Evaluating and Ranking the Firms in Chemical Industry Listed in Tehran Stock Exchange with TOPSIS

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ARTICLE INFO	ABSTRACT
	Due to the sublimation and perfection of human knowledge in economics, the concept of efficiency developed in the past two decades and the measurement of it, based on different theories and practice. In economics, efficiency means the maximum of possible output from a certain amount of input. The efficiency is very important for developing countries Because these countries face to a shortage of inputs, production factors and technologies. So the usage of existing resources is critical for these countries. This paper aims to evaluate and rank the financial performance of the chemical firms listed in Tehran stock exchange. We Use the data environment analysis and TOPSIS methods. This research includes one major question that which company performs better due to the financial ratios. The sample includes the firms in Tehran Stock Exchange within a 3-year period (2013-2015). The Results show that Ahvas Petrochemical company, Persian Gulf Petrochemical Industry company and Iran Chemical Industries company are more efficient than others.

1   Introduction

Evaluating firm performance using financial ratios has been a traditional yet powerful tool for decision-makers, including business analysts, creditors, investors, and financial managers. Rather than employing the total amounts observed on financial statements, these analyses were conducted using a number of financial ratios to obtain meaningful results. Ratio analysis can help stakeholders analyze the financial health of a company. Using these financial ratios, comparisons can be made across companies with in an industry, between industries, or within a firm itself. Such a tool can also be used to compare the relative performance of different size companies, [1-5].

Accounting and finance text books generally organize financial ratios into classes including liquidity, profitability, long-term solvency, and asset utilization or turnover ratios. Liquidity ratios evaluate the ability of a company to pay a short-term debt, whereas long-term solvency ratios investigate how risky an investment in the firm could be for creditors. Profitability ratios examine the profit-generating ability of a firm based on sales, equity, and assets. Asset utilization or turnover ratios

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measure how successfully the company generates revenues through utilizing assets, collecting receivables, and selling its inventories, [6-9].

As part of an empirical research, Matsumoto et al. [11] conducted a survey of security analysts to ascertain their perceptions regarding financial ratios. They discovered that growth rates were considered to be the most important, followed by valuation, and then profitability ratios. The analysts ranked earnings per share and leverage ratio slightly lower than the above three. They also found that the ranking orders of ratio groups were

quite different for retailers and manufacturers. Seeking excellence and perfection of human knowledge in economics, efficiency concept developed in the last two decades, based on different theories, its measurement is possible and practical. In economics, efficiency means maximum production output is possible by using a certain amount of input into two sections. Service organizations internal efficiency (efficient use of resources) and external efficiency (the ability to generate income) divided. Cost efficiency associated with internal efficiency, in other words by improving internal efficiency can be further reduced costs. External efficiency performance related income. This means that by providing better quality services, the number of clients increased to cause earn more money for the organization.

Due to this, efficiency is very important for developing countries. Because these countries lack of production and technology factors are encountered. Therefore, efficient use of available resources is vital for these countries. On the other hand, among the different organizations, researchers, banks regarded as one of the most important institutions of any economic system-have.

2 Literature review, institutional context and hypothesis development

2.1 Performance

Any of many different mathematical measures to evaluate how well a company is using its resources to make a profit. Common examples of financial performance include operating income, earnings before interest and taxes, and net asset value. It is important to note that no one measure of financial performance should be taken on its own. Rather, a thorough assessment of a company's performance should take into account many different measures.

The performance of different processes can have several meanings. At the same time there are many factors that affect the performance. Performance in terms of goods or services to be provided in a given time period stated. In this conception of organizational performance, including the effect of the output efficiency and other areas of performance will be determined based on the type and form. While most services are provided in the public sector, the private sector has appeared as producing more. Business functions or job outputs is at the end of a given period. It includes the goals or tasks and work. In this case, the result of all our efforts is to achieve business goals.

Use of financial ratios to assess the firm performance is not new. A simple literature search can find literally thousands of publications on this topic. The underlying studies often differentiate themselves from the rest by developing and using different independent variables (financial ratios) and/or employing different statistical or machine learning based analysis techniques. For instance, Horrigan [12] claimed that the development of financial ratios ought to be a unique product of the evolution of accounting procedures and practices in the U.S.; further stating that the origin of financial ratios and their initial use goes back to the late 19th century. Financial

ratios, which are calculated by using variables commonly found on financial statements, can provide the following benefits:

- Measuring the performance of managers for the purpose of
- rewards;
- Measuring the performance of departments within multi-level
- companies;
- Projecting the future by supplying historical information to
- existing or potential investors;
- Providing information to creditors and suppliers;
- Evaluating competitive positions of rivals;
- Evaluating the financial performance of acquisitions.

Other than the benefits provided above, financial ratios are also used for the purpose of predicting future performance. For example, they are used as inputs for empirical studies or are used to develop models to predict financial distress or failures. In fact, a vast majority of the recent studies focused on analyzing and potentially predicting bankruptcy as a means to identify characteristics (in term of financial ratios) of good or bad-performing firms and their potential values. Thousands of studies conducted in bankruptcy prediction distinguished themselves from those of the others by using a somewhat unique set of financial characteristics or employing a different set of prediction models (statistical or machine learning based). Though many of these studies are successful in predicting bankruptcy outcomes, they often fall short on identifying and explaining the characteristics that can be used as determinants of the firm performance.

In earlier studies, researchers utilized statistical methods which are prone to unrealistic normality and linearity assumptions. For example, Altman [13] applied multiple discriminant analysis, which requires data to meet normality, equal covariance and independency of variables conditions. The superiority of decision tree methods (arguably the most popular data mining techniques) is that they are free from these limiting assumptions. Furthermore, decision trees can be represented as easily understandable graphical displays, making them transparent and easily understandable to managers. Therefore, in this study we chose to use the most popular decision tree methods as our analysis tools.

2.2 Efficiency

When discussing the economic performance of producers, it is common to describe them as being more or less "efficient," or more or less "productive." In this Section we discuss the relationship between these two concepts. We consider some hypotheses concerning the determinants of producer performance, and we consider some hypotheses concerning the financial consequences of producer performance.

By the productivity of a producer we mean the ratio of its output to its input. This ratio is easy to calculate if the producer uses a single input to produce a single output. In the more likely event that the producer uses several inputs to produce several outputs, the outputs in the numerator must be aggregated in some economically sensible fashion, as must the inputs in the denominator, so that productivity remains the ratio of two scalars. Productivity growth then becomes the difference between output growth and input growth, and the aggregation requirement applies here as well.

Variation in productivity, either across producers or through time, is thus a residual, which Abramovitz [14] famously characterized as "a measure of our ignorance." Beginning perhaps with Solow [15], much effort has been devoted to dispelling our ignorance by "whittling away at the residual".

Much of the whittling has involved minimizing measurement error in the construction of output and input quantity indexes. The conversion of raw data into variables consistent with economic theory is a complex undertaking. Klette and Griliches [16] surveys the economic history of the residual, and state-of-the-art procedures for whittling away at it are outlined in OECD (2001). When the whittling is finished, we have a residual suitable for analysis.

Among the measures that have been proposed to define and assess productivity, efficiency measures are the best. Efficiency measures, inputs or resources that an organization with final goods and services produced, compare. Performance in comparison with the quantity of products and services offered to charge tax or labor force that is necessary to refer to them. However, the scale, productivity, customer satisfaction does not measure the degree of the desired goal. For example, the efficiency ratio measures the number of hours' doctors treated the patients show that while the measures are designed to demonstrate the effectiveness, of the total number of patients treated in managed care have been.

In theory, efficient productions are described by the most efficient input-output combinations of the production function. The production function in turn shows the technical or natural restriction in production. It also defines the production possibility set, containing all technically possible but inefficient production plans. In theory this area is of little interest as it is expected that profit maximizing firms always produce efficiently and do not waste resources.

Besides, we could further argue that in a competitive environment firms are forced to be efficient in order to survive and make enough profits to reinvest for being technically up to date. According to the above mentioned successful development of the German engineering industry and in line with economic theory it could be expected to find a majority of firms operating at an efficient level, i.e. with an efficiency score – scaled between zero and one – to be near one. However, empirical studies examining efficiency in non-regulated industries found little evidence for average efficiency scores close to one.

3 Methodology

3.1 TOPSIS

In the present study TOPSIS Method for Automatic Prioritization is used. TOPSIS one of the techniques used in multi-criteria decision making (MCDM) is.

The TOPSIS process is carried out as follows:

Step 1: Create an evaluation matrix consisting of m alternatives and n criteria, with the intersection of each alternative and criteria given as x_{ij}, we therefore have a matrix $(x_{ij})m*n$.

Step 2: The matrix $(x_{ij})m*n$ is then normalized to form the matrix R= $(x_{ij})m*n$, using the normalization method $r_{ij} = \dfrac{x_{ij}}{\sqrt{\Sigma_i^m = 1\, x_{ij}^2}} =, 1,2,\dots,n$

Step 3: Calculate the weighted normalized decision matrix T=(t_{ij})m*n=(wⱼrᵢⱼ)m*n,i=1,2,….,m

Where

woⱼ=wⱼ$\sum_{j=1}^n w_{i,j=}$1,2,…n

so that

$\sum_{j=1}^{n} w_j = 1$,

and w_j is the original weight given to the indicator $v_j, j = 1,2,\dots,n$.

Step 4: Determine the worst alternative (A_w) and the best alternative (A_b):

$A_w = \{(\max(t_{ij}|i=1,2,\dots,m)|i=1,2,\dots,m)|j\epsilon j)(\min(t_{ij}|i=1,2,\dots,m)|j\epsilon J)\} = \{t_{wj}|j = 1,2,\dots,n\}$

$A_b = \{(\min(t_{ij}|i=1,2,\dots,m)|i=1,2,\dots,m)|j\epsilon j)(\max(t_{ij}|i=1,2,\dots,m)|j\epsilon J)\} = \{t_{wj}|j = 1,2,\dots,n\}$

where,

$J_+ = \{j=1, 2,\dots,n|j$ associated with the criteria having a positive impact, and

$J_- = \{j=1, 2,\dots n|j$ associated with the criteria having a negative impact.

Step 5

Calculate the L2-distance between the target alternative i and the worst condition A_w

$d_{iw} = \sqrt{\sum_{j=1}^{n}(t_{ij} - t_{wj})^2}$, i=1,2,…,m,

and the distance between the alternative i and the best condition A_b

$d_{ib} = \sqrt{\sum_{j=1}^{n}(t_{ij} - t_{wj})^2}$, i=1,2,…,m,

where d_{iw} and d_{ib} are L2-norm distances from the target alternative I to the worst and best conditions, respectively.

Step 6: Calculate the similarity to the worst condition:

$s_{iw} = d_{iw}/(d_{iw}+d_{ib})$, $0 \le s_{iw} \le 1$, i=1,2,…,m..

$s_{iw} = 1$ if and only if the alternative solution has the best condition; and

$s_{iw} = 0$ if and only if the alternative solution has the worst condition.

Step 7: Rank the alternatives according to s_{iw} (i=1,2,…,m) (Hwang and Yoon [10]).

In this way there making a number of options and the number of criteria to decide who should be the criteria, the rating option, or performance to be allocated to each of them a score. The general philosophy is that using TOPSIS options, two options are defined hypothetical. One of these options is a collection of the best values observed in the decision matrix. The ideal option called positive (best possible) call. While one option is defined assumption that the worst conditions possible. The ideal option is negative. Criterion can be positive or negative in nature, also measured units can be different. Benchmark scores on TOPSIS is an option as possible ideal option close positive and negative is far from ideal option. Accordingly, a score is calculated for each option and options are ranked according to the scores.

The population of this research and the sample includes the firms in Tehran Stock Exchange within a 3-year period (2013-2015)

4   Empirical Results

To measure the goodness of fit, Kolmogorov-Smirnov test is the best tool. It will consider the two basic assumptions:

H0: the distribution of normal society

H1: population distribution is not normal

Calculate the percentage by weight

This form is to the questionnaire for the variable names in the columns and rows of the matrix is inserted and financial experts (n = 15) were asked to rate from 1 to 9, the preferred any other variable to specify In the end, the answers are simple averages in the table below. For example, in the following chart we can see that cash as dividends to preferred 2 units. In the end, Expert Choice Software weights of each of the variables have been identified.

At this point we have examined the research data. Each of years of research to determine the approach to segregation ratios were taken. The data for Ratios between zero and one is the basis for all subsequent steps in this research.

The second phase to determine the positive and negative ideal and the ideal positive and negative wishes calculated for each of the firms. These values are then used to calculate the ideal comes to the final. The final results are as follows:

Table 1: The result ranks from TOPSIS

year / Rank	2013	2014	2015	All of years
1	Persian Gulf Petrochemical Industry company	Persian Gulf Petrochemical Industry company	Persian Gulf Petrochemical Industry company	Persian Gulf Petrochemical Industry company
2	Ahvas Petrochemical company	Pardis Petrochemical company	Pardis Petrochemical company	Pardis Petrochemical company
3	Tamin Petrochemical company	Ahvaz Petrochemical company	Parsian Oil and Gas Development Company	Parsian Oil and Gas Development Company

5 Conclusions

In this research we goal to ranks the chemical industries by using TOPSIS method. To this aim we first examine the data from the chemical firms and after that by using TOPSIS, ranked this firms about the most efficiency company. The Results show that Ahvas Petrochemical company, Persian Gulf Petrochemical Industry company and Iran Chemical Industries company are more efficient than others.

References

[1] Chung, R., Firth, M., Kim, J.B., *Earnings Management, Surplus Free Cash Flow, and External Monitoring,* Journal of Business Research, 2005, 58, P.766 –776.

[2] Cooper, S., Davis M., Maximizing Shareholder Value, CIMA, 2004.

[3] Dechow, P.M., Sloan, R., Sweeny, A., *Detecting Earnings Management*, The Accounting Review, 1995, 70(2), P.193-225.

[4]   Healy, P.M., Wahlen, J.M., *A Review of the Earnings Management Literature and its Implication for Standards Setting,* Journal of Accounting Horizons , 1999, 13(4), P.365-373.

[5]   Jaggi, B., Gul, A., *Evidence of Accrual Management:* A Test of the Free cash flows and debt Monitoring Hypothesis , Working Paper , www.ssrn.com., 2000.

[6]   Jensen , M.C., Agency costs of free cash flow , corporate finance and takeovers, American economic review, 1986,76(2), P.323-329.

[7] Jones, S., Rohit, Sh., The Impact of Free Cash Flow, Financial Leverage and Accounting Regulation on Earnings Management in Australia's 'Old' and 'New' Economies, Managerial Finance, 2001, 27(12), P.18-39.

[8]   Lehn, K., Annete, P., *Free Cash Flow and Stock Holder Gains in Gohng Private Transactions*, The Journal of Finance, 1986, 44 (3), P.771-787.

[9]   Rappaport, A., *Creating Shareholder Value:A Guide for Managers and Investors Revised and Updated*, New York, The Free Press, 1998.

[10] Hwang, C.L., Yoon, K., *Multiple Attribute Decision Making: Methods and Applications*, New York: Springer-Verlag, 1981.

[11] Matsumoto, K., Shivaswamy, M., Hoban J., James P., *Security Analysts' Views of the Financial Ratios of Manufacturers and Retailers,* Financial Practice and Education, 1995.

[12] Horrigan, J.O., *Some empirical bases of financial ratio analysis*, The Accounting Review, 1965, 40(3), P.558-568.

[13] Altman, E. I., *Financial ratios, discriminant analysis and the prediction of corporate bankruptcy,* The Journal of Finance, 1968, 23(4), P.589-609.

[14] Abramovitz, M., *Resource and output trends in the United States since 1870, Resource and output trends in the United States since 1870*, 1956, 36, P.1-23.

[15] Solow, R.M., *Technical change and the aggregate production function*, The review of Economics and Statistics,1957, 22, P.312-320.

[16] Klette, T. J., Griliches Z., *The inconsistency of common scale estimators when output prices are unobserved and endogenous,* Journal of Applied Econometrics, 1996, 37, P.343-361.