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TECHNICAL EFFICIENCY AND RETURN TO SCALE IN THE INDONESIA ECONOMY DURING THE NEW ORDER AND THE REFORMATION GOVERNMENTS

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Abstract

This paper analyses technical efficiency and return to scale in the Indonesia economy during the year of 1967 to 2013. These range of years covering two eras of Indonesian government; the New Order era that lasted between the year of 1966 to 1998 and the Reformation era during the year 1998 to 2014. The analysis was also based on the Indonesia economy's business cycle those categorised as Oil Booming Phase (1967-1981), Recession Phase (1982-1986), Deregulation Phase (1987-1996), Multidimension Crisis Phase (1997-2001) and Economic Recovery Phase (2002-2013). Using data on Gross Domestic Product based on constant price of the year 2000, capital stock with the same based year and employment (1967-2013), Cobb-Douglas production functions were exercised to calculate technical efficiency and return to scale employing regression analysis tehniques. The results shows that technical effiency during the New Order Goverment were better than those during Reformation Goverment. The results also showed that technical efficiencies vary among phases in the Indonesian economy.

Keywords: technical efficiency, return to scale, New Order era, Reformation era.
JEL Classification: B41, D24, E23

1. Introduction

Since the declaration of Indonesian independence on 17 August 1945, the Indonesian economy has been up and down, experiencing booming and recession (Galih Adhidarma, 2015). Economic cycle such as booming, recession and even economic crisis did exist in the Indonesia economy. Socia Prihawantoro et. al (2009) have indicated that few phases in Indonesia economy during the year of 1967 to year 2013, namely: oil booming (1967-1981), recession (19082-1986), deregulation (1987-1996), multidimension economic crisis (1997-2001), and economic recovery (2002-2013).

Economists have long recognised that technology is a factor of production, and even the most important factor, given its role in labor quality and the design of capital good. Technological advances play a crucial role in improving productivity and thus the standar of living of a system; economic system (Adam, 2006). Measuring the effect of technology on productivity is a difficult pursuit. It is generally approached through metrics such as Gross Domestic Product, GDP per capita and Total Factor Productivity (TFP). The former two attempt to capture the overall output of a given economy from a macro-environmental perspective. The latter is attempting to measure technologically driven advancement through noting increase in overall output without increases in input. This is done through utilising production function equations

and identifying when the output is greater than the supposed input, implying an advance in external technological environment (Boundless, 2016).

Technology can be regarded as primary resource in economic development. The level of technology is also an important determinant of economic growth. The rapid rate of growth can be achieved through high level of technology. It was observed that innovation or technological progress is the only determinant of economic progress. However if the level of technology becomes constant the process of growth will stops. Thus, it is the technological progress which keeps the economy moving. Inventions and innovations have been largerly responsible for rapid economic growth in developed countries (Debasish, 2016).

In economics, the Cobb-Douglas production function is widely used to represent the relationship of an output to input (Bao Hong, 2008). It was proposed by Knut Wicksell (1851-1926) and tested againts statistical evident by Charles Cobb and Paul Douglas in 1928. From Cobb-Douglas production function, technical efficiency also known as total factor productivity, retun to scale, and ouput-capital elasticity as well as output-labor elasticity can easily be calculated by employing regression analysis (Salvatore, 1996).

Indonesian economy during the era of New Order under Suharto presidency (1966-1998) and during the era of Reformation (1999-2014) run by Habibie Presidency (1998-1999), Wahid Presidency (1999-2001), Megawati Presidency (2001-2004) and Yudhoyono Presidency (2004-2014) has shown clearly the economy's business cycle, up and down over time. Many economic indicators, such as GDP (Gross Domestic Product), Capital Stock and Employment have been published in many publications by National Statistical Agency (BPS, many years).

Previous researchers on technical efficiency, return to scale and output elasticities have been conducted, among others by Biresh K. Sahoo, at al., (2014), Krivonozhko, Dvorkovich, Utkin, Zharkov, Patrin, and Lyche (2007), Gebreselasie (2008), Feng and Serletis (2010), *Holyk (2016),* Page, Jr (1980), Erkoc (2012) and Yudistira 2004).

The reseach reported in this paper aimed at analyzing the coefficient of technical efficiency, return to scale and output-capital elasticity as well as output-labor elasticity of the Indonesia economy during the era of New Order and the era of Reformation.

2. Methods

Cobb-Douglas production function, $Q = \gamma K^{\alpha} L^{\beta}$, was employed in this exercise to calculate technical efficiency (γ), return to scale ($\alpha+\beta$), output-capital elasticity (α), and output-labor elasticity (β). This production function was developed and statistically tested by Charles Cobb and Paul Douglas (1928), where :

Q = total production (the real value of all goods and services produced in a year;

K = capital input (the real value of all machinery, equipment, and building;

L = labor input (the total number of person-hours worked in a year;

γ = technical efficiency in production process, known as total factor productivity;

α = output-capital elasticity;

β = output-labor elasticity.

Technical efficiency (γ), or total factor productivity (TFP) is the portion of output not explained by the amount of input used in production (Comin, 2006). This is a method of measuring overall productivity of business, industries or economies. Technical efficiency is the effectiveness by which a given set inputs is used to produce an output. A firm or an economy is said to be technically efficient if a firm or an economy is producing the maximum output from the minimum quantity of inputs, such as labor, capital and technology. Technical efficiency is

related to productive efficiency concerning with producing at the lowest point on the short run average cost curve. Thus productive effiency required technical efficiency (Pettinger, 2012). The values of α and β are basically determined by available technology. Output elasticity measure the responsiveness of output to a change in levels either capital or labor used in production. Further more, if $\alpha + \beta = 1$, the production function has constant return to scale, meaning that doubling the usage of capital (K) and labor (L) will also double output (Q). If $\alpha + \beta < 1$, return to scale are decreasing and if $\alpha + \beta > 1$, return to scale are increasing (Salvatore, D, 1996). The output elasticity of capital, $E_K = dQ/\delta K.K/Q = aQ/K.K/Q = \alpha$. Similarly, the output elasticity of labor, $E_L = dQ/\delta L.L/Q = bQ/L.L/Q = \beta$, and $E_K + E_L = \alpha + \beta =$ return to scale.

Converting the production function from $Q = \gamma K^{\alpha} L^{\beta}$ in to a logarithms form that is, $\ln Q = \ln \gamma + \alpha \ln K + \beta \ln L$. As this is a linier form, then the coefficiens (γ, α and β) can easily be estimated by regression analysis (Gaspersz, 1996). The Cobb-Douglas production function can be estimated either from data for a single firm, industry, region or nation over time using time-series analysis or for a single firm, industry, region or national one point in time using cross-sectional data (Salvatore, 1996). Structural analysis can be used to differentiate technical efficiency between the two eras of government as well as among the phases of the Indonesian economy.

Data needed for this exercise were national data on Gross Domestic Product, Capital Stock and Employment. Yearly data on GDP, Capital Stock and Employment were collected from the Central Beurau of Statictics. Fortunately data were available from the year of 1967 the early year of the New Order Government until the year of 2013 which was the last year of the Reformation Government. Basically most data used for this exercise are data collected by the Project on Technological Change and Economic Growth (2009-2011) and up-dated in 2015 (Socia Prihawantoro et al. (2009).

Analysis was also classified according to the Indonesian economy business cycle, phase were the economy performance up and down economic; experiencing with booming and recession. Based on available data, the phases of the Indonesian economy were classified into : Oilbooming Phase (1976-1981), Recession Phase (1982-1986), Deregulation Phase (1987-1996), Multidimension Crisis Phase (1997-2001) and Economic Recovery phase (2002-2013) (Alkadri, et al, 2010).

3. Results and Discussion

Figure 1 provides a picture on the Indonesia Gross Domestic Product (GDP) over time, 1967, the early year of the New Order Government to 2013 almost the end of the Reformation Era. Indonesian GDP in the first year (1967) was Rp 417.76 Billion and GDP at the last year (2013) was Rp. 2,686.49 Billion. On average, Indonesian GDP grows at 5.23%. It was noted that when multi dimension of economic crisis (known as monetary crisis) occurred in 1998, the Indonesian GDP grew at minus 13.13%, from Rp. 1,555.32 Billion in 1997 to Rp. 1,351.16 Billion in 1998.

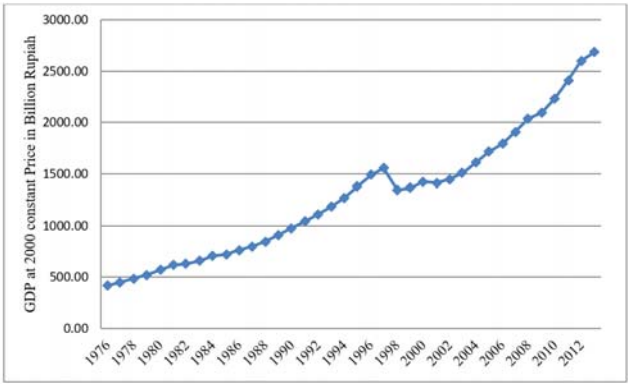

Figure 1: Indonesian Gross Domestic Product, 1967-2013.

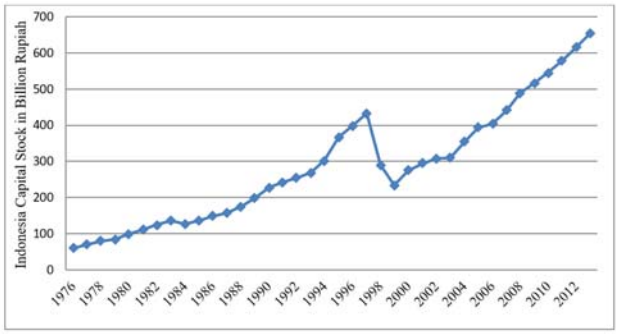

Figure 2: Indonesian Capital Stock, 1967-2013.

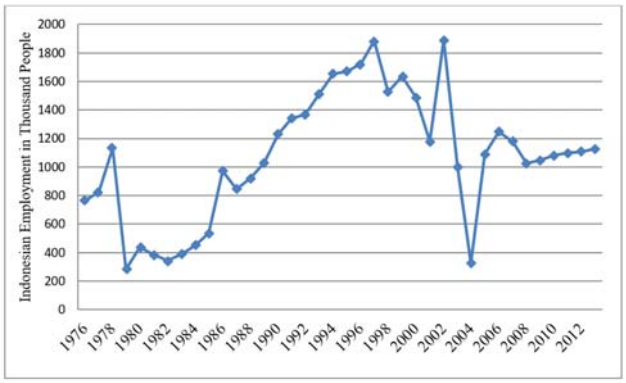

Figure 3: Indonesian Employment, 1967-2013.

Figure 2 provides a picture on the Indonesia Capital Stock (1967-2013), 1967, the early year of the New Order Government to 2013 almost the end of the Reformation Era. Indonesian Capital Stock in the first year (1967) was Rp. 60,341 Billion and GDP at the last year (2013) was Rp. 653, 23 Billion. On average, Indonesian Capital Stock grows at 7.17%, higher than the growth of GDP. It was noted that there were some years when the Capital Stock had negative growth. In 1983-1984, the growth of Capital Stock was -6.02%, and in 1997-1998 the growth of Capital Stock was -33% and in 1998-1999 was -19.38%. It was the same time when Indonesia and other Asian countries experienced monetary crisis.

Figure 3 provides a picture on the Indonesian employment (1967-2013), 1967, the early year of the New Order Government to 2013 almost the end of the Reformation Era. Indonesian employment in the first year (1967) was 675 thousand people and at the last year (2013) was 1,128 thousand people. On average, Indonesian Capital Stock grew at 9.45% %, higher than the growth of GDP as well as the growth of Capital Stock. However, there were some years when the growths of employment were negative, namely the years of: 1979 (-75.18%), 1981 (-2.54%), 1982 (-10.41%), 1988 (-18.95%), 2000 (-9%), 2001 (-20.18%), 2003 (-47.31%), 2004 (-67.45%), 2007 (-5.41%) and 2008 (-13.01%).

Table 1. The Coeffients of Technical Efficiency, Return to Scale and Output Elasticities during the New Order and the Reformation Governments.

Indonesian Economy	Y	a	β	RTS = α + β
All Period (1967-2013	2.78	0.80	-0.02	0.78
New Order Government (1967-1998)	3.08	0.67	0.03	0.70
Reformation Era Government (1999-2013)	2.98	0.72	0.03	0.75

Source: Data Analysis, Using Regression Analysis by Excell of Microsoft Office.

Table 1 provided results of calculation using an easy and user frendly Excell sofware of Microsoft Office. Technical efficiency, or total factor productivity of the Indonesia economy during the year 1967 to year 2013, was 2.78. In the New Order era the coefficient was 3.08 which was higher than that of the Reformation Government, 2.98. It means that technological progress during the New Order era was better than that of the Reformation Goverment. Even, the progress of technical production was higher than that at the national level.

Table 1 also showed that both during the two eras of Indonesian Government have experienced the decreasing return to scale, as the summation of α dan β, the coeffients of return to scale were

less than unity. The coefficients of return to scale during the Reformation Government was 0.75 a bit higher than that of the New Order Government, 0.70. Both were a slihgtly lower compared to that at the national level (0.78).

As also shown at Table 1, the coefficients of output elasticity of capital during the New Order and the Reformation governments (0.67 and 0.72) was lower than that at the national level (0.80). It can be marked easily, that the coefficient of output-capital elasticity during the Reformation government (0,75) was higher than that during the New Order government (0.67).

Finally, Tabel 1 indicates that the coeffients of output-labor elasticity during the Reformation government (0.03) as well the New Order government (0.03) were higher than that at national level (-0.02). The coefficient of output-labor elasticity during the Reformation era (0.03) was the same as that during the New Order government (0.03). The method used in this study showed that there were structural differences between the two period of government; the New Government era and the Reformation era.

Table 2 provides results of calculation from regression analysis. All the coefficients of technical efficiency during the Indonesia economy's business cycle were higher than that at national level (2.78). The technical efficiency coefficient at the Recession Phase (1982-1986) was 6.88 and at the Multidimension Crisis Phase (1997-2011) was 5.86. These two coefficients were the highest. Except the coefficient of technical efficiency at the Economic Recovery Phase (2.70) all of these coefficients were higher than that at the national level (2.78).

Table 2 also shows that all phases of the Indonesia economy business cycle were at the stage of decreasing return to scale, where the return to scale coefficients were less than unity. The coefficient of return to scale, namely the summation of ($\alpha + \beta$), at the Economic Recovery Phase was the higher (0.80) than those of the whole phases, including the phases of Multi dimension crisis (0.24), the Oil Boom (0.57), Deregulations (0.57). There was one phase where the value of return to scale coefficient that was negative. It was at the phase of Recessions' (-0.35). Although the value of the coefficient of elasticity of capital was negative, the value of the coefficient of output elasticity of labor was non-negative.

Table 2. The Coeffients of Technical Efficiency, Return to Scale and Output Elasticities Based on the Indonesia Economy's Cycles.

Indonesia Economy's Cycle	γ	α	β	RTS
All Phases (1967-2013)	2.78	0.80	-0.02	0.78
Oil Boom Phase (1976-1981)	3.78	0.60	-0.03	0.57
Resession Phase (1982-1986)	6.88	-0.35	0.22	-0.13
Deregulation Phase (1987-1996)	2.80	0.56	0.15	0.71
Multidimension Crisis Phase (1997-2001)	5.86	0.21	0.03	0.24
Economic Recovery Phase (2002-2013)	2.70	0.79	0.01	0.80

Source: Data Analysis, Using Regression Analysis by Excell of Microsoft Office.

All values of the coefficient of output elasticity of capital were lower than that at the national level (0.80).The smallest value of the coefficient were at Recessions Phase (-0.35) and Multidimension Crisis Phases (0.21). There was likely a bit odd, as the value of coefficient of output labor elasticity were negative, namely at the phase of Oil Boom (-0.03) and at the whole phase, the national level (-0.02). The other values of the elasticity of output of labor were 0.22; 0.15; 0.03 and 0.01 respectively for the coefficients of output-labor elasticity at Resession Phase,

Deregulation Phase, Multidimension Crisis Phase and Economic Recovery Phase. Again, this method of analysis can easily differentiate both technical efficiency and returns to scale during the economic phases in the Indonesian economy.

4. Conclussion

From discussion, it can be concluded that technical efficiency in Indonesian economy was higher during the New Order Government (3.08) than that in the Reformation Government(2.98). Decreasing return to scale exhibited in both goverment eras; the coefficients of return to scale were 0.70 and 0.75 consecutively during the New Order and the Reformation. Output elasticities were higher in the Reformation than those in the New Order, as output-capital elasticity was 0.72 in the Reformation compared to 0.67 in the New Order; meanwhile output-labor elasticity was 0.03 in the Reformation and 0.03 in the New Order. At all phases of the Indonesian economy's business cycle, the coefficients of technical efficiency were higher than that of the national average. All phases were also experienced the decreasing return to scale. The coefficients of output elasticity of capital were lower than those at national average. On the contrary, the coefficients of output elasticity of labor were generally higher than those at the national level, except the one at the Oil Booming Phase.

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