definition of Variables

In Korea, *Statistical Yearbook of Maritime Affairs and Fisheries* only published by Ministry of MAF shows official statistics for seaports input and output variables. Inputs are Berthing capacity, and Cargo handling capacity. Outputs are Import and export cargo throughput and Number of arrival and departure ship.

② CCR, BCC and Scale Efficiency Analysis[11)]

The efficiency results on the input oriented CCR and BCC models and scale efficiency from 1994 to 2003 for 26 Korean seaports are shown to <Table 2>. LINDO was used for calculating efficiency. On <Table 2>, followings should be noted. First, input-oriented model aims at reducing the input amounts by as much

---

11) More detailed explanation, please refer to the followings.
Tongzon (2001), pp.116-119, Banker, Charnes and Cooper (1984), pp. 1078-1092, Charnes, Cooper and Rhodes (1978), pp. 429-444.

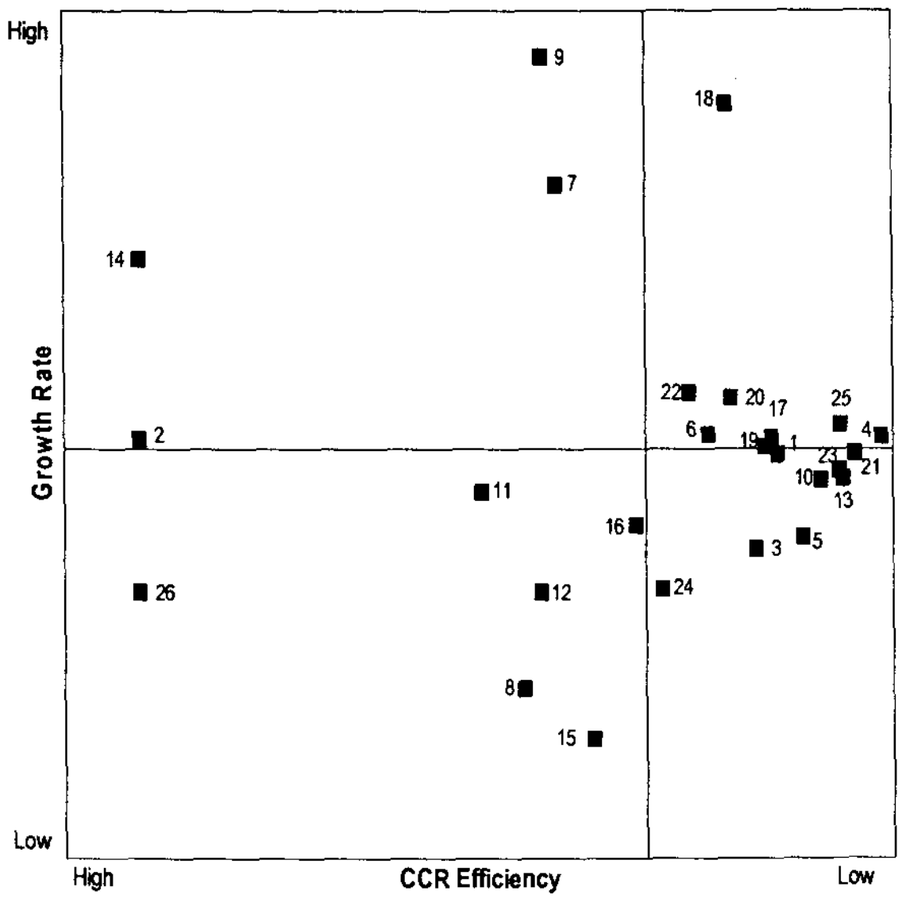
as possible while keeping at least the present output levels. Second, Pyungtag Port, Tongyoung Port, Gohyun Port, Okpo Port, Busan Port and Woolsan Port has shown the improvement of efficiency score in CCR and BCC efficiency scores. Third, Daesan, Okpo, Gohyun and Woolsan Ports are efficient.

<Table 2> Efficiency Results of CCR, BCC, and Scale Efficiency Score

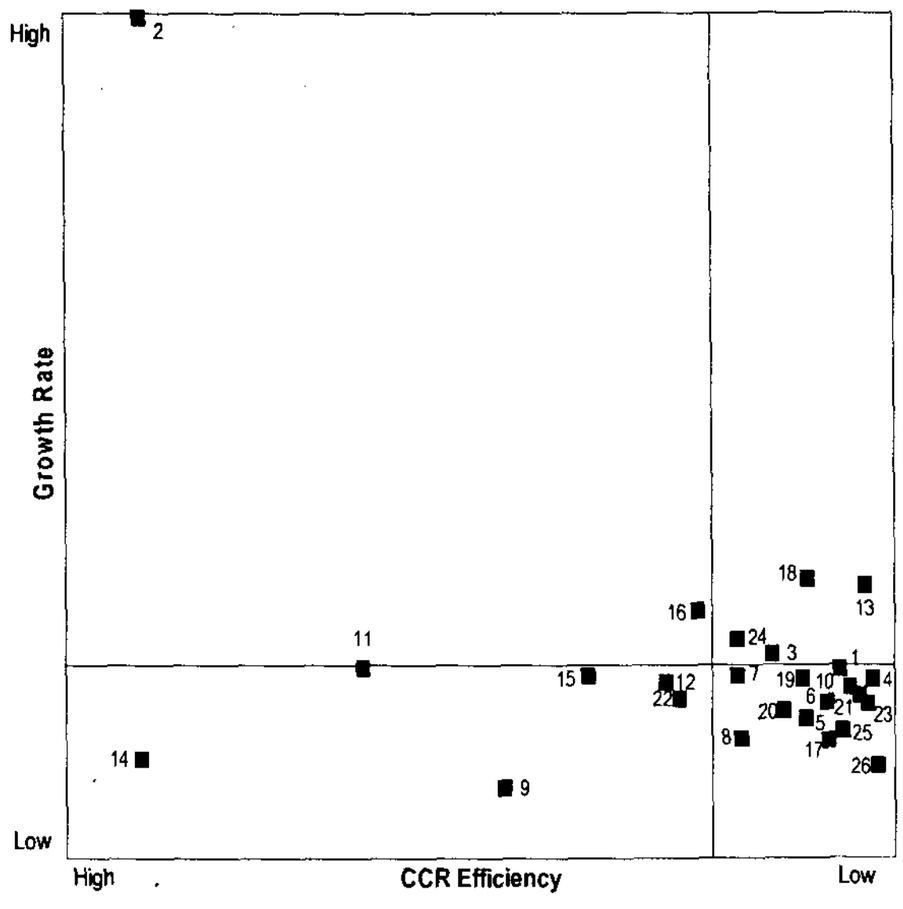
	1994		1999		2003		Scale Efficiency Score		
	CCR	BCC	CCR	BCC	CCR	BCC	1994	1999	2003
1. Incheon	0.1573	0.91537	0.07186	0.64542	0.51123	0.66422	0.171845	0.111341	0.769666
2. Pyungtag	1.0	1.0	1.0	1.0	0.70032	0.73999	1	1	0.946395
3. Daesan	0.18441	0.25174	0.16259	0.50871	1.0	1.0	0.732534	0.319605	1
4. Boryung	0.01997	0.04142	0.02948	0.05538	0.23933	0.31995	0.482147	0.53224	0.748023
5. Janghang	0.12434	0.46188	0.11675	0.39404	0.22882	0.30552	0.269201	0.296281	0.748947
6. Gunsan	0.24722	0.39444	0.09032	0.42475	0.34590	0.42555	0.626762	0.212649	0.812816
7. Mogpo	0.44850	1.0	0.20791	1.0	0.26413	1.0	0.448504	0.207915	0.264132
8. Wando	0.49046	0.59552	0.20286	0.21265	0.87585	1.0	0.823585	0.953978	0.875846
9. Yeasu	0.46695	0.81624	0.51721	0.99220	0.48575	1.0	0.572066	0.521278	0.485747
10. Gwangyang	0.10015	0.74823	0.05927	0.42744	0.41497	0.64613	0.133849	0.138666	0.642236
11. Jeju	0.54717	1.0	0.70522	1.0	0.24858	0.41041	0.547175	0.705217	0.605676
12. Seoguipo	0.46951	0.52144	0.30443	0.44764	0.27833	0.62363	0.900402	0.680083	0.446302
13. Samcheonpo	0.07023	0.07496	0.03873	0.04259	0.34412	0.56005	0.936971	0.909272	0.614449
14. Tongyoung	1.0	1.0	1.0	1.0	0.65722	0.73226	1	1	0.897522
15. Gohyun	0.40118	0.60515	0.40701	0.59364	1.0	1.0	0.662938	0.685621	1
16. Okpo	0.34480	0.73120	0.26074	0.39506	1.0	1.0	0.471551	0.660001	1
17. Masan	0.16398	0.43751	0.08769	0.38576	0.21693	0.33235	0.374804	0.227319	0.652717
18. Jinhae	0.22366	0.28675	0.11598	0.24973	0.11407	0.24291	0.779994	0.464428	0.469591
19. Busan	0.17402	1.0	0.12271	1.0	0.54850	1.0	0.174025	0.122709	0.548501
20. Woolsan	0.21871	1.0	0.14770	1.0	1.0	1.0	0.218712	0.147698	1
21. Pohang	0.05449	0.21116	0.04682	0.13571	0.32573	0.44298	0.258066	0.344994	0.735302
22. Samcheog	0.27421	0.29848	0.28522	0.37801	0.94553	1.0	0.918703	0.754531	0.945533
23. Donghae	0.07508	0.16196	0.03499	0.04580	0.24911	0.33599	0.463549	0.763836	0.741424
24. Mookho	0.31022	0.63501	0.20973	0.22893	0.21043	0.21349	0.48853	0.916129	0.985679
25. Okgae	0.07335	0.12251	0.06969	0.09686	0.36841	0.44872	0.598756	0.71945	0.821035
26. Sogcho	1.0	1.0	0.02301	0.33333	0.09429	0.39513	1	0.069041	0.238634
Average Ratio	0.33231	0.58888	0.24300	0.49976	0.48721	0.64767	0.57903	0.51786	0.73062

From [Figure 5] to [Figure 10], BCG matrixes concerning growth rate and CCR and BCC efficiency are shown. BCG matrixes concerning growth rate and scale efficiency are shown to from [Figure 11] to [Figure 13].

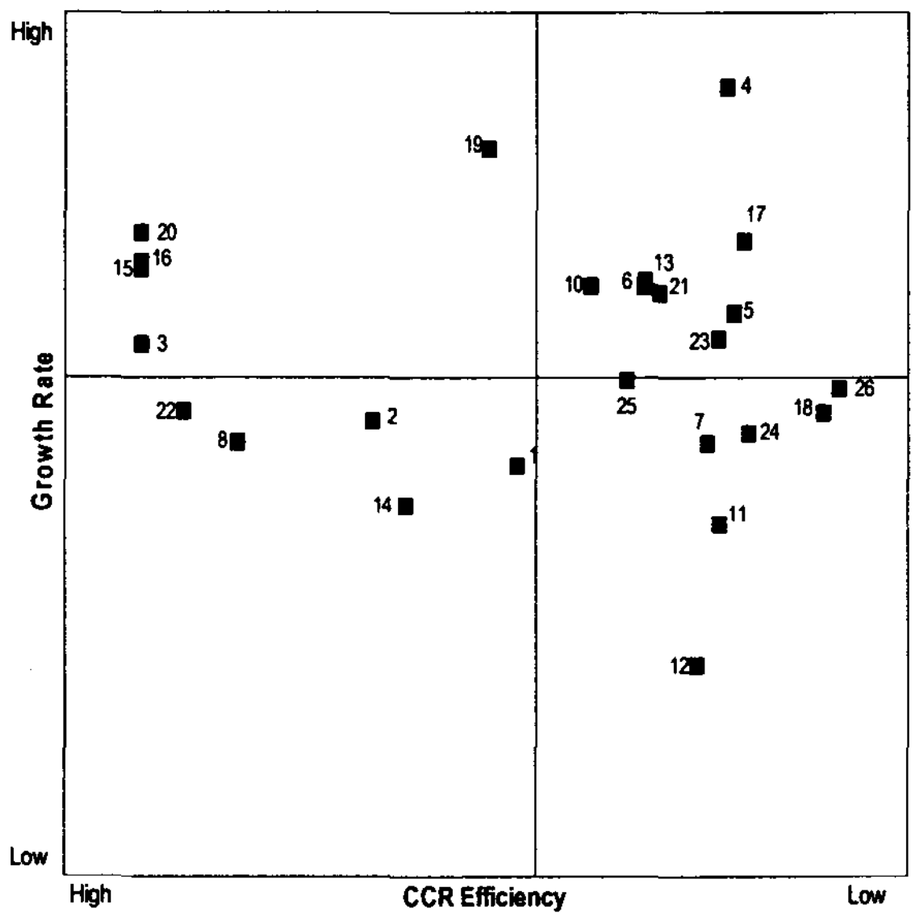
[Figure 5] BCG Matrix concerning Growth Rate and CCR Efficiency in 1994



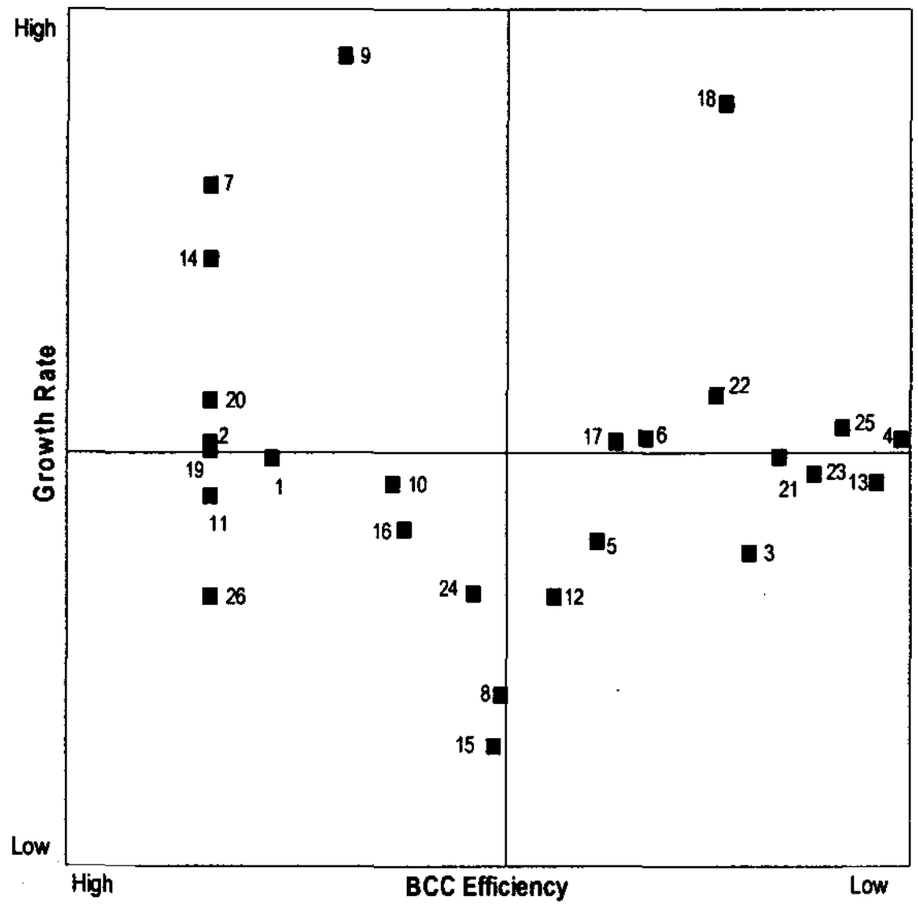
[Figure 6] BCG Matrix concerning Growth Rate and CCR Efficiency in 1999



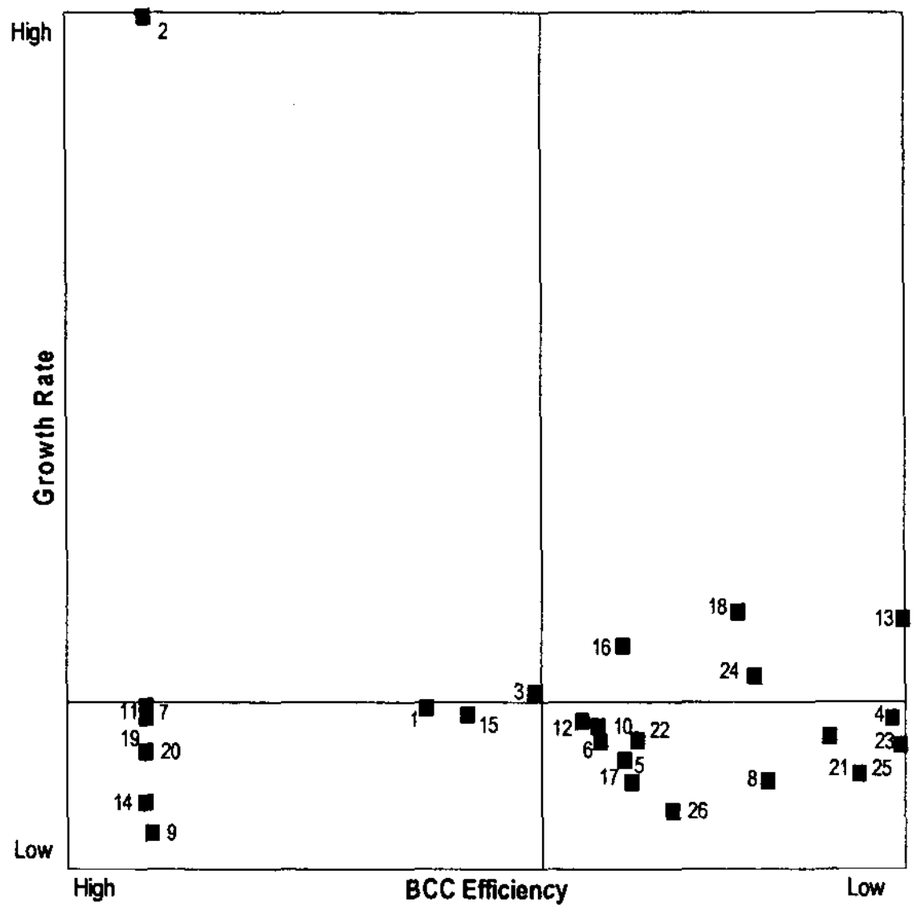
[Figure 7] BCG Matrix concerning Growth Rate and CCR Efficiency in 2003



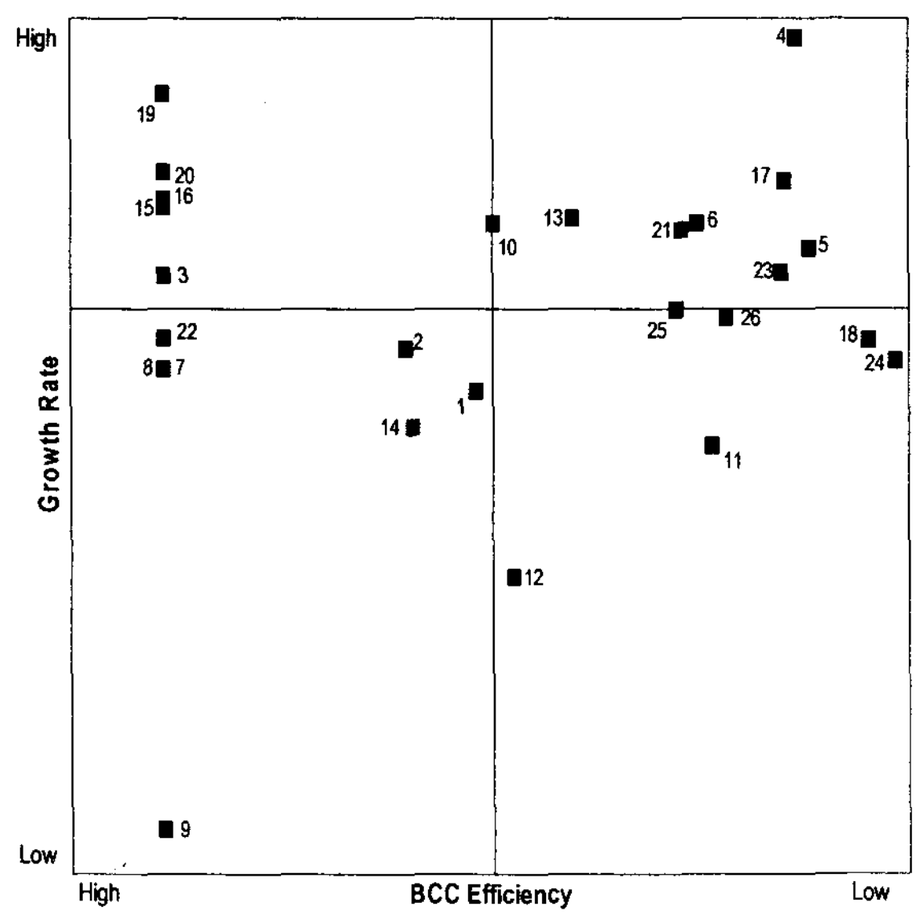
[Figure 8] BCG Matrix concerning Growth Rate and BCC Efficiency in 1994



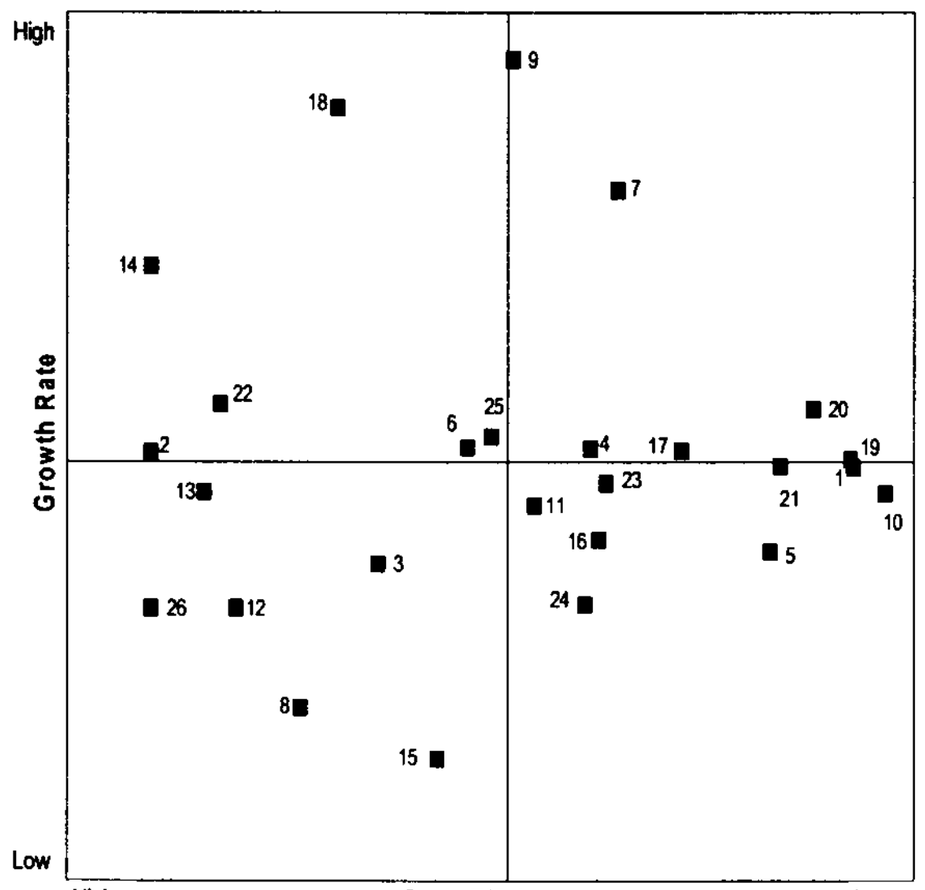
[Figure 9] BCG Matrix concerning Growth Rate and BCC Efficiency in 1999



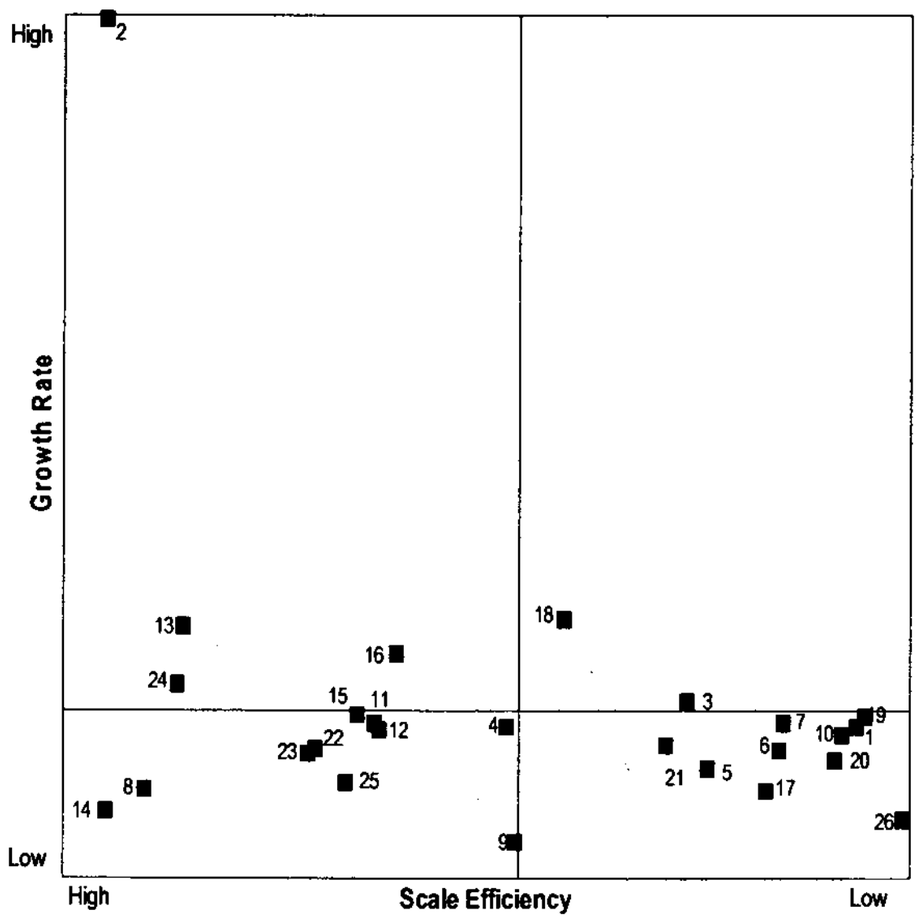
[Figure 10] BCG Matrix concerning Growth Rate and BCC Efficiency in 2003



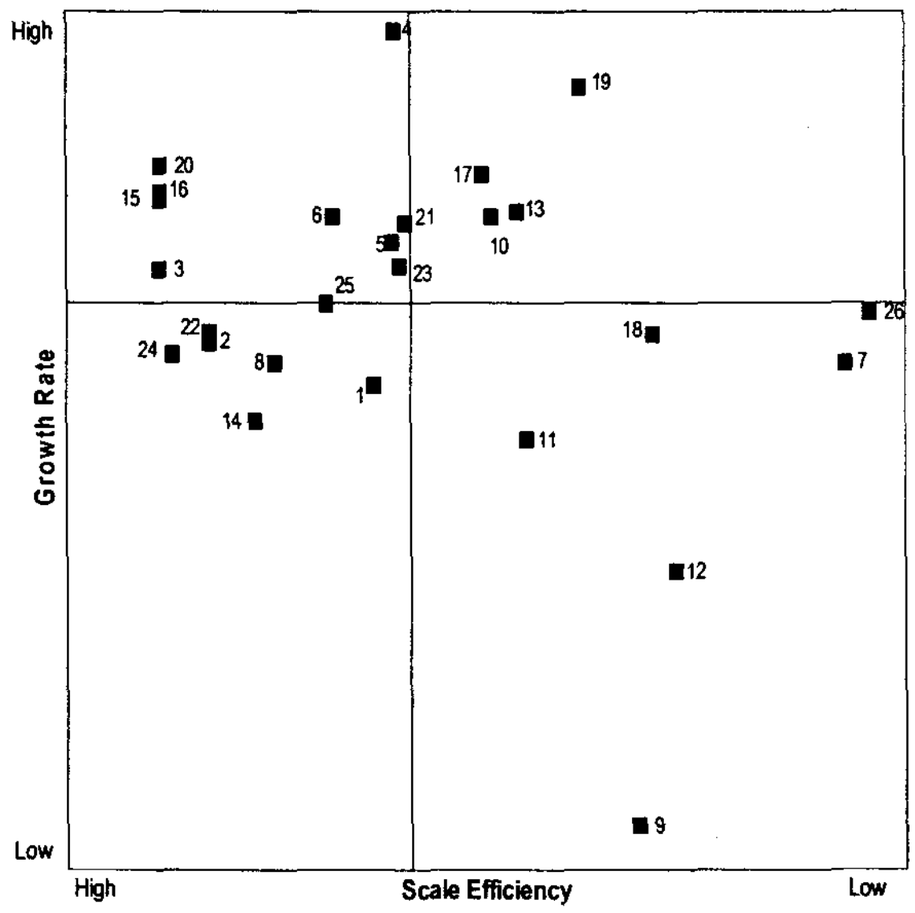
[Figure 11] BCG Matrix concerning Growth Rate and Scale Efficiency in 1994



[Figure 12] BCG Matrix concerning Growth Rate and Scale Efficiency in 1999



[Figure 13] BCG Matrix concerning Growth Rate and Scale Efficiency in 2003



<Table 3> A Trend of Competition Positioning in Korean Seaport concerning Market Share and Growth Rate

	1994	1999	2003
	Market Share and Growth Rate	Market Share and Growth Rate	Market Share and Growth Rate
1. Incheon	C C	C C	C C
2. Pyungtag	QM	Stars	C C
3. Daesan	Dogs	QM	Stars
4. Boryung	QM	Dogs	QM
5. Janghang	Dogs	Dogs	QM
6. Gunsan	QM	Dogs	QM
7. Mogpo	QM	Dogs	Dogs
8. Wando	Dogs	Dogs	Dogs
9. Yeasu	QM	Dogs	Dogs
10. Gwangyang	C C	C C	Stars
11. Jeju	Dogs	Dogs	Dogs
12. Seoguipo	Dogs	Dogs	Dogs
13. Samcheonpo	Dogs	QM	QM
14. Tongyoung	QM	Dogs	Dogs
15. Gohyun	Dogs	Dogs	QM
16. Okpo	Dogs	QM	QM
17. Masan	QM	Dogs	QM
18. Jinhae	QM	QM	Dogs
19. Busan	C C	C C	Stars
20. Woolsan	Stars	C C	Stars
21. Pohang	C C	Dogs	Stars
22. Samcheog	QM	Dogs	Dogs
23. Donghae	Dogs	Dogs	QM
24. Mookho	Dogs	QM	Dogs
25. Okgae	QM	Dogs	Dogs
26. Sogcho	C C	Dogs	Dogs

* Stars, CC(Cash Cows), QM(Question Marks), Dogs stand for 4 categories of BCG Matrix

<Table 4> A Trend of Competition Positioning in Korean Seaport concerning Growth Rate and CCR, BCC and Scale Efficiency Scores

	1994		1999		2003		Scale Efficiency Score		
	CCR	BCC	CCR	BCC	CCR	BCC	1994	1999	2003
1. Incheon	Dogs	C C	Dogs	C C	C C	C C	Dogs	Dogs	C C
2. Pyungtag	Stars	Stars	Stars	Stars	C C	C C	Stars	Stars	C C
3. Daesan	Dogs	Dogs	QM	Stars	Stars	Stars	C C	QM	Stars
4. Boryung	QM	QM	Dogs	Dogs	QM	QM	QM	C C	Stars
5. Janghang	Dogs	Dogs	Dogs	Dogs	QM	QM	Dogs	Dogs	Stars
6. Gunsan	QM	QM	Dogs	Dogs	QM	QM	Stars	Dogs	Stars
7. Mogpo	Stars	Stars	Dogs	C C	Dogs	C C	QM	Dogs	Dogs
8. Wando	C C	C C	Dogs	Dogs	C C	C C	C C	C C	C C
9. Yeasu	Stars	Stars	C C	C C	Dogs	C C	QM	C C	Dogs
10. Gwangyang	Dogs	C C	Dogs	Dogs	QM	St/QM	Dogs	Dogs	QM
11. Jeju	C C	C C	Stars	C C	Dogs	Dogs	Dogs	C C	Dogs
12. Seoguipo	C C	Dogs	C C	Dogs	Dogs	Dogs	C C	C C	Dogs
13. Samcheonpo	Dogs	Dogs	QM	QM	QM	QM	C C	Stars	QM
14. Tongyoung	Stars	Stars	C C	C C	C C	C C	Stars	C C	CC
15. Gohyun	C C	C C	C C	C C	Stars	Stars	C C	C C	Stars
16. Okpo	C C	C C	Stars	QM	Stars	Stars	Dogs	Stars	Stars
17. Masan	QM	QM	Dogs	Dogs	QM	QM	QM	Dogs	QM
18. Jinhae	QM	QM	QM	QM	Dogs	Dogs	Stars	QM	Dogs
19. Busan	QM	Stars	Dogs	C C	Stars	Stars	QM	Dogs	QM
20. Woolsan	QM	Stars	Dogs	C C	Stars	Stars	QM	Dogs	Stars
21. Pohang	Dogs	Dogs	Dogs	Dogs	QM	QM	Dogs	Dogs	Stars
22. Samcheog	QM	QM	C C	Dogs	C C	C C	Stars	C C	C C
23. Donghae	Dogs	Dogs	Dogs	Dogs	QM	QM	Dogs	C C	Stars
24. Mookho	Dogs	C C	QM	QM	Dogs	Dogs	Dogs	Stars	C C
25. Okgae	QM	QM	Dogs	Dogs	Dogs	Dogs	Stars	C C	Stars
26. Sogcho	C C	C C	Dogs	Dogs	Dogs	Dogs	C C	Dogs	Dogs

* Stars, CC(Cash Cows), QM(Question Marks), Dogs stand for 4 categories of BCG Matrix

<Table 3> shows the followings.

First, Incheon Port, Pyungtag Port, Gwangyang Port, Busan Port, Pohang Port and Woolsan Port show the competition positioning in terms of market share and growth rate, because these ports are located in the Stars and Cash Cows in BCG matrix categories. But Jeju Port, Seoguipo Port, Mookho Port, and Okgae Port are under the bad situation as they are in Dogs during 10 years.

Second, except above-mentioned ports, all other Korean seaports are under the bad situation, because they are under dogs or QMs in 1994, 1999, and 2003.

According to <Table 4>, followings are found.

First, in the middle of 1990s, Pyungtag Port, Mogpo Port, Yeasu Port, and Tongyoung Port have shown the position of "Stars" in the CCR and BCC efficiency score with Growth rate. But this position moves into Daesan Port, Okpo Port, Gohyun Port, Busan Port, and Woolsan Port in 2003.

Second, in terms of Cash Cows, Incheon Port, and Samcheog Port, and Wando Port have shown the improvement of positioning in 2003 compared to those of 1990s.

Third, BCG matrix between Growth rate and scale efficency score has shown that Pyungtag Port, Wando Port, Tongyoung Port, Gohyun Port, Samcheog Port, and Okgae Port have their positioning as "Cash Cows" or "Stars".

Fourth, 16 out of 26 ports in 2003 have shown their good positioning compared to those of 1994, 1999.

Fifth, Incheon Port improves its BCG matrix categories in 2003. However, competition positioning in scale efficiency scores of Gwangyang Port, and Busan Port has been deteriorated.

The results of <Table 3> and <Table 4> give an indication of the dynamics within the Korean seaports and allows both port authority and port manager to gain useful insights into the structure of the seaport's competitive position compared to its competition partners. For example, Pyungtag Port, which is placed to "Cash Cows", with high efficiency in a low growth market is good and cash generator. Seaport authority of Pyungtag Port should manage the port cautiously but maintain the strong position against competitors to move into "Stars".

V. Conclusion

This paper has shown the trend of competition positioning of 26 Korean ports in 1994, 1999, and 2003 by using BCG matrix which consists of relative market shares, growth rate of cargo handling, and also growth rate and CCR and BCC efficiency scores with scale efficiency scores in the vertical and horizontal axes.

The empirical main results are as follows.

First, big seaports in Korea(Incheon Port, Pyungtag Port, Gwangyang Port, Busan Port, Pohang Port and Woolsan Port) have shown their competitive positioning in terms of market share and growth rate.

Second, Daesan Port, Okpo Port, Gohyun Port, Busan Port, and Woolsan Port have gained their competitive positioning in 2003 in terms of growth rate and CCR and BCC efficiency scores.

Third, Pyungtag Port, Wando Port, Tongyoung Port, Gohyun Port, Samcheog Port, and Okgae Port have their competitive positioning in terms of growth rate and scale efficiency scores.

The policy implications of this paper are as follows.

First, seaport authority each seaport can analyze their competitive positioning in Korea and identify how much they gain or lose their market share, growth rate, CCR, BCC and scale efficiency during the past 10 years. Therefore, BCG matrix method using in this paper can give seaport manager the basic information for planning the future port management.

Second, according to the results of BCG matrix which consists of market share, CCR, BCC, and scale efficiency scores, and growth rate, the Korean seaport authority should follow the management ways of benchmark ports to improve their competition positioning in the BCG matrix.

Third, to respond the serious challenge from China and Japan seaports, government should invest the scheduled amount to the domestic seaports continuously and efficiently.

The limitation of this paper are as follows. This paper has just shown the trend of competition positioning of 26 Korean seaports by using BCG matrix without explaining the reason why these situation or positioning have been appeared or

changed. The next study will deal with this subject.

<References>

1. Banker, R. D., A. Charnes and W. W. Cooper (1984), "Some Models for Estimating Technical and Scale Inefficiencies in Data Envelopment Analysis," *Management Sciences*, Vol. 30, pp.1078-1092.
2. Bennathan, E. and A. Walters, *Port Pricing and Investment Policy for Developing Countries*, Oxford Univ. Press, 1979.
3. Callen, J.L., "Efficiency Measurement in the Manufacturing Firm," *Journal of Productivity Analysis*, Vol. 2, 1990, pp.5-13.
4. Charnes, A. and W. W. Cooper, "Management Science Relations for Evaluation and Management Accountability," *Journal of Enterprise Management*, Vol. 2, No. 2, 1980.
5. Charnes, A., W. W. Cooper and E. Rhodes, "Measuring the Efficiency of Decision Making Units," *European Journal of Operational Research*, Vol. 2, 1978, pp.429-444.
6. Cullinane, K. and Dong-Wook Song, "Container Terminals in South Korea: Problems and Panaceas," *Maritime Policy and Management*, Vol. 25, No. 1, 1998, pp.63-80.
7. Cullinane, K., D.W. Song, and R. Gray," A Stochastic Frontier Model of the Efficiency of Major Container Terminals in Asia: Assessing the Influence of Administrative and Ownership Structures," *Transportation Research PART A*, Vol36, 2002, pp.743-762.
8. Dowd, T. J., "Container Terminal Leasing and Pricing," *Maritime Policy and Management*, Vol. 11, No. 4, 1984, p.280.
9. Dowd, T. J. and T. M. Leschine, "Container Terminal Porductivity: A Perspective," *Maritime Policy and Management*, Vol. 17, No. 2, 1990, pp.108-109.
10. Farrel, M. J., "The Measurement of Productive Efficiency," *Journal of the Royal Statistical Society, Series A*, Part 3, 1957.
11. Fleming, D. K., "World Container Port Rankings," *Maritime Policy and Management*, Vol. 24, No. 2, 1997, pp.175-181.
12. Frankel, E. G., "Port Performance and Productivity Measurement," *Ports and Harbors*, Vol. 36, No. 7, September 1991, pp.11-13.
13. Ha, Dong-Woo, *An Analysis of Competition Surroundings among the Main Container Ports of East-North Area*, Marine Industry Research Institute, December, 1996.
14. Haezendonck, E., *Essays on Strategy Analysis for Seaports*, Garant, 2001.
15. Han, Chul-Hwan, "Competitive Strategies among the Northeast Asian Ports," *Shipping Studies -Theory and Practice-*, Vol. 4, *Korean Association of Shipping Studies*, Autumn 2002a, pp.33-67.
16. Han, Chul-Hwan, "Strategic Positioning Analysis on the Asian Container Ports," *The Journal of The Korean Association of Shipping Studies*, Vol. 34, Korean Association of Shipping Studies, April 2002b, pp.99-115.
17. Han, Chul-Hwan, "An Empirical Study on the Determinants fo Port Performance and Effciency," *Proceedings of the 2nd International Gwangyang Port Forum and Int'l Conference for the 20th Anniversary of Korean Association of Shipping Studies*, Korean Association of Shipping Studies, April 24-26, 2002c, pp.247-259.
18. Humphrey, D. B., "Cost and Technical Change: Effects from Bank Deregulation," *Journal of*

Productivity Analysis, Vol. 4, 1993, pp.9-34.
19. Jansson, J. O. and D. Shneerson, Port Economics, MIT Press, 1982., Schonfeld, P. and S. Frank, "Optimizing the Use of a Containership Berth," *Tansportation Research Record,* No. 984, 1986, pp.56-62.
20. Jun, Il-Soo, Kim, Hak-So, and Kim, Bum-Jung, An Enhancement Plan for International Competition Power of Korea's Container Ports, Marine Industry Research Institute, December 1993, pp.219-258.
21. Lee, Sung-Woong, "Competition among Hub Ports and the Strategy for Co-opetition of Gwangyang Port," *Proceedings of the 4nd International Gwangyang Port Forum,* Korean Association of Shipping Studies, April 19-21, 2006, pp.34-79.
22. Mairesse, J. and E. Kremp, "A Look at Productivity at the Firm Level in Eight French Industries," Journal of Productivity Analysis, Vol. 4, 1957, pp.211-234.
23. Monie, G. De, "Measuring and Evaluating Port Performance and Productivity," UNCTAD MONOGRAPHS on PORT MANAGEMENT, No.6, International Association of Ports and Harbors, September 1987, pp.2-11.
24. Oh, Sung-Dong and Park, Ro-Kyung, "A Method of Measuring the International Competitiveness of Container Ports: A DEA Approach, Focused on Productivity Analysis," *Journal of Korea Port Economic Association,* Vol.17, No.1, May 2001, pp.27-51.
25. Petersen, N. C., "DEA on a Relaxed Set of Assumptions," *Management Science,* Vol. 36, No. 3, pp.305-314.
26. Roll, Y. and Y. Hayuth, "Port Performance Comparision Applying Data Envelopment Analysis(DEA)," *Maritime Policy and Management,* Vol. 20, No. 2, 1993, pp.153-161.
27. Roll, Y. and A. Sachish, "Productivity Measurement at the Plant Level," *Omega,* Vol. 9, No. 1, 1981, pp.37-42.
28. Sachish, A., "Productivity Functions as A Managerial Tool in Israel Ports," *Maritime Policy and Management,* Vol. 23, No. 4, 1996, pp.341-369.
29. Seiford, L. and R. M. Throll, "Recent Development in DEA," *Journal of Econometrics,* Vol. 46, 1990, pp.7-38.
30. Siegal, I. H., *Company Productivity: Measurement for Improvement,* W. E. Upjohn Institute for Employment, 1980.
31. Suykens, F., "Some Remarks Productivity in Seaports," *Ports and Harbors,* Vol. 32, No. 12, Dec. 1987, pp.14-23.
32. Talley, Wayne K., "Optimum Throughput and Performance Evaluation of Marine Terminals," *Maritime Policy and Management,* Vol. 15, No. 4, pp.327-331
33. Talley, W. K., "A Comparison of Two Methodologies for Selecting Transit Performance Indicators," *Transportation,* Vol. 13, 1986, pp.201-210.
34. Teurelincx, D., "Functional Analysis of Port Performance as a Strategic Tool for Strengthening a Port's Competitive and Economic Potential," *International Journal of Maritime Economics,* Vol. II, No.2, 2000.
35. The Federation of Korea Industries, *The Enhancement Assignment for Competition Power of Ports, Industry Policy* 97-3, September 20, 1997.
36. Tongzon, J., "Efficiency Measurement of Selected Australian and Other International Ports Using Data Envelopment Analysis," *Transportation Research, Part A,* Vol. 35, 2001, pp.113-128.
37. Tulkens, H.," On FDH Efficiency Analysis: Some Methodological Issues and Applications

to Retail Banking, Courts, adn Urban Transit," *The Journal of Productivity Analysis*, Vol. 4, 1993, pp.183-210.

38. Valantine, V.C. and R. Gray, " Competition of Hub Ports: A Comparison between Europe and the Far East," *Proceedings of the 2nd International Gwangyang Port Forum and Int'l Conference for the 20th Anniversary of Korean Association of Shipping Studies*, Korean Association of Shipping Studies, April 24-26, 2002, pp.161-176.
39. Walter, A., "Marginal Cost Pricing in Ports," *The Logistics and Transportation Review*, Vol. 11, 1975, pp. 297-308.

http://www.valuebasedmanagement.net/methods_bcgmatrix.html
http://www.momaf.go.kr