A Survey of the Efficiency of Pharmacological Companies using DEA Model

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ABSTRACT

The present study evaluates the efficiency of pharmacological companies listed on Tehran Stock Exchange (TSE) using data envelopment analysis model. The study population is 23 companies based on the data of TSE. In this study, by providing the most important indices, inputs and outputs of data envelopment model are defined. In this study, the debt, operating cost, asset are selected as three data and sale price, net profit are selected as two outputs. The study population is companies listed on TSE during 2007-2014 presenting their financial statements to TSE as 20 companies. Based on the existing data, the results of efficiency of each of companies are achieved using data envelopment analysis software. Finally, the most efficient ones are selected as the model. During comparison, the inefficient companies can approach themselves to the efficient companies to achieve the required efficiency level.

Keywords: Data envelopment analysis, Tehran Stock Exchange, Efficiency, Index.

1. INTRODUCTION

Before the First World War, due to the lack of development of financial markets and lack of separation of management from ownership, the management mostly focused on operating efficiency and assessment of performance and physical asset of companies. After the First World War and continuous development, management was separated from ownership and this created various issues as agency theory, data hypothesis, efficient market, etc. An important point in economy is not what is occurred or predicted or expected to be occurred. The data hypothesis and efficient market are the issues to determine the structure or mechanism to adapt the expectation and reality in economy namely in asset markets and ranking is the attempt to achieve this purpose.

Any system or organization has defined goals and the system management by facilities and resources can achieve the goals. The evaluation of achieving the goals and using resources plays an important role. Indeed, performance assessment is the main issue of activities and management steps as to direct the required set, the management should be aware of the performance of the required set to take strategy based on this information. Today, performance improvement has received much attention in organizations but without an efficient and effective evaluation system, any step to improve the performance is useless. Based on the role and importance of performance evaluation system and lack of such system in the companies listed on TSE, using an efficient and effective method (math) is useful. For more than a century, most of the professors of Universities in financial and economic fields focused on the efficiency of asset market in different countries. In case of an efficient asset market, the securities price is determined fairly and the asset allocation as the most important factor of economic development is performed as optimal (Jahankhani, 1993, 7). The present study helps the asset market for efficiency. The model design and using it in the stock market enables us that the real and legal investors can distinguish the efficient companies as efficient compared to other companies. Thus, they can perform a reasonable investment and the efficient companies can easily have access to their required financial resources. This means the movement of asset market to efficiency and this role is played by ranking institutes in developed countries. These institutes are not found in Iran and our financial market and it is hoped to eliminate this problem in Iran asset market.

2. REVIEW OF LITERATURE

In recent decades, ranking has received much attention. This ranking is used as an index to measure efficiency. Agheghbal Ali and Robert Taxin in a study "Ranking the operation of factories in US applied the DEA method to rank the economic operation. DEA is used in different industries including energy. Zhou et. al., in a study considered suitable and unsuitable outputs as the output of DEA and evaluated the energy efficiency (Zhou et. al., 2008). Lee evaluated total energy efficiency using DEA and applied energy as output and consumed energy as input (Lee, 2008). In insurance industry, this model is used. Kao, C. & Hwang (2008) applied DEA to evaluate the managerial performance in 24 non-life insurance companies of Taiwan. Ali Fazel Yazdi and Dr. Mahmoud Moinoldin in a study evaluated and efficiency of Iran insurance companies by DEA method (2015). Seyed Habibollah Mirghafuri and Meysam Shafie in a study compared and ranked telecommunication companies using DEA method. Sabura Ketal (2009) in a study "determination of the efficiency of companies listed on TSE including 17 pharmacological companies during 2003-2008 was investigated.

3. STUDY METHODOLOGY

This study is applied in terms of purpose. In terms of inference method, it is descriptive. In terms of study design and analysis is ex post facto. The required data of this study is via the evaluation of audited financial data and it is collected via parallel data channels as using the data of the companies and referring to the financial documents. In the present study, input-based data envelopment analysis model as expenses debt, asset, outputs of sale model and net profit are used. The study population is companies listed on TSE during 2008-2015 presenting their financial statements in TSE as 20 companies. Alborzdaru, Iran Daru, Parsdaru, Tehran Daru, Tehran Shimi, Daru Aboreihan, Daru Osveh, Daru

Amin, Daru Eksir, Daru Hakim, Daru Damlaran, Daru Razak, Daru Zahravi, Daru Abidi, Daru Farabi, Daru Loghman, Daru Kosar, Daru Jaberebn Hayan, injection product, Kimidaru. It is worth to mention that the companies not presenting their financial reports during the studied period to the TSE are not investigated.

4. STUDY QUESTIONS

As the study method is descriptive inference. The study and sample are consistent and the goal is not generalizing the results to beyond the study place and time. This study attempts to answer the following questions and the hypothesis and its statistical test can not be considered but the questions are expressed in the form of descriptive hypothesis.

How is the efficiency of each of units in case of using DEA?

What is the rank of each of companies to each other?

Which factors are effective on efficiency?

What are the preferred groups in efficiency evaluation?

5. STUDY RESULTS

The Description of the Results of Inputs and Outputs

The distribution of inputs and outputs: The collected inputs and outputs are based on three inputs and 2 outputs and their statistical distribution is shown in Table 30.1.

Table 30.1
Distribution of inputs and outputs

	Very high	*High*	*Average*	*Low*	*Very low*	*Sum*
Asset	70	35	23	10	2	140
Debt	35	65	27	11	2	140
Operating expenses	105	22	10	2	1	140
Net profit	30	35	68	5	2	140
Sale	25	37	60	13	5	140

As shown in Table 30.1, based on frequency distribution Table, each of the inputs and outputs is described in a qualitative 5-item scale of very high to very low. The values inside each block show the number of units by which each of inputs and outputs have special qualitative condition of five conditions.

Describe the Statistical Parameters of Inputs and Outputs

By the calculation of statistical parameters of Table 30.2, the descriptive results regarding inputs and outputs of pharmacological companies are shown.

Based on Table 30.2, by statistical main parameters, we can describe inputs and outputs of 20 pharmacological companies as:

Table 30.2
The description of inputs and outputs

		Sum	*Mean*	*Max*	*Min*
Inputs	Debt	43.274.624	137.687	927.625	14.617
		21.435.23			
	Operating expenses	12.248.840	352.561	871.290	16.430
	Asset	12.248.840	543.65.52	210.560	01.500
Outputs	Net profit	8.432.203	87.452	830.640	17.365
	Sale	62.345.260	392.253	18.265.360	69.540

- The sum of debt as totally (X1 or first input): 137.687 million Rls debt, 14.617 million Rls the least debt 927.625 million Rls, the highest debt in the studied companies (pharmacological companies).
- Operating expenses (X2 or second input) averagely 352.561 million Rls, the highest 871.290 million Rls and the lowest as 16.430 million Rls.
- Asset (X3 or third input) averagely 52.543.56 million Rls, the highest asset 210.560 million Rls and the minimum is 15000 million Rls.
- The net profit price (Y1 or the first output) is totally 8.432.203 million Rls averagely 87.452 million Rls, the highest net profit 830.640 million Rls and the lowest price is 17365 million Rls.
- Sale (Y2 or the second output) totally 62.345.260 million Rls, averagely 392.253 million Rls, the highest 18.265.360 million Rls and the lowest 32.540 million Rls.

The Description of the Efficiency Results

In this section, the efficiency value using DEA model with all inputs and outputs is shown in Tables 5.3, 5.4. The results of efficiency of pharmacological companies listed on TSE show that in the existing condition and with the combination of collected inputs and outputs, the efficiency of each company is how much as a relative quantitative criterion in zero to one.

Table 30.3
The calculated efficiency in different years as each year separately for the companies listed on TSE

DMUs	*Nemad*	*Eff-93*	*Eff-87*	*Eff-88*	*Eff-89*	*Eff-90*	*Eff-91*	*Eff-92*	*Eff-93*
DMU1	Deshtehran	0.7918	0.8110	0.6324	1.0000	1.0000	0.9483	1.0000	1.0000
DMU2	Dalbar	0.8093	0.9617	1.0000	0.9271	0.9498	1.0000	1.0000	1.0000
DMU3	Depars	0.4537	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
DMU4	Detehran	1.0000	8723..	1.0000	1.0000	0.6543	1.0000	1.0000	1.0000
DMU5	Dasveh	0.6632	0.7326	0.7639	0.8911	1.0000	0.8900	0.8023	1.0000
DMU6	Damin	1.0000	0.9294	0.8922	1.0000	1.0000	0.8398	0.8932	0.9240
DMU7	Deler	0.9037	0.8844	0.9968	1.0000	0.5427	1.0000	1.0000	1.0000
DMU8	Derazak	0.7938	0.8329	1.0000	0.9948	0.9056	0.9321	0.7637	0.7796
DMU9	Dedam	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

DMUs	*Nemad*	*Eff-93*	*Eff-87*	*Eff-88*	*Eff-89*	*Eff-90*	*Eff-91*	*Eff-92*	*Eff-93*
DMU10	Dezahravi	8793..	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
DMU11	Defza	0.7038	0.7641	1.0000	1.0000	0.9928	1.0000	0.9040	0.8819
DMU12	Defar	0.7546	0.9335	1.0000	1.0000	0.9609	0.9446	0.9472	0.9092
DMU13	Deloghma	0.8409	0.8893	1.0000	0.9984	0.9933	0.9183	1.0000	1.0000
DMU14	Dekosar	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
DMU15	Dejar	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
DMU16	Dekhazar	0.8287	0.9355	0.9180	1.0000	0.8382	0.9447	0.8458	0.6925
DMU17	Defra	0.7763	1.0000	0.9088	0.8234	.8460	0.7954	0.8354	0.8021
DMU18	Dekimi	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
DMU19	Deskhuz	0.9354	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
DMU20	Sarem	0.7974	0.8924	0.8988	0.9347	0.9652	1.0000	1.0000	1.0000
Average efficiency		0.8764	0.9248	0.9608	0.9655	0.7926	0.9572	0.9492	0.9429
Number of efficient units		9256	96666666668	13	14	10	12	13	14

Any company in different years dedicating one is efficient and in other years is called non-efficient.

Table 30.4
The calculated efficiency in different years as whole for the companies listed on TSE

DMUs	*Nemad*	*Eff-86*	*Eff-87*	*Eff-88*	*Eff-89*	*Eff-90*	*Eff-91*	*Eff-92*	*Eff-93*
DMU1	Deshtehran	0.7836	0.7103	0.6324	0.7346	0.7299	0.7299	0.93319	1.0000
DMU2	Dalbar	0.8093	0.8308	0.7732	0.6640	0.6928	0.6928	0.94739	0.9207
DMU3	Depars	0.4537	1.0000	1.0000	0.5875	0.6676	1.0000	1.00000	1.0000
DMU4	Detehran	1.0000	8723..	1.0000	1.0000	0.7992	1.0000	0.93011	0.9301
DMU5	Dasveh	0.6300	0.6274	0.6448	0.6502	0.6502	0.6646	0.66460	1.0000
DMU6	Damin	1.0000	0.8820	0.7275	0.6994	0.6531	0.6238	0.81132	0.8113
DMU7	Deler	0.9022	0.7862	0.7762	0.7129	0.6163	0.7664	1.00000	1.0000
DMU8	Derazak	0.7938	0.8033	0.7130	0.7472	0.6298	0.6173	0.67039	0.6468
DMU9	Dedam	0.8787	0.8996	0.8672	1.0000	0.8662	0.9236	0.98297	1.0000
DMU10	Dezahravi	8793..	1.0000	0.6628	0.7331	0.7496	0.7496	0.74958	0.7496
DMU11	Defza	0.6954	0.6652	0.7229	0000..1	0.7272	0.8051	0.80508	0.8051
DMU12	Defar	0.7074	0.7648	0.7758	0.8463	0.7149	0.7045	0.73275	0.8047
DMU13	Deloghma	0.8409	0.8026	0.7642	0.7052	0.6292	0.7048	1.00000	1.0000
DMU14	Dekosar	1.0000	1.0000	0.9690	0.9193	0.8384	1.0000	0.95368	1.0000
DMU15	Dejar	1.0000	0.9222	4362..	0.9394	1.0000	0.9340	0.86401	1.0000
DMU16	Dekhazar	0.7792	0.7252	0.7081	0.6674	0.53624	0.7189	0.71676	0.6732
DMU17	Defra	0.6961	0.7057	1.0000	0.7077	0.6649	0.6324	0.78782	0.8021
DMU18	Dekimi	0.9292	0.8224	0.8154	0.9279	1.0000	0.9583	1.00000	1.0000
DMU19	Deskhuz	0.8345	1.0000	1.0000	0.7134	6343..	0.5698	0.82395	0.8240
DMU20	Sarem	0.7728	0.7464	0000..1	0.6799	0.7532	0.6729	1.0000	0.9453
Average efficiency		0.9227	0.8322	0.7834	0.7568	0.7114	0.7696	0.8635	1.0000
Number of efficient units		4	4	5	3	2	33	5	10

The companies with value one are efficient and other companies are non-efficient.

The study findings in Table 30.5 are shown with the efficiency results using the statistical parameters.

Table 30.5
The description of statistical parameters of efficiency of companies listed on TSE

Parameter	*Mean*	*Max*	*Min*	*Variance*	*SD*	*Number of efficient units*	*Total units*
Efficiency	6045.	1	4362..	0.0234	1324.	36	140

Table 30.5 shows that among 140 companies, 36 companies have dedicated one and are efficient and the remaining 104 companies with the size lower than 1 is inefficient. The highest efficiency size is regarding efficient companies, those companies with value 1. Like DMU1 IN 2014. The lowest size of efficiency is 0.4362 regarding 15 DMU in 2009. Averagely, the efficiency of DMUs is 0.6045 with standard deviation 0.1324.

Ranking the Pharmacological Companies Listed on TSE

As in DEA model, the maximum efficiency is 1, we can not distinguish between 36 efficient companies. If the evaluated company in efficiency size, bigger value of an input is given, we can achieve the value by which the values of companies are ranked. The inefficient units (104 companies) are not changed compared the previous condition in terms of efficiency.

Table 30.6 shows the ranking of units based on their ranking efficiency. Based on this data, the best DMU in terms of efficiency DMU15 of 2007 and lowest efficiency is dedicated to DMU13 of 2005. The results are sorted based on ranking from the best to the lowest rank. The highest performance of DMU in terms of efficiency rank to DMU15 in 2007 with rank size 1.543 and its lowest value is dedicated to DMU15 of year 2009 with efficiency 0.4362.

Table 30.6
The calculation of the rank efficiency and ranking the pharmacological companies

Rank	*DMU*	*Rank efficiency*	*Rank*	*DMU*	*Rank efficiency*	*Rank*	*DMU*	*Rank efficiency*	*Rank*	*DMU*	*Rank efficiency*
1	DMU15-86	1.54335	36	DMU20-86	0.94526	71	DMU11-84	0.80508	106	DMU1-84	0.72988
2	DMU9-86	1.3718	37	DMU1-92	0.93319	72	DMU11-92	0.80508	107	DMU6-88	0.72745
3	DMU18-86	1.2292	38	DMU4-92	0.93011	73	DMU11-86	0.80508	108	DMU11-90	0.72718
4	DMU15-92	1.1842	39	DMU4-86	0.93011	74	DMU12-86	0.80470	109	DMU16-87	0.72525
5	DMU6-88	1.14248	40	DMU18-86	0.92918	75	DMU8-87	0.80329	110	DMU11-88	0.72294
6	DMU13-86	1.1415300	41	DMU9-91	0.92360	76	DMU13-87	0.80262	111	DMU1-88	0.72098
7	DMU13-92	1.34353	42	DMU2-86	0.92074	77	DMU17-86	0.80205	112	DMU16-91	0.71888
8	DMU3-86	1.31493	43	DMU14-82	0.91931	78	DMU4-90	0.79924	113	DMU19-88	0.71749
9	DMU14-9	1.25489	44	DMU7-9	0.90217	79	DMU8-86	0.79378	114	DMU16-92	0.71676
10	DUM-91	1.23792	45	DMU9-87	0.89964	80	DMU17-92	0.78782	115	DMU12-90	0.71487
11	DMU7-86	1.14500	46	DMU20-92	0.89605	81	DMU7-87	0.78621	116	DMU19-82	0.71337
12	DMU3-87	1.13870	47	DMU9-82	0.88911	82	DMU1-86	0.79057	117	DMU7-82	0.71289
13	DMU3-86	1.12982	48	DMU6-87	0.88199	90	DMU15-90	0.78313	118	DMU8-88	0.71032

Rank	*DMU*	*Rank efficiency*	*Rank*	*DMU*	*Rank efficiency*	*Rank*	*DMU*	*Rank efficiency*	*Rank*	*DMU*	*Rank efficiency*
14	DMU3-88	1.12059	49	DMU9-9	0.87872	84	DMU11-82	0.78173	119	DMU1-87	0.71031
15	DMU14-91	1.11194	50	DMU15-88	0.86777	92	DMU16-86	0.77921	120	DMU16-88	0.70811
16	DMU1-86	1.10915	51	DMU9-88	0.86721	86	DMU7-88	0.77621	121	DMU17-82	0.70766
17	DMU4-91	1.09698	52	DMU9-90	0.86621	87	DMU12-88	0.77577	122	DMU12-86	0.70741
18	DMU4-82	1.09639	53	DMU15-91	0.86401	88	DMU2-88	0.77325	123	DMU17-87	0.70567
19	DMU19-87	1.09444	54	DMU15-92	0.86401	89	DMU20-86	0.77283	124	DMU13-82	0.70524
20	DMU7-92	1.05025	55	DMU18-82	0.92862	90	DMU7-91	0.76643	125	DMU13-91	0.70486
21	DMU14-87	1.03718	56	DMU15-87	0.92216	91	DMU12-87	0.76487	126	DMU12-91	0.70454
22	DMU4-87	1.02292	57	DMU12-82	0.91627	92	DMU13-88	0.76425	127	DMU6-82	0.69939
23	DMU18-92	1.01912	58	DMU18-87	0.84240	93	DMU20-90	0.75318	128	DMU17-86	0.69844
24	DMU5-86	1.01735	59	DMU13-86	0.84087	94	DMU10-86	0.74958	129	DMU17-86	0.69614
25	DMU14-86	1.00091	60	DMU15-82	0.83940	95	DMU10-90	0.74958	130	DMU11-86	0.69545
26	DMU10-86	1.00000	61	DMU14-90	0.83841	96	DMU10-91	0.74958	131	DMU2-90	0.69283
27	DMU10-90	1.00000	62	DMU19-86	0.83450	97	DMU10-92	0.74958	132	DMU2-91	0.69283
28	DMU3-91	1.00000	63	DMU2-87	0.83078	98	DMU8-82	0.74716	133	DMU12-91	0.60324
29	DMU3-92	1.00000	64	DMU19-92	0.82395	99	DMU8-86	0.74675	134	DMU6-82	0.64939
30	DMU4-87	1.00000	65	DMU19-86	0.82395	100	DMU20-87	0.74639	135	DMU17-86	0.69844
31	DMU9-92	0.98297	66	DMU18-90	0.82107	101	DMU20-88	0.74639	136	DMU17-86	0.69614
32	DMU14-90	0.96898	67	DMU18-88	0.81539	102	DMU1-82	0.73455	137	DMU11-86	0.63445
33	DMU18-91	0.95905	68	DMU6-86	0.81132	103	2DMU10-8	0.74311	138	DMU2-90	0.623583
34	DMU14-92	0.95368	69	DMU6-92	0.81132	104	DMU12-92	0.73275	139	DMU2-91	0.63483
35	DMU2-92	0.94739	70	DMU2-86	0.80933	105	DMU1-90	0.72988	140	DMU19-90	0.61614

Determine the Effective Factors on Efficiency

In the previous section, the final results of efficiency of units by DEA are explained. This section determines the effective factors on efficiency size and its effect degree. This section explains the preferred groups in efficiency evaluation, the effect of each of inputs and outputs, good values of inputs and outputs for the companies as for inefficiency, they have values under 1 and based on the values of resources (inputs), the outputs (results) and shortage can be considered.

The Analysis of Preference Groups

The preferred groups are DMUs as compared in a relative measurement of a DMU. If the DMU is efficient with value 1, it is the preferred efficiency evaluation but regarding non-efficient units with values lower than 1, the performance of one or some DMUs, other efficient DMUs can be used as evaluation and these DMUs are considered as reference groups.

As shown in Table 30.7, each of 30 efficient DMUs are selected as preferred. It is worth to mention that in DEA model, Landa size regarding non-zero and landa size of other DMUs not preferred are zero.

Table 30.7
The dispersion distribution of preferred groups

Number of preferred	*DMU Name*	*Number of preferred*	*DMU Name*
33	DMU14-92	58	DMU3-87
33	DMU18-93	55	DMU12-88
32	DMU3-90	53	DMU5-90
30	DMU1-89	53	DMU14-89
17	DMU9-88	52	DMU17-91
15	DMU61-86	50	DMU11-89
11	DMU11-93	44	DMU4-92
10	DMU11-92	41	DMU7-88
2	DMU17-91	40	DMU4-90
0	DMU19-90	38	DMU19-93
0	DMU8-91	36	DMU9-92

The Analysis of the Effect of Inputs and Outputs

In efficiency evaluation using DEA model, the role of inputs and outputs can be evaluated by different forms. Table 30.8 shows the summary of the results of degree of importance of each of inputs and outputs.

Table 30.8
The summary of the results and importance coefficient of inputs and outputs

DMU	*U1*	*U2*	*V1*	*V2*	*V3*
DMU 1	0.0013	0.0031	0.0017	00	0.0029
DMU 2	0.0027	0.0073	0.0082	0.0004	0.0083
DMU 3	0.0015	0.0028	0.0025	00	0.0036
DMU 4	0.0012	0.0076	0.0478	00	0.0072
DMU 5	00	0.0015	0.04	0.0048	0.0025
DMU 6	0.0016	0.0043	0.0036	0	0.0073
DMU 7	0.0052	0.0048	00	0.0003	0.0047
DMU 8	0.0032	0.0041	0.0023	0	0.0068
DMU 9	0.0011	0.0007	0.0055	000	0.009
DMU 10	0	0.004	0.1088	0.013	0.0058
DMU 11	0	0.0069	0.0093	00	0.0051
DMU 12	00	0.0019	0.015	0.0084	0
DMU 13	0.001	0.0013	0.0021	0.001	0.0034
DMU 14	0.0031	0.0042	0.0026	00	0.0042
DMU 15	0.0005	0.0011	0.0012	00	0.0011
DMU 16	0.0013	0.0028	0.0025	00	0.0027
DMU 17	0.001	0.0022	0.0012	00	0.002
DMU 18	0.0008	0.0009	00	00	0.0021
DMU 19	0.003	0.0118	0.0013	00	0.008
DMU 20	0.0075	00	00	0.0067	0.0018

In this model, the real inputs and outputs are used and the efficiency of each unit in the fractional model (non-linear) is achieved based on the sum of value of outputs of each unit to the sum of values of data of the same unit in comparison to other units. The study results in DEA model and value coefficients are determined by the model as at first the highest efficiency is attributed to evaluation unit based on the real performance regarding the inputs and outputs and second, the size in case of attributing these value coefficients to unit (company) can not exceed value 1. The value coefficients of data are expressed by V1 to V3 and value coefficients of importance of outputs are defined by U1, U2. If U2 or V2 is zero, in evaluation of efficiency of a company the output or input has not role.

The effect of eliminating each of inputs and outputs on the size of efficiency, if in limited evaluation in each stage, we eliminate only one input or output, its effect on efficiency of evaluated DMU can be defined.

Second state: The efficiency is reduced and in this case, the eliminated factor in evaluation has positive effect on efficiency of DMU. For example, DMU14 2008 as considered efficient in total evaluation by eliminating each of second and third inputs or first and second outputs can be considered inefficient and its efficiency size of value 1 in total evaluation is reduced to 0.76231, 0.95973, 0.92216 and 0.849450.

Third state: The efficiency value is increased and in this case, the eliminated factor has negative effect on efficiency size of DMUs. The results show that this case is not occurred for any DMU and efficiency value in case of elimination of each of inputs or outputs is lower or equal in comparison with the total evaluation. It is because in value coefficient to achieve the highest value of efficiency for DMU can be evaluated and by adding a factor, efficiency is increased but it is not reduced by eliminating it. Table 30.9 shows the comparison of the evaluation results as totally and individual elimination of each of inputs and outputs.

Table 30.9
The summary of the efficiency assessment with elimination of each of inputs and outputs

Variable		*Efficiency mean*	*Number of efficient units*
Total efficiency	Variables	0.77324	31
Eliminate input 1	Debt	0.44271	19
Eliminate input 2	Operating cost	0.77382	25
Eliminate input 3	Asset	0.65439	17
Eliminate input 1	Net profit	0.20324	24
Eliminate input 2	Sale	0.50823	18

Excess Resources and Shortage of Output

In DEA model, the unit efficiency size is based on the value of using resources (inputs) or results production (outputs). Efficient unit is the one by which we can not produce the outputs with a few inputs or with the same inputs we can not produce more outputs. Thus, S is zero. For inefficient units, S size of inputs of excess resources and S of outputs shows the shortage of results or outputs to the ideal situation.

Table 30.10
The deficiency and excess variables

DMUs	*Nemad*	*Total efficiency*	*Excess variables*			*Excess variables*	
			S1	*S2*	*S3*	*S4*	*S5*
DMU1-93	Depars	1.00000	0.00000	0.00000	0.00000	0.00000	0.00000
DMU2-93	Vesaya	0.2074	0.00000	0.00000	0.00000	11843.60012	0.00000
DMU3-93	Delbera	1.00000	0.00000	0.00000	0.00000	0.00000	0.00000
DMU4-93	dtehran	0.93011	36415.36502	0.00000	0.00000	7780.93112	0.00000
DMU5-93	Debalk	1.00000	0.00000	0.00000	0.00000	0.00000	0.00000
DMU6-93	Dabur	0.81132	0.00000	0.00000	0.00000	34621.74514	0.00000
DMU7-93	Shtehran	1.00000	0.00000	0.00000	0.00000	0.00000	0.00000
DMU8-93	Dasveh	0.74675	100000	0.00000	0.00000	49693.97426	0.00000
DMU9-93	Dabur	1.00000	0.00000	0.00000	0.00000	0.00000	0.00000
DMU10-93	Dekimi	0.74958	10109.35052	0.00000	0.00000	12825.06659	0.00000
DMU11-93	Deler	0.80508	0.00000	0.00000	0.00000	27992.46472	0.00000
DMU12-93	Derazak	0.80470	46661.25367	0.00000	0.00000	6724.08128	0.00000
DMU13-93	Dezahravi	1.00000	0.00000	0.00000	0.00000	0.00000	0.00000
DMU14-93	Debid	1.00000	0.00000	0.00000	0.00000	0.00000	0.00000
DMU15-93	Dedam	1.00000	0.00000	0.00000	0.00000	0.00000	0.00000
DMU16-93	Deloghman	0.67323	0.00000	0.00000	0.00000	69846.69416	0.00000
DMU17-93	Dekosar	0.80205	0.00000	0.00000	6979.94919	30166.24424	0.00000
DMU18-93	Deloghma	1.00000	0.00000	0.00000	0.00000	0.00000	0.00000
DMU19-93	Defra	0.82395	0.00000	0.00000	0.00000	18984.02840	0.00000
DMU20-93	Dekimya	0.94526	0.00000	230.88313	202.14844	0.00000	0.00000

The Expected Inputs and Outputs

If we add the corresponding S with outputs to the real outputs and deduct the corresponding values of inputs from the white real inputs, the good inputs and outputs or expected ones can be achieved in total evaluation. For good or expected inputs and outputs, all 140 DMUs can be efficient and they have one. Regarding efficient units (36 companies), the good inputs and outputs are not different from the real inputs and outputs. Table 30.11 shows the expected inputs and outputs.

Table 30.11
The expected inputs and outputs

DMUs	*Nemad*	*Efficiency*	*Debt*	*Operating cost*	*Asset*	*Net profit*	*Sale*
DMU1-86	Deshtehran	0.89605	388454.00000	779509.00000	79000.00000	4229.00000	365548.00000
DMU2-86	Dalbar	1.00000	83358.96583	79395.64353	9507.40394	68875.60035	195563.00000
DMU3-86	Depars	0.71229	593388.00000	18338762.00000	19110.00000	136600.00000	39930.00000
DMU4-86	Detehran	1.00000	7522765.3456	94089.49676	34595.3432	165465.98765	19758.00000
DMU5-86	Dasveh	0.94133	635609.00000	596587.00000	145600.00000	8565.00000	64585.00000
DMU6-86	Damin	1.00000	42356.00645	188985.06099	54669.58036	67530.74534	500039.00000
DMU7-86	Deler	0.86432	174356.00000	488467.00000	8770.00000	923455.00000	533073.00000
DMU8-86	Derazak	1.00000	18898.60958	765459.84579	18877.55698	72334.97456	500660.00000
DMU9-86	Dedam	0.700475	856466.99998	753450.00000	75000.00000	198793.00000	199844.00000

DMUs	*Nemad*	*Efficiency*	*Debt*	*Operating cost*	*Asset*	*Net profit*	*Sale*
DMU10-86	Dezahravi	1.00000	85056.96974	78248.69356	7627.48799	4555.0320	1997516.00000
DMU11-86	Defza	0.75458	199846.48407	96885.45933	194549.87466	65489.46475	88758.00000
DMU12-86	Defar	0.82908	566505.93666	12365.67855	18772.7763	168446.08358	12378.00000
DMU13-86	Deloghma	0.886570	16650.00000	756643.00000	7700.00000	255795.00000	85646.00000
DMU14-86	Dekosar	1.00000	224437.00000	145566.00000	96430.00000	68475.00000	568999.00000
DMU15-86	Dejar	1.00000	650556.00000	486896.00000	187400.00000	569599.00000	757535.00000
DMU16-86	Dekhazar	0.986582	1774456.95475	18828.2205	6995.56650	188494.6226	556860.00000
DMU17-86	Defra	0.61123	566730.53765	550355.07568	65504.67553	185863.54454	143314.00000
DMU18-86	Dekimi	0.86655	476389.00000	675559.00000	17600.00000	566533.00000	949304.00000
DMU19-86	Deskhuz	1.00000	74704.68083	53636.53966	53760.55740	53715.05840	155353.00000
DMU20-86	Sarem	0.86655	16753.39098	165438.4343	99746.37760	854650.00000	545336.00000

6. QUARTER ANALYSIS

In this analysis, the relationship between efficiency size in total evaluation with the values of each of inputs and outputs can be evaluated and the performance is analyzed as analyzed in each stage. It is worth to mention that this analysis is performed in fiscal year 2014 and it is also performed for other years.

1. The horizontal axis is dedicated to one of the inputs and outputs and vertical axle is dedicated to efficiency.
2. The relationship between unit performance about input or output and efficiency evaluation as the coordinate of a point is shown on the chart. To determine the investigated company, the point is shown with code label of the company.
3. The space between two axes is divided into four regions (quarters). The division of horizontal axle of the median is the size of input or output and the criterion of dividing vertical axle is the median of efficiency size.
4. Based on putting the point in each of four sections to the analysis performance, we can define the recommendations of performance improvement. For example, based on the quarter analysis of the first output (net profit) and efficiency size, the units can be divided into four.

First set: High efficiency and high net profit are the companies in which the performance result about higher net profit is higher than median (acceptable) and their efficiency size is high and higher than efficiency median. Their performance based on the results or outputs is good and for efficiency size or evaluation result is good. The companies can develop the performance.

Second set: High efficiency and low net profit of these companies about the output of net profit is not at good condition (less than medium) but the size of efficiency or their performance evaluation is good. This is because based on other output or using resources or inputs in comparison to other companies can have good condition. These companies can improve the results in terms of increasing output as the net profit and the attempt to produce more results.

Third set: The low efficiency and high net profit: These companies in terms of performance about the output, net profit is at good condition but efficiency size or their performance evaluation result is low. This is because of inadequate output or good value of using inputs or resources. These companies should have better performance about other inputs and outputs.

Fourth set: Low efficiency and low net profit of these companies can be evaluated in terms of outputs (net profit price) and it can also have low efficiency. It is recommended that these companies increase their performance about this output. In charts 1-5, the quarter analysis for each of inputs and outputs can be shown.

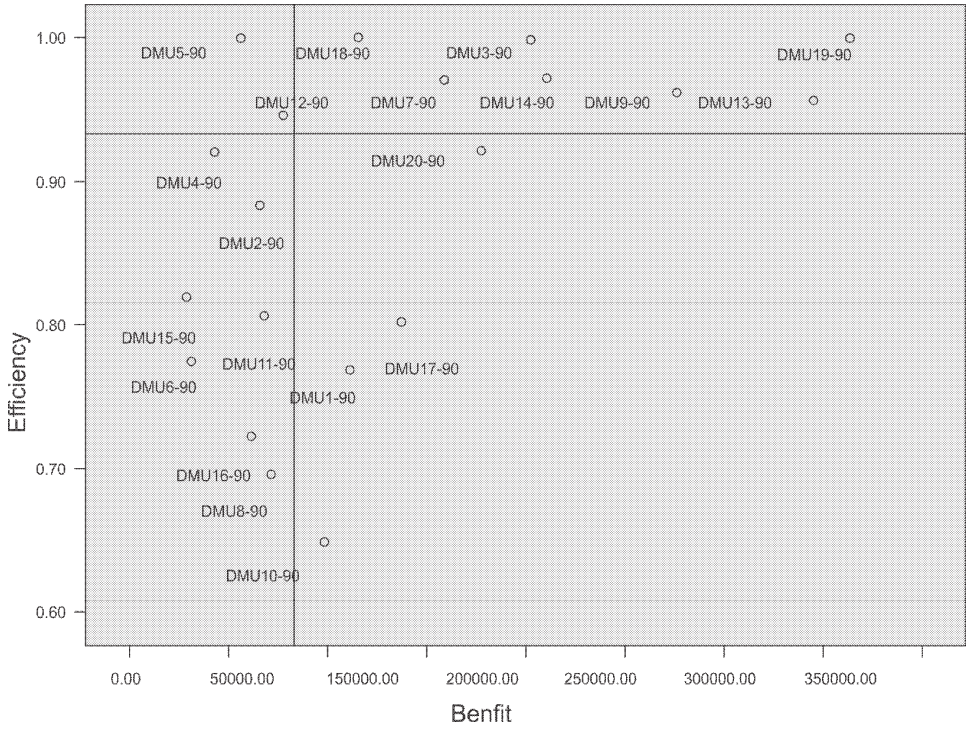

Figure 30.1: Quarter analysis of efficiency with net profit

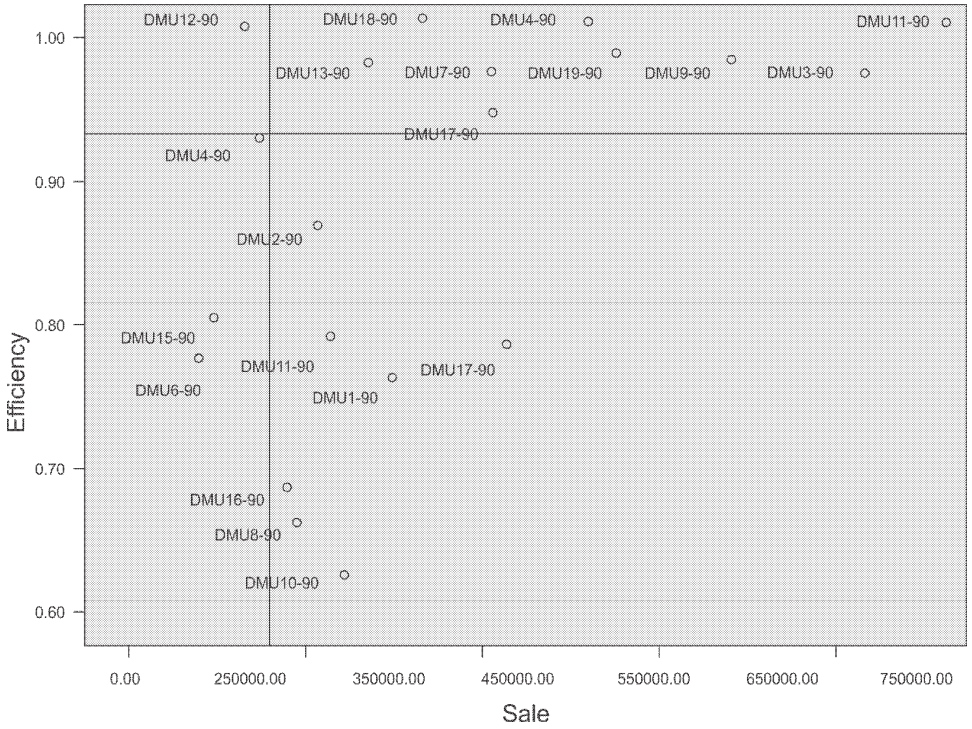

Figure 30.2: Quarter analysis of efficiency with sale

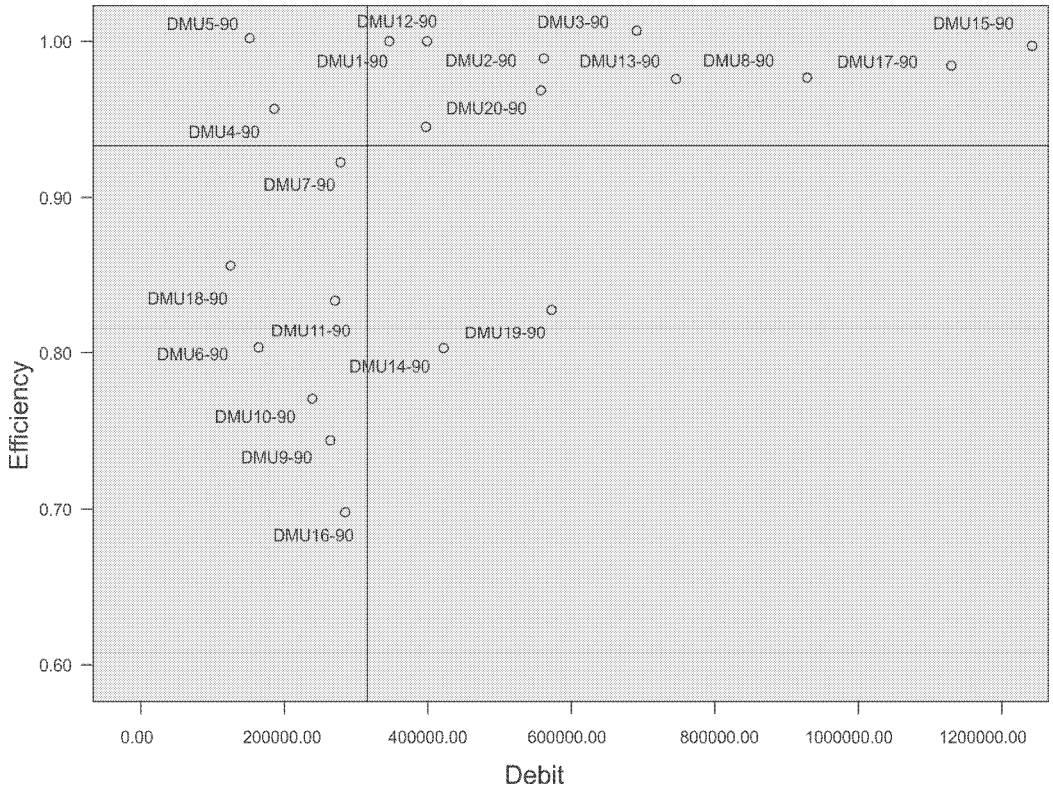

Figure 30.3: Quarter analysis of efficiency with debt

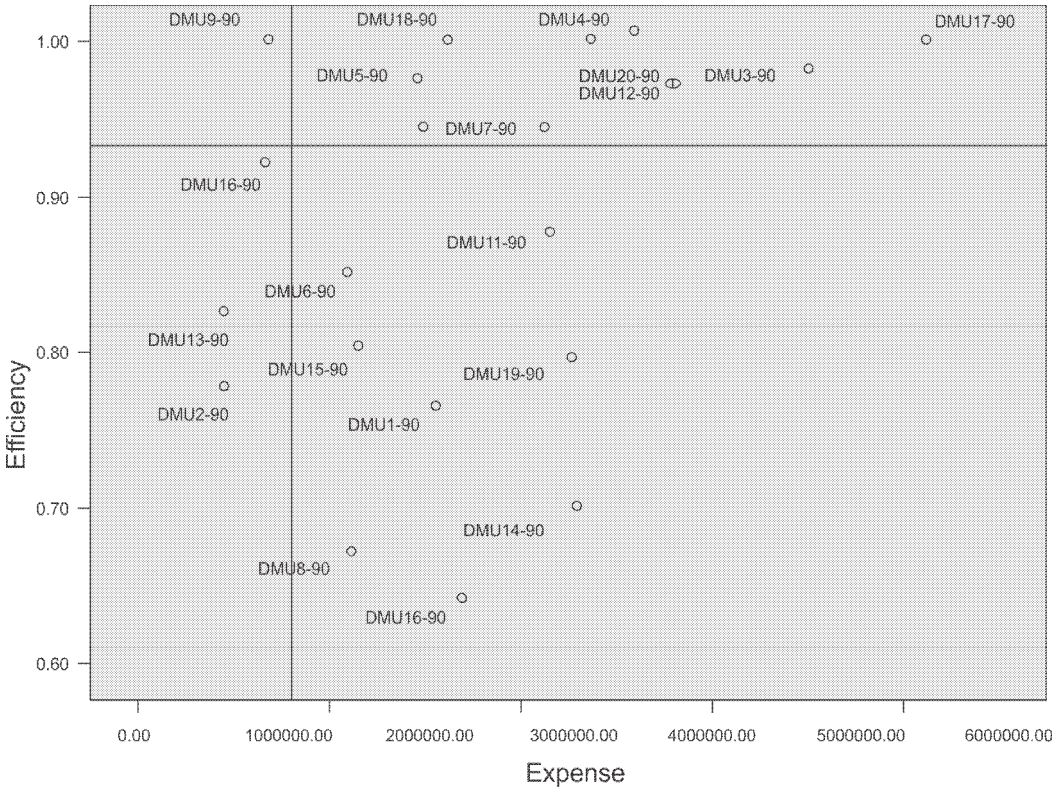

Figure 30.4: Quarter analysis of efficiency with operating expenses

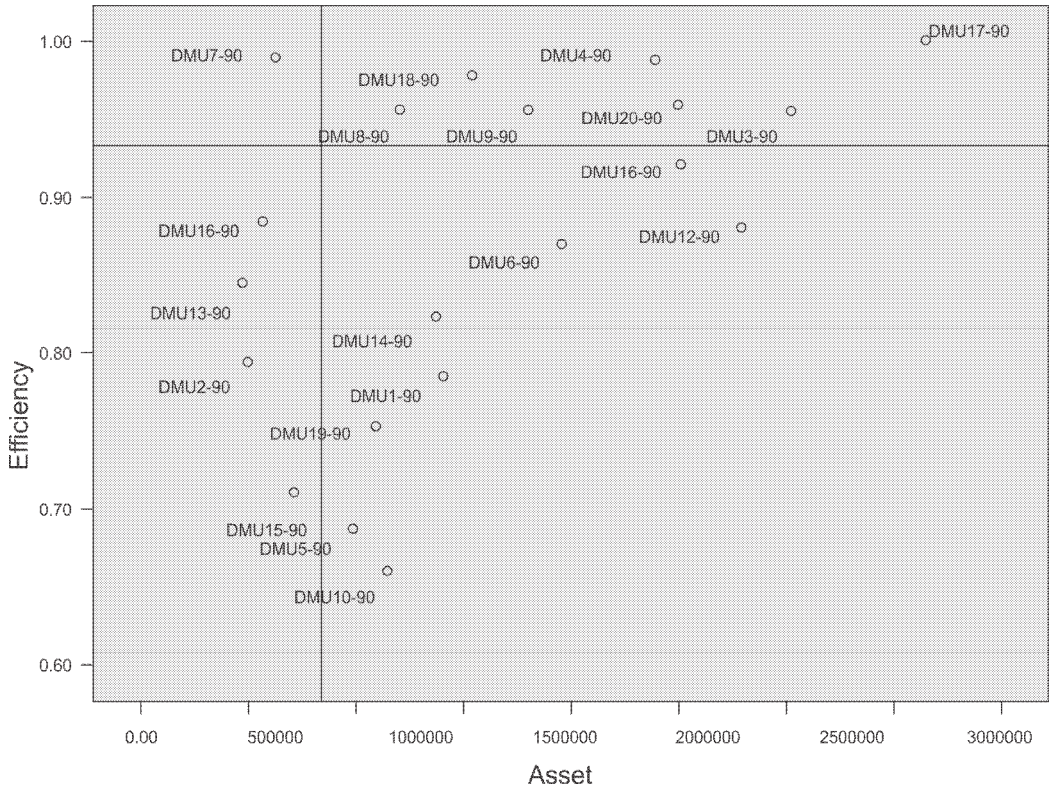

Figure 30.5: Quarter analysis of efficiency with asset

7. CONCLUSION AND RECOMMENDATIONS

Based on the results of present study, we can refer to the applications as ranking the pharmacological companies by stock market as monthly or seasonal using DEA method, using the managers of companies of the results of study to evaluate the performance and using the results of study by investors and shareholders for decision making about sale or purchase.

Based on the results and limitations of present study, it is recommended that the researchers in future studies consider the followings.

1. Comparison of efficiency of pharmacological companies of our country with the efficiency of pharmacology of other areas in the world to compare the efficiency and competitiveness.
2. In this study, the study scope is evaluated only by DEA method and it is recommended that the researchers in their studies compare the performance and regression methods (econometric) by DEA.
3. Evaluation of competition of pharmacology industry of inside and outside.
4. Evaluation of the reasons of efficiency and inefficiency of pharmacological companies.

Each six months or one year, evaluation process is repeated with the similar method and the applied study method is used in the study.

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