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ANALYSIS ON PRODUCTIVITY OF MEAT PROCESSING INDUSTRY IN INDONESIA

Jafrizal

Faculty of Economics, University of Sriwijaya, Indonesia

E-mail: drh_jafrizal@yahoo.co.id

ABSTRACT

The purpose of the paper is to analyze level of productivity of and affecting factors in meat processing industry in Indonesia. Data used are the data from the 1990 to 2013 annual survey of big-scale and mid-scale Indonesian meat processing industry from Indonesian Central Bureau of Statistics and the Indonesian Standardized Industrial Classification (ISIC) used is code 10130. Level of productivity is estimated using Total Factor Productivity approach and Data Envelopment Analysis-Malmquist (DEA-Malmquist) method. The findings show that the average productivity is 127.9%, which consists of 114.29% of growth of technology. In addition, the growth of efficiency is 95.5% and growth of economic scale is 98.33% (diseconomy and inefficiency). The market structure of the industry is strict oligopoly where average concentration of four largest companies (CR4) is 62.5%. Based on regression analysis using Weighted Least Square (WLS), it is found out that concentration, capital intensity and number of business unit have positive, significant influence towards productivity. Collusion and intensity of import have negative, significant influence towards productivity. There is different level of productivity prior to and after the implementation of anti-monopoly regulation; the level of productivity increases after the regulation has been established. On the other hand, level of productivity decreases after imported meat quota regulation is established compared to the time when the regulation has yet been established.

KEY WORDS

Oligopoly, concentration, collusion, regulation, meat product.

Growth of Indonesian meat processing industry has become attention of the researchers in the last few decades (Aswicahyono, 1998; Basri, 2001; Margono & Sharma, 2006; Modjo, 2007; Probowo & Cabanda 2011; Setiawan, 2013; Surjaningsih & Permono, 2014). Based on the data from the Central Bureau of Statistics (2014), growth of Gross Domestic Bruto (GDP) of meat processing industry between 2007 to 2013 keeps declining from 17.6% in 2007 to 1.13% in 2013. Demand of processed products of which ingredient is meat is increasing to 51.4%. Similar condition is also reported by Modjo (2007) who stated that between 1988 and 2000, industrial productivity is high. Surjaningsih and Permono (2014) reported between 2000 and 2004, industrial productivity is high but it is declining between 2005 and 2009. On the other hand, the National Development Planning Board (2010); Probowo and Cabanda (2011) reported similar information that growth of productivity between 2000 and 2007 is high.

Growth of productivity is influenced by various different factors. Different studies have resulted in different findings. Widiati and Kuncoro (2006) reported that productivity of processing industry in Indonesia is related to industrial concentration, size of company, use of imported goods as input, behavior in industry and government policy. Keramidou and Mimis (2011c) revealed that productivity of an industry is not influenced by capital intensity, age of company and skills of employees. At the opposite, Sripoorni and Manonmani (2014) reported that capital intensity has reported positive influence of modal intensity towards productivity. Pradiptyo (1996), also reported that government action also contributes in developing concentration. Bird (1999); Kuncoro (2007); Bank of Indonesia (2008) reported that the industry has relatively high concentration between 67 to 71.5% with tight oligopoly market structure so that it affects low productivity and efficiency of meat processing industry in Indonesia.

Policy intervention, regulation and government that involve limiting raw materials and finished goods can be violated by particular companies to strengthen their positions and control towards the market (Setiawan, 2013). The establishment of regulations about exporting and importing livestock in 2007 aims at decreasing imported beef until 10% of the national consumption. The regulation resulted in shortage of supply for beef used for household consumption and raw materials for certain industry. As the consequence, in 2013 the price of meat increased sharply. The condition influences performance of the national meat processing industry.

LITERATURE REVIEW

The basis of the study is Structure-Collusion-Productivity paradigm with the model developed by Martin (1999) and Carlton & Perlof (2005). Development of framework for industrial organization aims at creating simple causal effects with linear interaction between structure (concentration), behavior (collusion) and performance (productivity), as well as to analyze effect of regulation in market development. Some previous studies are Maudos (1998), Gumbou and Moudos (2000), Ollinger et al, (2005), Byeongyong et al, (2005), and Setiawan et al, 2012a), and Setiawan (2013).

Estimation of growth of productivity refers to theories by Kumbkhar and Lovell (2000) and Coelli et al (2005) who divide growth of productivity into three decompositions namely change of efficiency, technology and economic scale. The Malmquist index is introduced by Caves et al., (1982), and their decomposition for a change in efficiency and technology is proposed by Nishimizu and Page (1982) and Fare et al., (1992).

Empirical studies about meat processing industry in various countries have been conducted by various experts such as Xia and Buccola (2002) who found out that level of productivity of meat processing industry in the USA was low. Ali (2007) in India revealed that between 1980 and 2013, growth of productivity was low. Nossal et al., (2008) stated that productivity of meat processing industry in Australia is growing each year. In Ukraine, Goncharuk (2009) described that growth-increasing efficiency happened due to decrease of inputs such as capital and employees. In Spain, Kapelko et al., (2012) elaborated that decreasing productivity happened due to lower technology.

Related to the elaboration, the study analyzes productivity of meat processing industry and influence of concentration, collusion, intensity of imported meat, capital intensity, number of companies, anti-monopoly regulation, and imported meat quota regulation towards productivity of meat processing industry in Indonesia. The methods used are Data Envelopment Analysis Malmquist (DEA-Malmquist) and Weighted Least Square regression analysis.

RESEARCH METHODOLOGY

Data. The data used in the study were the data from the 1990 to 2013 annual survey of big-scale and mid-scale Indonesian meat processing industry from Indonesian Central Bureau of Statistics (*Badan Pusat Statistik* or BPS) and the Indonesian Standardized Industrial Classification (ISIC) of which code is 10130.

Method. Concentrated Ratio (CR) is a tool used to measure structure of an industry. CR4 is combination of market share of four biggest companies in the industry.

$$CR4 = \sum_{i=1}^4 S_i \quad (1),$$

where: CR4 = Concentration of the fourth largest company; S_i = market share of i company.

Collusion refers to collusion of estimated score from level of collusion (α) using Clarke et al, (1984) and Demsetz (1973) models presented in the following equation:

$$\Pi / R = \alpha / \eta + ((1-\alpha)) / \eta \quad 0 \leq \alpha \leq 1 \text{ dan } (\partial \alpha) / (\partial H > 0) \quad (2)$$

Π refers to profit, R refers to income, Π / R refers to profit revenue ratio and H refers to Herfindahl Index (HI) or the square amount of market share from all companies in one industry, α refers to collusion, η refers to elasticity of good demand towards change of price. The unit is in the form of percentage. Imported Intensity is total volume of national imported beef per year (in millions of tons).

Capital Intensity Ratio is ratio between total amount of capital divided by the number of production. Smaller ratio means the more efficient the use of asset is (Setiawan et al, (2012b, 2013); Ullah et al, (2013); Keramidou et al, (2010).

$$CIR = (\text{Total Value of Assets}) / (\text{Production}) \quad (3)$$

Regulation refers to government regulation related to anti-monopoly that is the 1999 Regulation number 5 as the Anti-Monopoly regulation and imported and exported meat and implementation of imported meat limitation that is Minister of Agriculture's Decree number 59/Permentan/HK.060/8/2007 as regulation for imported meat quotas. Different effect of the regulations can be seen using regulation Dummy. Year after the regulations is established is given score of 1 and year before the regulation is established is given score of 0. Company Unit refers to number of mid-scale and big-scale companies in meat processing industry in one year (Unit).

Productivity is decided using Malmquist Index. Malmquist Index is introduced by Gua et al., (1982), and their decomposition to change in efficiency and technology is proposed by Nishimizu & Page (1982) and Fare et al. (1992). Kumbhakar and Lovell (2000). Collie, et al., (2005) elaborate Total Factor Productivity (TFP) into three components namely change of technology (technical change), change in technical efficiency (technical change efficiency), and economic effect scale. Malmquist Productivity Index (MPI) measures change in productivity based on time variance and can be described in change of efficiency and change of technology (change of productivity) with DEA as non parametric approach. DEA-Malmquits model can be elaborated in functional pattern (distance function) and the time is t and $t + 1$.

$$MPI_I^t = \frac{E_I^t(x^{t+1}, y^{t+1})}{E_I^t(x^t, y^t)} \text{ and } MPI_I^{t+1} = \frac{E_I^{t+1}(x^{t+1}, y^{t+1})}{E_I^{t+1}(x^t, y^t)} \quad (4),$$

where: I represents orientation of MPI model and change in TFP index is total factor of productivity (tfpch).

Model Specification. Model of equation for meat processing industry in Indonesia is development of the model that had been used empirically by Keramidou et al., (2010), Keramidou et al., (2011), Ohlan (2013), Xie and Cummins (2013) and Setiawan et al, (2012b and 2013); thus, the equation is as follow:

$$\begin{aligned} TFP = & C(1) + C(2) * CR4 + C(3) * COLLUSION + C(4) * IMPORT + \\ & C(5) * CIR + C(6) * UNIT + C(7) * RAM + C(8) * RKID + [AR(2) = \\ & C(55)] \end{aligned} \quad (2.5) \quad C2, C3, C8 < 0 \text{ and } C4, C5, C6, C7 > 0$$

Estimation model used is WLS-weighted square.

Hypothesis. Hypothesis in the study is that concentration has negative effect towards production, collusion has negative effect towards productivity, intensity of import has negative effect towards productivity, capital intensity ratio has positive effect towards productivity, company unit has positive influence towards productivity, anti-monopoly regulation is different (positive) towards productivity after it is established, and imported beef quota regulation is different (negative) towards productivity after being established.

FINDINGS AND DISCUSSION

Based on DEA-Malmquist estimation, average level of productivity (Total Productivity Factor/ TFP) of the industry between 1990 and 2013 is 127.9% that means the growth of productivity of the industry is 27.9%. The growth of productivity is contribution of positive growth of technology that is 14.29% while growth of efficiency and economic scale is negative.

Table 1 – Growth of Productivity of Meat Processing Industry in Indonesia

Period	Components Total Factor Productivity (TFP)			
	Δ TFP (percent)	(Δ Efficiency) (percent)	Δ Tech (percent)	Δ Scale (percent)
1990-1992	94.5	89	105	94.5
1993-1995	137	129.33	112.67	108
1996-1998	137	100.67	138.67	99.67
1999-2001	128.67	100.33	124	95.33
2002-2004	95.33	104.67	92	115
2005-2007	125.33	102.67	121.33	102.67
2008-2010	130	102	123	104.33
2011-2013	133.67	97	132.67	98.67
Rata-Rata	127.9	99.5	114.29	98.33

Description: *Efficiency* = Technical Efficiency; *TECH* = Technology;

Scale = Scale Economics; *TFPch* = Total Factor Productivity Change; Δ = Change / Growth.

Source: Results DEA-Malmquist Estimation.

The lowest growth of productivity occurs between 1990 and 1992 of -5.5% while the highest growth of productivity occurs between 1993 and 1995 as well as 1996 and 1998 of 37% which becomes the contribution of technical efficiency growth and growth while the growth of economic scale is negative. After the economic crisis, the growth of declined and the lowest one was between 2002 and 2004 of -4.67%. The findings are in line with Aswicahyono (2002) and Timmer (1999). The condition happened due to huge number of new companies using cutting-edge technology and as the effect it requires some time for employees to be able to operate the machine well. Based on report of The World Bank (1991) between 1990 and 1992, input of capital in 1992 is IDR 572,500,000,000 or 51 billions more than 1990.

Between 1993 and 1995, it was found out that the average Total Factor of Productivity (TFP) is 137% that means growth of productivity of the industry is 37%. The growth is the positive contribution from change in efficiency growth, positive change of technology and economic scale. The positive growth of productivity is different from Tanuwijaya and Sharma (2004) and Modjo (2007) who found out that the growth of productivity in the meat processing industry is negative.

The average productivity of the industry between 2005 and 2007 is 25.33%. Between 2008 and 2010, there is 30% growth of the industry. In addition, between 2011 and 2013, there is also 33.67% increase. The growth is also the contribution of the growth of technology and economic scale while technical efficiency is negative. There is an issue regarding availability of raw materials and price in the industry between 2011 and 2013. Decreasing number of import results in shortage of raw materials and increasing price helps the industry in the form of cost efficiency. High expenses for raw materials results in low efficiency. Productivity of the industry can still grow due to the use of technology and economic scale. The finding is consistent with the findings of a study conducted by Aswicahyono (2002).

In order to find out influence of concentration, import intensity and regulation towards productivity of meat processing industry, estimation of regression using Weighted Least Square is used. The findings are concentration (CR4) has positive significant influence towards productivity (TFP). It is in line with Fitriani et al., (2014) and different from Gopinath et al (2002). The finding is different from the hypothesis. It happens because the company with huge market share tends to increase productivity using cutting-edge technology which

gives positive contribution towards technology while growth of efficiency and economic scale are negative. High productivity is due to increasing capital for machinery and huge buildings. Change of efficiency and economic scale do not cause growth of productivity so that developing skills of employees so that they can adjust to the growth of technology in meat processing industry is vital.

Collusion has negative significant influence towards productivity (TFP). The finding is in line with the hypothesis. Such condition happens due to collusion that takes place to decide number of production and price; collusion can increase and control price in order to avoid overproduction that reduces price. The production control influences productivity of processing industry accumulatively.

Table 2 – Analysis of Factors Affecting Productivity

Independent Variable	Symbol	Coefficient	t-Statistic	P-Value	Prob
Constant	C(1)	-9.374	-4.880	0.000	***
Concentration (CR4)	C(2)	1.848	2.555	0.025	***
Collusion (Collusion)	C(3)	-3,999	-2.911	0.013	***
Import Of Meat Intensity (Import)	C(4)	-0.014	-5.106	0.000	***
Capital Intensity Ratio (CIR)	C(5)	0.933	3.003	0.011	***
Unit Of Company (Unit)	C(6)	0.365	4.947	0.000	***
Antitrust Regulation (RAM)	C(7)	0.741	2.963	0.012	***
Meat Import Quota Regulation (RKID)	C(8)	-6.081	-4.449	0.001	***
Aotoregression Ordo 2(AR-2)	C(55)	-1.074	-6.153	0.001	***
R-squared	0.679	Mean dependent var	1.308		
Adjusted R-squared	0.465	S.D. dependent var	0.677		
S.E. of regression	0.495	Sum squared resid	2.944		
Durbin-Watson stat	2.769				

Source: *Weighted Least Squares Regression Results.*

Capital Intensity Ratio (CIR) has significant, positive influence towards productivity (TFP). Capital intensity is effort of company to use all his assets to create sales. The higher CIR is, the more efficient the use of asset is. The average CIR during the study is 0.56 or 56% of the capital used for production. High CIR in the form of cutting-edge machine and equipment to create finished products will increase productivity of industry.

Number of business unit has positive, significant influence towards productivity (TFP). The finding is in line with the hypothesis. Increasing number of productivity will increase national production when a new company develops its market share. Increasing number of companies will encourage competition, decrease concentration and improve performance of the industry. It is in line with Gopinath, et al., (2002)'s study. Increasing number of companies in business competition will also encourage companies to improve efficiency of their production to survive the competition.

There is significant difference prior to and after the implementation of anti-monopoly regulation towards TFP. The finding is different from the findings of the study conducted by Gopinath et al, (2002) and Nurdianto (2004). Such condition support the indication that there are other factors such as the effect of the 1997/1998 economic crisis that affect production after the establishment of anti-monopoly regulation in 1999. One of the purposes is to eliminate monopoly and collusion as well as creating more competitive market. High concentration will encourage collusion that decreases competition and causes inefficient production. The condition decreases productivity of which source is efficiency. The influence does not happen in meat processing industry where an increase of productivity is caused by growth of technology. During the 1997/1998 economic crisis more particularly during the economic recovery, purchasing power and currency rate against US\$ was high. It was predicted that these elements influence productivity of the industry so that anti-monopoly regulation is not the variable that influences productivity.

There is significant difference after the imported meat quota regulation was established towards TFP. After the regulation was established, the productivity decreases compared to the time when the regulation has yet been established. The finding is in line with the

hypothesis. Putting limitation for imported meat to nearly 10% has influence towards hotel, restaurant, catering, big retails and processing industry that uses meat as the raw materials. Setting limitation for imported meat for household will increase demand for processed meat products. High demand will cause increasing raw materials and their price. Besides that, efficiency and productivity will also decrease.

CONCLUSION

Based on the analysis, level of productivity (Total Factor of Productivity/ TFP) of meat processing industry in Indonesia between 1990 and 2013 is 127.9% that becomes positive contribution of growth of technology and negative contribution of growth of efficiency and economic scale. The market structure of the industry is strict oligopoly, where average growth of productivity of the four largest company in the industry (CR4) is 62.5%. Concentration, capital intensity and number of business unit have positive significant influence towards productivity, while intensity of import and collusion have negative significant influence towards growth of productivity. Level of productivity is increasing after the implementation of anti-monopoly regulation, while level of productivity decreases after the implementation of regulations related to imported meat quota.

POLICY IMPLICATION

Increasing productivity in Indonesian meat processing industry happens due to technology instead of growth of economy or economic scale. It can be seen based on low growth of economy and economic scale. Policy to increase efficiency and economic scale can happen by the use of efficient raw material, increasing skills of employees and use of efficient fuel such as natural gas, using local products as capital, increasing capacity of production by facilitating market access and raw materials as well as continuous supervision from anti-monopoly regulation executors.

Collusion and intensity of import can reduce growth of productivity. There should be a policy that requires supervision towards companies that have collaboration for setting production and prices. Companies should be encouraged to work together in terms of transfer of technology between companies, getting raw materials to improve efficiency of the companies. There should be supervision related to imported meat intensity of which allocation is given to household consumption, hotel, restaurant and catering. Increasing import will decrease productivity of meat processing industry so that imported meat quota and meat product regulations should consider sustainability of meat processing and livestock industry in Indonesia.

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