Global Trade War: On the Efficiency of US Steel and Non-US Steel Companies

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Abstract: This study aims at analyzing the efficiency of steel companies in the United States and outside the United States to measure their comparative strengths to confront the global trade war based on Data Envelopment Analysis. Quantitative approach was employed by means of Data Envelopment Analysis by the assumption of Variable Return to Scale. The respondents were four US based steel companies and non-US based steel companies. Intermediation approach was used in measuring the inputs and outputs. Input variables comprised the assets and labor cost; while the Output variables consisted of operational profit. This study has found that no steel company was efficient during the observation period. It has been revealed that there was significant difference in efficiency performance between US based steel companies and Non-US based steel companies.

1 INTRODUCTION

The Trump tariffs are a series of tariffs imposed during the presidency of Donald Trump. In January 2018, Trump imposed tariffs on solar panels and washing machines, and later the same year, he imposed tariffs on steel and aluminum. Beginning on June 1st, 2018, Trump administration imposed a 25% tariff on imports of steel, and a 10% tariff on aluminum, on the European Union, Canada, and Mexico. The tariffs angered U.S. allies, who planned retaliatory tariffs on U.S. goods, and heightened chances of a trade war. China said that it will retaliate for the tariffs imposed on $50 billion of Chinese goods that come into effect on July 6. India is also planning to hit back to recoup trade penalties of $241 million on $1.2 billion worth of Indian steel and aluminium. Other countries, such as Australia, are concerned of the consequences of a trade war (Long, 2018).

2 LITERATURE REVIEW

A trade war is an economic conflict resulting from an extreme protectionism in which states raise or create tariffs or other trade barriers against each other in response to trade barriers created by the other party. Increased protection causes both nations output compositions to move towards their autarky position. For example, if a country were to raise tariffs, then a second country in retaliation may similarly raise tariffs. An increase in subsidies, however, may be difficult to retaliate against by a foreign country. Many poor countries do not have the ability to raise subsidies. In addition, developing countries are more vulnerable than developed countries in trade wars. Thus, in raising protections against dumping of cheap products, a government risks making the product too expensive for its people to afford. Trade wars and protectionism have been implicated as the cause of some economic crises, in particular the Great Depression (Irwin, 2017).

Efficiency and effective use of resources are the main goal of every company manager. When a company cannot effectively produce their goods and services, it results in the failure in the competition of using their fund as well as distributing the fund to divisions in needs of business capital. Conceptually, the more efficient the operations of a company, the easier the optimum profit will be achieved. Subsequently, the easier addition of fund will be distributed, the more competitive the fund. It all eventually leads to the better the quality of goods

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and service given to clients, as well as the safer and healthier the company will become.

Every organization certainly needs to be effective. In general, efficiency means to avoid every possible waste. Bear in mind that the ability of an organization to acquire and possess operation infrastructures, also known as source of fund and resources essential for the operation of the organization, is limited – while the objectives are infinite, there is no justification for extravagance. Efficiency is the answer for difficulties in calculating the measurement of performance such as allocation, techniques, and total efficiency (Hadad, 2003). According to Bastian (2009), efficiency is the capability to complete tasks correctly or mathematically. It is defined as the calculation of output and input ratio or the amount of output obtained from certain amount of input used.

According to Kurnia (2005), DEA is one of the non-practical analyses which is used to measure relative efficiency. Practically, either profit-oriented or non-profit oriented business organizations, their production and activities use certain amount of inputs in order to achieve certain amount of outputs. The analysis tool also measures the efficiency basis and is also a tool for policy making in aiming at efficiency improvement. Sutawijaya and Lestari (2009) add that DEA can be used in many fields, including: health care, education, transportation, manufacturing, and also banking.

3 RESEARCH METHOD

This was a quantitative research which devised quantitative analytical tools and Data Envelopment Analysis (DEA) method. The variables in the research were divided into two, namely inputs and outputs. Input variables comprised assets and labor cost; while output variables were in the form of operational profits. Aside from that, the research used secondary sources obtained from the annual financial reports of these selected US based and non-US based steel companies within the period of 2013-2016.

The populations of this research were steel companies registered in the World Steel Association in the period of 2013-2016. The sampling method in this research was done through purposive sampling method which meant the samples were chosen based on the judgement, showing that samples were not chosen randomly and the information about the samples was obtained in certain ways. The sampling criteria were the largest steel producer by volume located in United States and the largest steel producer by volume based in the country outside of United States affected by trade war during the same period of time and steel companies delivering financial reports during the observation period (2013-2016) which have been publicized.

According to the criteria, the US largest steel producers by volume were AK Steel, Nucor Corporation, Steel Dynamics and US Steel Corporation, consecutively. On the contrary, non-US steel producers by volume affected by trade war meeting were ArcelorMittal, China Baowu Steel Group, Maanshan Iron and Steel Company, and ThyssenKrupp.

3.1 Data Envelopment Analaysis (DEA)

This research used Data Envelopment Analysis (DEA) method with Variable Return to Scale (VRS) model. DEA is a mathematical program optimization method which measures the technical efficiency of an Economic Activity Unit (EAU) and compares the units with others (Sutawijaya and Lestari, 2009). DEA is a non-parametric approach which is linear to programming-based supported by technical efficiency software packages. Specifically, OSDEA is used for this study .

DEA assumes that each Economic Activity Unit will have weight which maximizes its efficiency ratio (maximized total weighted output/total weighted input) (Muharam and Pusvitasari, 2007). Maximization assumption of efficiency ratio had made this DEA research to employ output orientation in calculating the technical efficiency. Another type of orientation was the minimization of input, however from both two assumptions the similar results will be achieved (Sutawijaya and Lestari, 2009). Each EAU used combination of different inputs to achieve different output combinations, this way each EAU would choose a set of measurementwhich reflect those diversities.

An EAU is said to be relatively efficient when the dual value equals to 1 (efficiency value at 100 percentile); when the dual value is less than 1, it means that the EAU is considered to be relatively inefficient or suffering from inefficiency (Huri and Susilowati, 2004). Technical efficiency in steel company was measured using ratio between output and input. DEA will calculate steel company which use input n to reach output m which is different (Sutawijaya and Lestari, 2009).

3.2 Normality Test (Shapiro-Wilk Test)

Normality test was conducted as the requirement to conduct independent sample t-test. Normality test could be performed by doing non-parametrical statistical analysis Shapiro-Wilk. This research used Shapiro-Wilk difference testing because this research only recruited less than 50 subjects or respondents. Shapiro Wilk test was considered to be more accurate when the subject is less than 50.

3.3 Independent Sample t-Test

Statistical technique was used as data processing for the research in the form of knowing the difference of two averages (independent t-test). The formula to acquire the standard deviation of average calculation difference ($S_{\bar{x}_1 - \bar{x}_2}$). This hypothesis testing in the form of difference testing of two averages aimed to verify the accuracy of the hypothesis. In other words, it aimed to determine whether the hypothesis is rejected or accepted. The significance was 95%.

Where:

If $t_{calculation} > t_{Table}$ then H_1 is accepted

If $t_{calculation} < t_{Table}$ then H_1 is rejected

4 RESULT AND DISCUSSION

This research aimed to compare the efficiency values which currently become an important aspect in measuring the performance of steel companies. Steel companies as Economic Activity Units are said to be relatively efficient when their dual value shows the value of 1 (efficiency value equals to 100 percent). In contrast, when the dual value is less than one, then the respective EAU can be considered as relatively inefficient (Huri and Susilowati, 2004). Based on the calculation using DEA method with the assumption of Variable Return to Scale (VRS) using OSDEA software, it is seen from the table that the level of efficiency achieved by all of US based and non-US based steel companies in 2013-2016 tended to fluctuate over the years.

Table 1: US based steel companies.

US based	Efficiency value
AK steel 2013	1
AK steel 2014	0,833365887
AK steel 2015	0,882797963
AK steel 2016	1
Nucor 2013	0,693475868
Nucor 2014	0,776181594
Nucor 2015	0,492737385
Nucor 2016	0,740671037
Steel dynamics 2013	0,93340913
Steel dynamics 2014	0,761457273
Steel dynamics 2015	0,624471496
Steel Dynamics 2016	1
US Steel 2013	1
US Steel 2014	0,496787074
US Steel 2015	1
US Steel 2016	0,827619804

Table 2. Non-US based steel companies.

Non-US Based	Efficiency Value
ArcelorMittal 2013	0,138189787
ArcelorMittal 2014	0,317495912
ArcelorMittal 2015	0,625406565
ArcelorMittal 2016	0,63958895
Baowu Steel 2013	0,635874753
Baowu Steel 2014	0,624412882
Baowu Steel 2015	0,081815492
Baowu Steel 2016	1
Maanshan Steel 2013	0,216192461
Maanshan Steel 2014	0,156617197
Maanshan Steel 2015	1
Maanshan Steel 2016	0,240326323
ThyssenKrupp 2013	0,17941338
ThyssenKrupp 2014	0,240090524
ThyssenKrupp 2015	0,216271204
ThyssenKrupp 2016	0,260972677

There were no steel companies remained efficient during observation period. Hence, it can be assumed that neither US nor non-US steel company has succeed in maximizing their inputs and outputs. This means that the value of inputs and outputs achieved by the companies was said to be less efficient and could not achieve their targets.

Inefficient steel companies cannot maximize their inputs and outputs. This means that the inputs and outputs achieved by the steel companies cannot meet their targets (Muharam and Pusvitasari, 2007).

According to the calculation of DEA, US based steel companies and non-US based steel companies suffered from inefficiency rooted from the input variables (assets and labor costs) and the output variables (operational profits). The measure of steel company efficiency tends to be limited to the correlation between technical and operational system in the process of converting the input to become output (Sutawijaya and Lestari, 2009). Therefore, what is needed is an internal micro policy, which means optimum control and allocation of inputs in order to gain maximum outputs.

The use of the first input, total asset, by the steel companies suffered from inefficiency because the value of total asset was bigger than the target. The allocated inputs were bigger than the target and could not be maximized in order to produce outputs. The suggested solution is by allocating input total asset surplus to other input so that it can be more productive assets. Aside from that, in order to fix management of productive asset proportion, either credit or financing distributed to the organization's many operational divisions should be properly adjusted by their relative size, so that the operational function of the steel companies can be improved. The use of the second input, labor costs, is not in accordance to or bigger than what the steel companies have needed to pay their employees' salaries. This is supported by the fact that there is an increase in the number of employees which is not balanced with the needed skills, causing the steel companies to suffer from the decrease of productivity (Sutawijaya and Lestari, 2009).

Output inefficiency in this current research has been caused by operational profits. It has been far too small than its potential. An improvement proposed for the companies is to increase the value of credit distribution/financing to the organization's many operational divisions properly adjusted by their relative size.

In order to be able to significantly see the difference of efficiency value between each period group, *independent sample t-test* testing was conducted. This required normal data distribution. Data normality test in this research was acquired using Shapiro-Wilk test.

Table 3. Shapiro-Wilk test.

Bank	Normality test result
US based steel companies	0.561
Non-US based steel companies	0.851

The result of *Shapiro-Wilk* normality test using SPSS 16 has shown that overall efficiency acquired from DEA method during the post Eurozone crisis period in 2013-2016 has possessed normal data distribution because it has bigger value than the alpha (0.05).

After conducting analytical testing by means of t-test or Independent Sample t-test, the result gained was the difference of efficiency performance using DEA-VRS approach. In the following table, the value of t calculation is 4.474; while the value of t table with $\alpha = 0.05$ and Df = 3 is 2.353. It can be concluded that t calculation > t table; therefore, H_1 is accepted. Based on the achieved probability value, the value is 0.004. Since the value is smaller than the alpha (0.05), H_0 is rejected.

Table 4. Independent sample t-test.

Model	*t* calculation	df	Probability
DEA-VRS	4.474	3	0.004

Based on the comparison of the t value and the achieved probability, it can be concluded that there has been significant difference in the value of efficiency between the US Based Steel Companies and non-US based steel companies.

The obvious contrast of different inefficiency between the US Based Steel Companies and non-US based steel companies could be explained by Chinese based steel companies that is dominated by a number of large state-owned groups owned via shareholdings by local authorities, provincial governments and even the central authorities. Profits are low despite continued high demand due to high debt and overproduction of high end products produced with the equipment financed by the high debt. The central government is aware of this problem but there is no easy way to resolve it as local governments strongly support local steel production. Meanwhile, each firm aggressively increases production (Hogan, 2000).

5 CONCLUSION

In conclusion, among US US Based Steel Companies and non-US based steel companies, there were no steel companies remained efficient during the period of observation. The influence of input and output variables in each bank was shown to be different towards the efficiency. Furthermore, according to the independent sample t-test testing, it could be concluded that there has been significant

difference in the efficiency value of the US Based Steel Companies and non-US based steel companies, can be calculated from the comparison of t value and the achieved probability (H_1 is rejected)

Referring to the results and the conclusion, some suggestions have been proposed for involved parties and further researches. In order to improve their efficiency, steel companies need to allocate surplus in the use of inputs to other inputs. For further researches, it is recommended that further researchers use bigger samples in order to achieve optimum results and can describe steel companies efficiency in the world in broader sense.

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