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Measuring the Productivity of the Foods and Beverages Industries in Indonesia: What Factors Matter?

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Abstract

The foods and beverages industries have shown the largest share of output in the manufacturing sector of Indonesia for more than a decade. This study aims to investigate its performance indicators through the growth of total factor productivity (TFP) and its determinants, such as imported raw materials, exports, absorptive capacity, firm size, market concentration, and capital ownership. This study employed firm-level panel data from 2008–2015 and the Growth Accounting method of Solow residual in addition to the fixed effects model to estimate TFP growth and its determinants. The results show that the foods and beverages industries in Indonesia showed positive TFP growth from 2008–2015. Moreover, variables of absorptive capacity, firm size, and market concentration promote the TFP growth of firms. Meanwhile, import intensity discourages TFP growth. However, within a certain threshold, firms with import activities perform better than non-importer firms. However, imports and exports may entail transfer of technology and knowledge and will be the bridge between the firms and the advanced market. This study recommends that policy makers increase the managerial capabilities of firms through a more massive training program as well as provide incentives to workers in the form of rewards or relief of income tax, while also improve product competitiveness through more intensive programs on the Indonesian National Standard (SNI) and the Domestic Component Level (TKDN).

Keywords: foods and beverages; manufacture; productivity

JEL classifications: D24; F23

1. Introduction

The manufacturing industry of Indonesia, for at least one decade, is the tenth biggest in the world, implying its remarkable contribution as the largest contributor to the economy of Indonesia. BPS-Statistics Indonesia (2020) notes that this manufacturing industry promotes more than 20% of the total Gross Domestic Product (GDP) or an average of 25% from 2005 to 2014. The year of 2005 is recorded as the largest contribution by 27.4% but in the following nine years slightly decreased to 25% in 2014 and 19% in 2018. Among the 24 subsectors of the manufacturing industry, the foods and beverages sectors have the largest share of output of more than 20% since 2006.

Considering that the foods and beverages industries are pivotal subsectors in the manufacturing industry, it is essential to measure the performance of this subsector to identify the factors that matter to its economic indicators. An indicator to which literature has devoted their effort is the growth of total factor productivity (TFP) that captures both the upward and downward marginal productivity of all factors, e.g. capital and labor (Fuentes & Morales 2011). Some studies have been conducted to investigate the TFP growth of the foods and beverages industries in Indonesia. For instance, by employing the Stochastic Frontier Analysis (SFA) approach, Sari, Khalifah & Suyanto (2016) demonstrate the spillover effects of foreign direct investments (FDI), foreign capital ownership, intensity of imported raw materials, export intensity, absorptive capacity, and

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market concentration on the efficiency and productivity of firms. The result shows that all those variables significantly promote efficiency and productivity of firms.

Moreover, by using the Luenberger indicator with fixed effects and random effects model, the finding by Sari, Khalifah & Suyanto (2016) is supported by Setiawan (2019) that reveals the negative effect of market concentration in the foods and beverages industries on productivity. This finding argues that the greater magnitude of market concentration lowers competition among firms. This condition is obtained as firms with large production size will dominate the market concentrated merely in several producers. Consequently, the productivity of the more-dominating firms will be markedly positive while the less-dominating firms might encounter lower productivity because of less efficiency of production.

Even though there is a large number of studies discussing the determinants of productivity, to the best of the knowledge of the author, there are a few published studies that employed the Growth Accounting method of Solow (1956) for the firm-level perspective. Therefore, this study contributes to the literature by employing the Growth Accounting method to calculate TFP growth. This approach is essential as studies of Margono & Sharma (2006), Sari, Khalifah & Suyanto (2016), Suyanto, Salim & Bloch (2009), and Suyanto & Salim (2011), demonstrating the partial effect of firm size, region, capital ownership, age, imported materials and exports on efficiency, do not investigate the direct effects of the variables on productivity, despite the possibility of their direct effects on TFP of firms. Moreover, Fuentes & Morales (2011) postulated that the Neoclassical production function represents the maximum output that can be obtained from a combination of production factors. However, it might exist several omitted factors that will render it impossible to achieve the production frontier, such as the adjustment costs for intersectoral reallocation of resources and technology diffusion. In this regards, the effect of these potential omitted factors must then be explained by the disturbance term in the growth accounting approach. Therefore, the main purpose of this study is to answer the following questions: do the foods and beverages industries experience positive TFP growth? Supposing they do, do the factors such as imported materials, exports, absorptive capacity, firm size, market concentration, and capital ownership affect the productivity of firms in the foods and beverages industries?

The remaining sections are organized as follows. Section 2 discusses the literature review. Section 3 documents the data, methodology, and the econometric specification. This section is then followed by section 4 that presents the findings and further discussion. Finally, the conclusion and policy implications are explained in the section 5.

2. Literature Review

The notion of Total Factor Productivity (TFP) is based on the decomposition of outputs that is not included by the amount of production factors (Comin 2010). In this regard, the intensity and efficiency of production factors determines the level in which TFP is estimated. Seminal papers have been prolific and the indicators to measure TFP remain growing. The growth accounting method was the initiator to measure TFP. The growth accounting method conventionally calculates with an aggregate neoclassical production function that elucidates both upward as well as downward marginal productivity of all factors employed, e.g. capital and labor, and constant returns to scale (Fuentes & Morales 2011). The Growth Accounting approach reveals TFP growth as the residual level of the production function after the contribution of the growth of all factors to output growth is estimated. Hence, the residual represents the exogenous factor proximate directly with a technological level and technological progress. The production function is stated as follows:

$$\mathrm{Y_t} = \mathrm{F}(\mathrm{K_t}, \mathrm{h_t L_t}, \mathrm{Z_t}) \quad (1)$$

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where Y is the total output as a function of the physical capital (K), raw labor (L), human capital (h) and a TFP index (Z). Meanwhile, K, h, and L capture input factors, and Z is the residual to capture the exogenous factor associated directly with a technological level as well as a technological shock.

Widodo & Firmansyah (2017) investigate the sources of Total Factor Productivity (TFP) growth of the foods and beverages industries of Indonesia in 2000–2009. By employing the non-parametric approach of Fare and Primont index of productivity, they discover that the industry processing and preserving meat, fish, fruits, vegetables, cooking oil, and fat provides the utmost contribution to productivity growth. Jafrizal (2017) estimates the level of TFP growth as well as its determinants in the subsector industry of meat processing in Indonesia in 1990–2013. By employing Data Envelopment Analysis (DEA), the study discovers that the meat processing sector experiences a large magnitude of TFP at 127.9%, consisting of 114.29% of technological progress. It also demonstrates that factors such as industrial concentration, capital intensity, and the number of business unit affect TFP positively. The anti-monopoly policy stipulated during the period of study has a significant influence in obtaining the TFP level that rises following the policy. In contrast, the level of productivity decreases following the initiation of the regulation on imported meat quota.

The intensity of imported materials and export intensity are considered to affect the productivity of firms. Amiti & Konings (2007) examine the effects of reducing input tariffs on the productivity of firms. They discover a significant effect where productivity improves by 12% with a decrease in input tariffs by 10%. De Loecker (2013) examines the potential effect of the learning-by-exporting (LBE) method using micro data from Slovenia. LBE refers to a mechanism by which the performance of a firm improves subsequent to entering the export market. This mechanism can be explicitly captured by estimating productivity evolution by depending on previous export experience. De Loecker (2013) discovers that there is a remarkable increase in productivity when firms enter export markets. This study is later promoted by Atkin, Khandelwal & Osman (2017) deploying a case of Egypt where firms show the learning-by-exporting method through the information flows that lead to significant demand for high-quality products from knowledgeable buyers in addition to the wider market access to the domestic markets.

Absorptive capacity is associated with the quality of human capital of a firm. This is because it recognizes relevant external knowledge as a source and demands more resources to transform the knowledge to be later assimilated with the existing knowledge (Todorova & Durisin 2007). Henry, Kneller & Milner (2009) propose that the existing level of human capital may enhance the possibility of higher technology absorption as firms with a large number of high-skilled workers will absorb advanced technology learning faster. Le & Pomfret (2011) proxy this absorptive capacity with labor costs per person, such as training and wages, meaning that a firm empowers more high-skilled workers to absorb technology transfer more easily and reach faster productivity.

Other factors such as firm size, market concentration, and capital ownership are also acknowledged to affect the productivity of firms. Sari, Khalifah & Suyanto (2016) argue that a larger firm may have higher productivity as their capital equipment and advanced technology are easily more dominant. Meanwhile, market concentration may also affect productivity. Setiawan, Emvalomatis & Lansink (2012) observe the effect of industrial concentration of the foods and beverages industries on the efficiency of firms in 1995–2006. They discover that industrial concentration of the foods and beverages industries affects technical efficiency negatively. This finding indicates that firms in highly concentrated industry prefer to obtain more price-cost margin through cartels or anticompetitive practices to from efficiency enhancement. Hence, maintaining an oligopolistic structure in industry creates a distortion, implying a waste of resources in the

economy of Indonesia. Capital ownership is considered as a determinant of TFP by several studies (Aritenang & Chandramidi 2020; Sari, Khalifah & Suyanto 2016). Those studies examine whether foreign capital owned as a form of foreign direct investment promotes efficiency and productivity. In this regard, firms with foreign capital ownership may gain support from their headquarters located in foreign country. Therefore, it may affect their productivity.

3. Method

This study employed the firm-level data of the annual survey on the large and medium foods and beverages manufacturing sectors from 2008 to 2015 obtained from BPS-Statistics Indonesia. The data represent 74.71% of the population of the manufacturing firms in Indonesia. All firms from the foods (code 10) and beverages (code 11) sectors that are two-digit aggregation level based on the Indonesian Industrial Standard Classifications (KBLI) are included. To elaborate the analysis, the three-digit KBLI is also revealed. In collecting the dataset to classify large and medium firms, BPS-Statistics Indonesia refers to the number of workers employed. A firm is categorized as medium level if it employs between 20 to 99 workers. Meanwhile, firm that employs more than 100 workers is categorized as large firm.

The number of firms in the dataset change significantly over the year due to business closing or subsector shifting. Although balanced panel might capture better constant estimates, however, selecting balanced panel data may reduce the observation significantly. In this regard, this study used unbalanced panel data from firms that existed in the industry for at least three years. Even though a minimum period of two years is sufficient to estimate TFP growth, this study is based on a three-year period as it enables this study to compare the current output of the firms with the output of the previous year(s). However, observation with balanced panel is also revealed for robustness test purpose.

This study considered several primary variables on behalf of the production function, i.e. total output, capital approximated by fixed assets of a firm (in Rupiah), number of workers, energy (in Rupiah), and raw materials (in Rupiah). Moreover, this study considered several variables contributing to TFP growth, i.e. the intensity of imported materials (the ratio of imported raw materials to total materials), export (1 supposing the firm is an exporter, and 0 otherwise), absorptive capacity (average labor costs, i.e. wage and salary, per worker), firm size (the ratio of the output of the firm to the total output in the industry), the degree of market competition proxied by Herfindahl-Hirschman index (HHI), and capital ownership (1 supposing the firm has at least 10% foreign capital share, and 0 otherwise (see Sari, Khalifah & Suyanto 2016).

The descriptive statistic of those variables is summarized in Table A1 in Appendix. The number of firms observed in this study ranges from 2,425 to 3,104 firms each year.[1] In general, the output growth of the foods and beverages industries is positive following the increase in the number of firms. The highest average output growth is in 2013 at 367%, in line with the growth of firms by 1.5%. Moreover, the value of capital shows dramatic fluctuations with a large deviation during 2008-2015. Another highlight is the heterogeneity of the data. In terms of capital ownership, there are 4.8% firms with foreign ownership under observation. The average firm size does not change significantly at averagely 0.07%. In addition, market concentration shows a significant decrease from 2008–2011, meaning higher competitiveness in the foods and beverages industries.

The variables of monetary value, such as output, capital, energy, material, and cost of labor might be biased supposing these are directly used. Therefore, an adjustment to the price index is required to ensure that the data are constant (Yasin 2021). This adjustment employed the deflating approach

[1] In terms of balanced panel data, the total firm is 758 each year.

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by dividing the current value of output by the deflator calculated from the Wholesale Price Index of 2010 multiplied by the growth of Wholesale Price Index between periods t and $\mathrm{t}-1$.

We employed the Translog model postulated by Christensen, Jorgenson & Lau (1973) and that has been used by current studies such as Misra (2019) and Nafar (2017). The Translog model uses the Solow residual approach to estimate TFP growth using Ordinary Least Square (OLS) regression. We discovered that most of the growth accounting studies used the basic Cobb-Douglas production function with two production factors such as capital and labor. Consequently, the assumption of constant elasticity substitution, a stringent assumption that is supposedly ignored when we use Translog, should be applied (Kumbhakar & Wang 2005; Wang & Wong 2012). Therefore, we elaborated the specification by using the Translog production function with four inputs – capital, labor, energy, and raw materials. The Translog production function is specified as follows.

$$\begin{aligned}\mathrm{y_{it}} &= \alpha_{\mathrm{k}}(\mathrm{k_{it}})+\alpha_{\mathrm{l}}(\mathrm{l_{it}})+\alpha_{\mathrm{e}}(\mathrm{e_{it}})+\alpha_{\mathrm{r}}(\mathrm{r_{it}})\\ &+\frac{1}{2}\alpha_{\mathrm{kk}}(\mathrm{k^2})_{\mathrm{it}}+\frac{1}{2}\alpha_{\mathrm{ll}}(\mathrm{l^2})_{\mathrm{it}}+\frac{1}{2}\alpha_{\mathrm{ee}}(\mathrm{e^2})_{\mathrm{it}}\\ &+\frac{1}{2}\alpha_{\mathrm{rr}}(\mathrm{r^2})_{\mathrm{it}}+\alpha_{\mathrm{kl}}(\mathrm{k_{it}}\times\mathrm{l_{it}})+\alpha_{\mathrm{ke}}(\mathrm{k_{it}}\times\mathrm{e_{it}})\\ &+\alpha_{\mathrm{kr}}(\mathrm{k_{it}}\times\mathrm{r_{it}})+\alpha_{\mathrm{le}}(\mathrm{l_{it}}\times\mathrm{e_{it}})\\ &+\alpha_{\mathrm{lr}}(\mathrm{l_{it}}\times\mathrm{r_{it}})+\alpha_{\mathrm{er}}(\mathrm{e_{it}}\times\mathrm{r_{it}})+\alpha_{\mathrm{t}}(\mathrm{t})\\ &+\alpha_{\mathrm{kt}}(\mathrm{k_{it}}\times\mathrm{t})+\alpha_{\mathrm{lt}}(\mathrm{l_{it}}\times\mathrm{t})+\alpha_{\mathrm{et}}(\mathrm{e_{it}}\times\mathrm{t})\\ &+\alpha_{\mathrm{rt}}(\mathrm{r_{it}}\times\mathrm{t})+\frac{1}{2}\alpha_{\mathrm{tt}}(\mathrm{t^2})+\mathrm{A_{it}} \qquad (2)\end{aligned}$$

Where y is the total output, k is capital, l is labour, e is energy, r is raw materials. Those variables are expressed in natural logarithmic and the deviation from its geometric mean. Subscript i and t denote i-th firm and t-th year. $\mathrm{A_{it}}$ is the residual that represents TFP growth where generally $\mathrm{A_{it}}=\exp\left(\frac{\mathrm{Y_{it}}}{\mathrm{K_{it}}.\mathrm{L_{it}}.\mathrm{E_{it}}.\mathrm{R_{it}}}\right)$. t is a time variable. While the equation of the determinants of TFP is specified as follow.

$$\begin{aligned}\mathrm{TFP_{it}} &= \phi_0+\phi_{\mathrm{imp}}\mathrm{Import_{it}}+\phi_{\mathrm{exp}}\mathrm{Export_{it}}\\ &+\phi_{\mathrm{Abs}}\mathrm{Absorptive_{it}}+\phi_{\mathrm{fsize}}\mathrm{FirmSize_{it}}\\ &+\phi_{\mathrm{fsize}}\mathrm{MarketConcentration_{jt}}\\ &+\phi_{\mathrm{HHI}}\mathrm{Own_{it}}+\varsigma_{\mathrm{it}} \qquad (3)\end{aligned}$$

Where ϕ is the coefficient of TFP's determinants and ς are error terms. To estimate these parameters, Fixed Effect model is employed.

The intensity of imported materials estimates whether the exposure of import brings a positive impact on TFP growth. Likewise, exporter firms may also reveal a notable contribution to TFP growth. In terms of absorptive capacity approximated by labor cost per workers, a higher value is assumed that the firm empowers high-skilled workers that leads to higher TFP growth (Le & Pomfret 2011). Firm size represents the share of the firm in an industry, in which a greater share may lead to greater TFP growth. The degree of market competition captures the competitiveness among firms in an industry. A higher level of HHI interprets that an industry is more concentrated, leading to the less competition. The dummy capital ownership represents the foreign capital share of a firm.

A suitable model to reveal the findings is necessitated to ensure that the regression result is valid. This study refers to the two tests, F-Test and Hausman Test, to determine which model is appropriate for further analysis. F-test is to determine between Pooled Ordinary Least Square (POLS) (as the null hypothesis) and Fixed Effect Model (FEM) (as the alternative hypothesis). The significant by 10% of the F-statistic in the FEM model reveals the valid utilization of FEM model. The following test is Hausman test to select between FEM (as the alternative hypothesis) and Random Effect Model (REM) (as the null hypothesis). Supposing p-value is less than 10%, we reject null hypothesis, hence FEM is employed for the analysis.

This study employed several strategies to examine the robustness in the TFP growth model. Model

1 refers to a full unbalanced observation without year-specific effect, while Model 2 refers to a full unbalanced observation with year-specific effect. Model 3–6 are the 50% quantile group by the average TFP growth of each firm. Model 3 and 4 are the first quantile group without and with year-specific effect. Model 5 and 6 are the second quantile group without and with year-specific effect. Model 7 and 8 refer to a full balanced observation without and with year-specific effect.

4. Result

The two-steps of regression is conducted in this study. The first step is to calculate TFP growth, and the second step is to determine factors influencing TFP growth. The first step was conducted with Translog function. The results of the estimation are shown in Table 1.

According to Table 1, our production function is relatively robust for all models. Table 1 also exhibits the more suitable production function to be analyzed further, either POLS or FEM, by addressing the F-test of FEM. As the p-value of the F-test is lower than 1%, the null hypothesis is rejected, and FEM is used for further analysis. In terms of significance and the magnitude of the coefficient, the results, as expected, show that capital, labor, energy, and raw materials are statistically significant in affecting output. Among those four variables, raw materials have the largest coefficient of more than 0.5, implying the largest role towards output of the foods and beverages industries. This finding is relatively similar to prior studies such as those by Sari, Khalifah & Suyanto (2016) and Esquivias & Harianto (2020).

Referring to the unbalanced panel observation, the further step is to test FEM and REM model using the Hausman Test. The result presented in Table 2 shows that the p-value is lower than 1%, meaning that we reject null hypothesis, and FEM is, finally, used to calculate the total factor productivity.

The following step is to estimate TFP using equation (3). This estimation is summarized in Figure 1.

According to Figure 1, overall, total factor productivity of the foods and beverages industries shows positive trend during 2009–2015. A slight decrease occurred in 2014 to -16.18% from 16.92% in 2013, yet, it positively increased to 6.84% in 2015. To elaborate the analysis, Figure 2 reports the TFP score based on three-digits KBLI[2].

According to Figure 2, the subsector of Meat Processing and Preservation in the Foods Industry (Code 101) shows the highest average TFP growth of 5.02%, while Milk Processing Industry, Milk and Ice Cream Products (Code 105) shows the lowest average TFP growth of 1.07% in 2009–2015. The beverages industry shows a TFP growth of 5.81%, leading the magnitude of TFP growth in this study. The following step is to examine the determinants of TFP growth. The result is reported in Table 3.

According to Table 3, several variables are statistically significant at =10% for all models except exports. Imports is found significantly negative. It means that an increase in imported materials significantly decreases the TFP growth of firms. This result is in contrast with Damijan, De Sousa & Lamotte (2009), Sari, Khalifah & Suyanto (2016), and Setiawan (2019). Even though Damijan, De Sousa & Lamotte (2009) postulate that firms importing materials are forced to meet the stringent technical standards to empower sophisticated technology offered by the advance market, in terms of the foods and beverages industries, this argument is not relevant. A plausible reason for this finding may be attributed to the program of the government of Indonesia to impose the minimum level of domestic component (TKDN) for the manufacturing industry. According to the BPS-Statistics Indonesia (2015), the Foods and Beverages industries are the fifth and sixth lowest subsectors in terms of the intensity of imported materials. In this sense, it may affect the TFP growth of importers whose performance is deteriorating. Meanwhile, the insignificant effect of exports indicates that being exporter firms

[2]The list of three-digit subsector is summarized in the Appendix.

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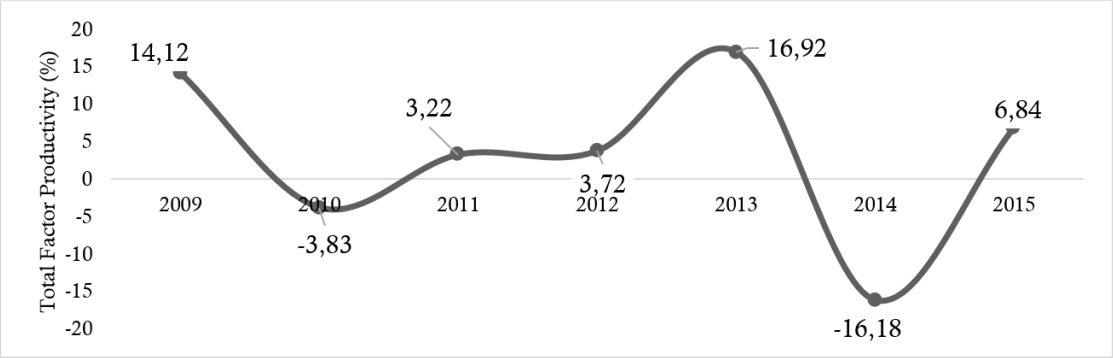

Figure 1. The Average Total Factor Productivity in 2009–2015
Source: Author's calculation

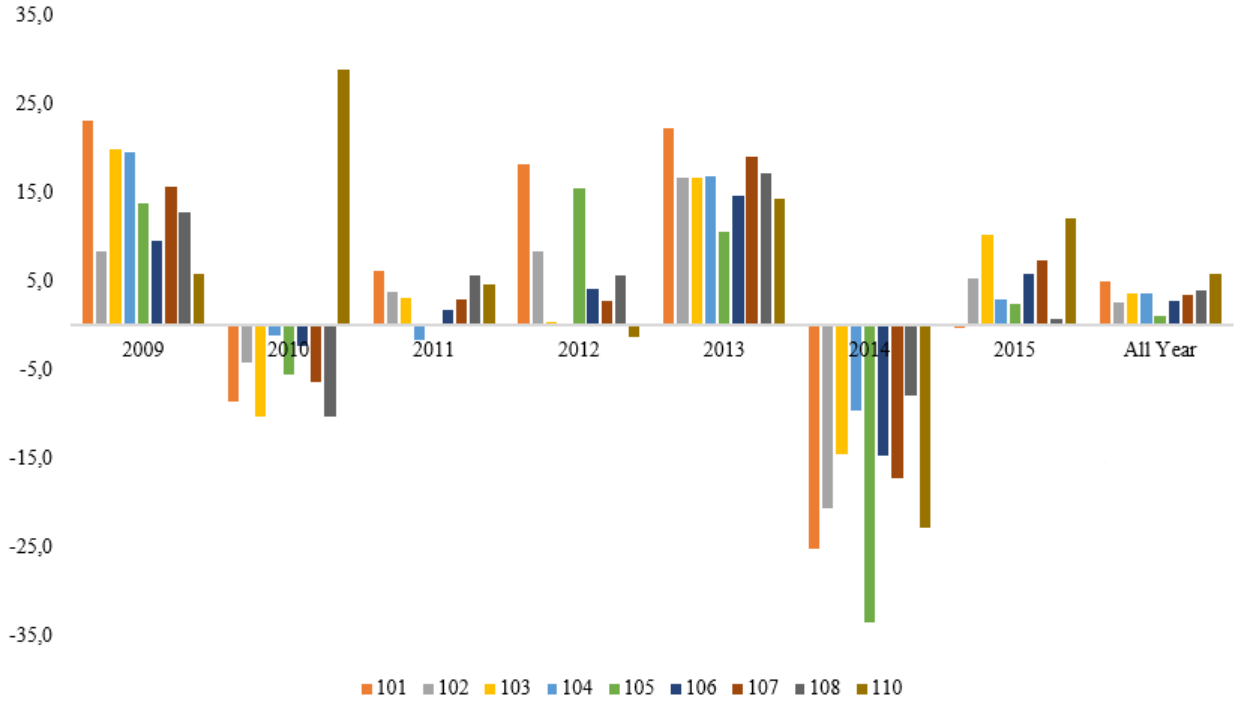

Figure 2. The TFP Score Based on Three-Digits KBLI
Source: Author's calculation

Table 1. The Regression of Production Function

	Unbalanced Panel Observation			Balanced Panel Observation		
	POLS	FEM	REM	POLS	FEM	REM
k	0.08***	0.028***	0.059***	0.069***	0.031***	0.050***
	(0.002)	(0.003)	(0.002)	(0.004)	(0.005)	(0.004)
l	0.253***	0.189***	0.279***	0.186***	0.135***	0.187***
	(0.006)	(0.011)	(0.008)	(0.01)	(0.018)	(0.013)
e	0.117***	0.108***	0.121***	0.109***	0.106***	0.112***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.006)	(0.005)
r	0.680***	0.633***	0.668***	0.703***	0.682***	0.701***
	(0.002)	(0.004)	(0.003)	(0.004)	(0.006)	(0.005)
k × l	0.041***	0.028***	0.032***	0.048***	0.024***	0.033***
	(0.003)	(0.003)	(0.003)	(0.006)	(0.006)	(0.006)
k × e	0.01***	0.009***	0.01***	0.018***	0.013***	0.016***
	(0.001)	(0.001)	(0.001)	(0.003)	(0.003)	(0.003)
k × r	-0.042***	-0.0031***	-0.034***	-0.039***	-0.03***	-0.033***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.003)	(0.002)
l × e	0.011***	0.017***	0.016***	0.008	-0.002	0.005
	(0.003)	(0.004)	(0.003)	(0.006)	(0.008)	(0.007)
l × r	-0.09***	-0.096***	-0.093***	-0.089***	-0.094***	-0.088***
	(0.003)	(0.003)	(0.003)	(0.005)	(0.007)	(0.006)
e × r	-0.056***	-0.049***	-0.053***	-0.058***	-0.045***	-0.049***
	(0.001)	(0.001)	(0.001)	(0.003)	(0.003)	(0.003)
k × k	0.007***	0.001	0.003***	0.001	-0.005**	-0.003
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
l × l	0.009	0.007	0.008	0.032**	0.059**	0.06***
	(0.008)	(0.011)	(0.009)	(0.016)	(0.023)	(0.02)
e × e	0.043***	0.03***	0.039***	0.034***	0.029***	0.031***
	(0.002)	(0.002)	(0.002)	(0.004)	(0.004)	(0.004)
r × r	0.155***	0.123***	0.141***	0.155***	0.128***	0.14***
	(0.001)	(0.001)	(0.001)	(0.003)	(0.003)	(0.003)
t	0.025***	0.039***	0.029***	0.021***	0.028***	0.023***
	(0.002)	(0.002)	(0.001)	(0.003)	(0.002)	(0.002)
t × t	-0.006***	-0.009***	-0.007***	-0.003	-0.005***	-0.003**
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
k × t	0.002**	0.003***	0.002***	0.002	0.004***	0.004***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
l × t	0.007***	0.011***	0.011***	0.009**	0.011***	0.009***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)
e × t	0.004***	0.002**	0.002**	0.002	0.002	0.001
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
r × t	-0.009***	-0.009***	-0.010***	-0.009***	-0.011***	-0.011***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
	-0.174***	-0.088***	-0.126***	-0.229***	-0.185***	-0.218***
Constant	(0.006)	(0.007)	(0.007)	(0.009)	(0.011)	(0.012)
Observations	22621	22621	22621	6064	6064	6064
R-squared	0.951	0.749	0.743	0.954	0.804	0.802
P-Value	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***

Source: Author's calculation

Note: POLS is Pooled Least Square, FEM is Fixed Effect Model, and REM is Random Effect Model. Standard error in parentheses, *: α=10%, **: α=5%, ***: α=1%.

does not significantly promote productivity. This finding promotes the finding of Negara & Adam (2012) that suggest that the insignificant effect of exports on the productivity is caused by the economy of Indonesia that is dominated by domestic consumption. Moreover, Tojo & Matsubayashi (2011) suggest that exporters will benefit from export activities only supposing they fill the dominant portion of their total sales, otherwise exporters will handle large transaction costs as well as demanding technical barriers of trade that in turn sink their profits. As our variable of exports only captures a binary dummy, it does not represent the quantity of exports. Figure 3a illustrates TFP growth differentiated by importers.

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Table 2. The Result of Hausman Test of Production Function

Test: Ho: difference in coefficients not systematic
Chi2(20) = 1167.47
Prob>Chi2 = 0.000

Source: Author's calculation

Table 3. The Regression of the Determinants of TFP Growth from Fixed Effect Model

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Import Intensity	-0.112*	-0.106*	-0.278***	-0.258***	0.019	-0.258***	-0.237**	-0.202**
	(0.061)	(0.059)	(0.085)	(0.082)	(0.086)	(0.082)	(0.089)	(0.087)
Export	0.018	0.019	0.009	0.017	0.028	0.017	0.009	-0.003
	(0.026)	(0.025)	(0.035)	(0.034)	(0.039)	(0.034)	(0.038)	(0.038)
Absorptive Capacity	0.033***	0.019***	0.03***	0.012**	0.036***	0.012**	0.034***	0.018***
	(0.004)	(0.004)	(0.005)	(0.006)	(0.005)	(0.006)	(0.005)	(0.006)
Firm Size	7.296***	8.262***	3.443	3.688	10.26***	3.688	5.066***	5.090***
	-1.877	-1.823	-2.667	-2.577	(2.65)	-2.577	(0.958)	(0.935)
Market Concentration	1.354***	3.045***	0.695*	1.359	2.053***	1.359	-0.272***	0.88
	(0.284)	(0.97)	(0.367)	-1.305	(0.438)	-1.305	(0.099)	(0.367)
Capital Ownership	-0.083	-0.069	0.005	0.028	-0.191**	0.028	-0.180**	-0.178**
	(0.054)	(0.052)	(0.068)	(0.066)	(0.086)	(0.066)	(0.077)	(0.075)
Constant	-0.526***	-.244***	-0.532***	-0.189*	-0.506***	-0.189*	-0.474***	-0.202**
	(0.055)	(0.075)	(0.073)	(0.099)	(0.082)	(0.099)	(0.081)	(0.087)
Observations	15681	15681	7938	7938	7743	7938	5306	5306
R-squared	0.013	0.071	0.01	0.079	0.018	0.079	0.019	0.067
Dummy Year	NO	YES	NO	YES	NO	YES	NO	YES

Source: Author's calculation

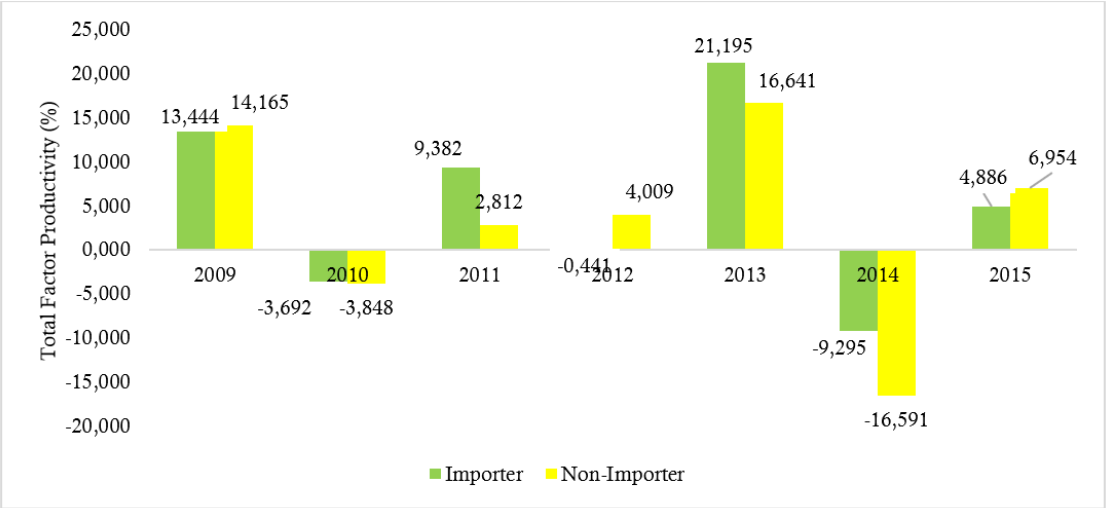
Note: t-statistic in parentheses, *: α=10%, **: α=5%, ***: α=1%.

Model 1 refers to a full unbalanced observation without year-specific effect.
Model 2 refers to a full unbalanced observation with year-specific effect.
Model 3–6 are the 50% quantile grouped by the average TFP growth of each firm.
Model 3 and 4 are the first quantile group without and with year-specific effect.
Model 5 and 6 are the second quantile group without and with year-specific effect.
Model 7 and 8 refer to a full balanced observation without and with year-specific effect.

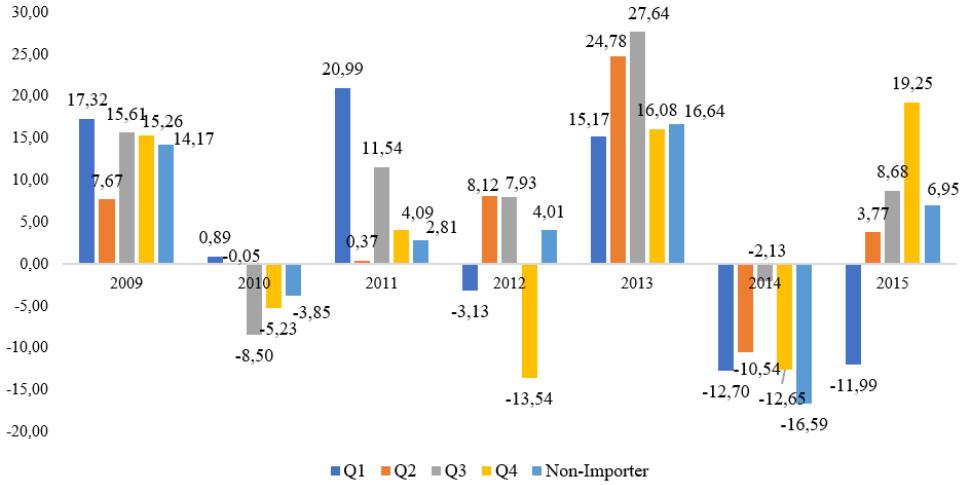
Figure 3a shows the mixed results of TFP growth between importer and non-importer firms. In 2010, 2011, 2013, and 2014, importer firms experience better TFP growth than non-importer firms with a difference of 0.15%, 6.57%, 4.55%, and 7.29% respectively. In contrast, 2009, 2012, and 2015 are dominated by non-importer firms with a difference of 0.72%, 4.4%, and 2.06% respectively from importer firms. This result shows a contrast finding with our estimation in Table 3. A plausible reason is that the magnitude of imported materials might matter. In this regard, within a certain threshold, imported materials may remain needed to support TFP growth of firms. We prove this argument by illustrating the quantile value of TFP growth based on import intensity (Q1, Q2, Q3, Q4) and non-importers (Figure 3b). Figure 3b shows that non-importer firms do not experience the highest TFP growth for all periods. Meanwhile, each threshold of import intensity experiences, at least once, the highest TFP growth.

Figure 4 illustrates the TFP growth differentiated by exporters. According to Figure 4, exporter firms lead to higher TFP growth in 2009, 2010, 2011, and 2013. As these results are relatively similar, it suggests that the presences of imports and exports as openness variable in promoting TFP may be indifferent. In this sense, global demand during those years might affect the performance of the foods and beverages industries in Indonesia.

Absorptive capacity contributes significantly positive to TFP growth. This result reveals that when firms allocate more spending on high-skilled workers, the TFP growth rate will rise. This finding is plausible as the number of human capital is an essential factor for faster absorption of the technology transfer as the quality of workers will be assessed by this indicator (Henry, Kneller & Milner 2009). Theoreti-



a. The Average TFP Growth in 2009-2015 based on Importers and Non-importers



b. TFP growth Based on the Quantile of Import Intensity

Figure 3
Source: Author's calculation

cally, absorptive capacity consists of cost of training, in this sense investing to the human capital such as the spending on labor training might also foster firms' TFP growth.

Firm size statistically shows a large significant positive effect on TFP growth, meaning that a larger firm will rapidly and largely grow TFP. This finding is plausible as some studies claimed that larger firms are more likely to possess advanced technology and capital equipment compared to the relatively smaller firms (Sari, Khalifah & Suyanto 2016; Yasin 2020). Moreover, as the foods and beverages industries are most likely to have identical outputs, the larger outputs produced by advanced technology will directly represent higher TFP growth. Thus, indirectly, technology diffusion might have a pivotal role in enlarging the growth scale of the foods and

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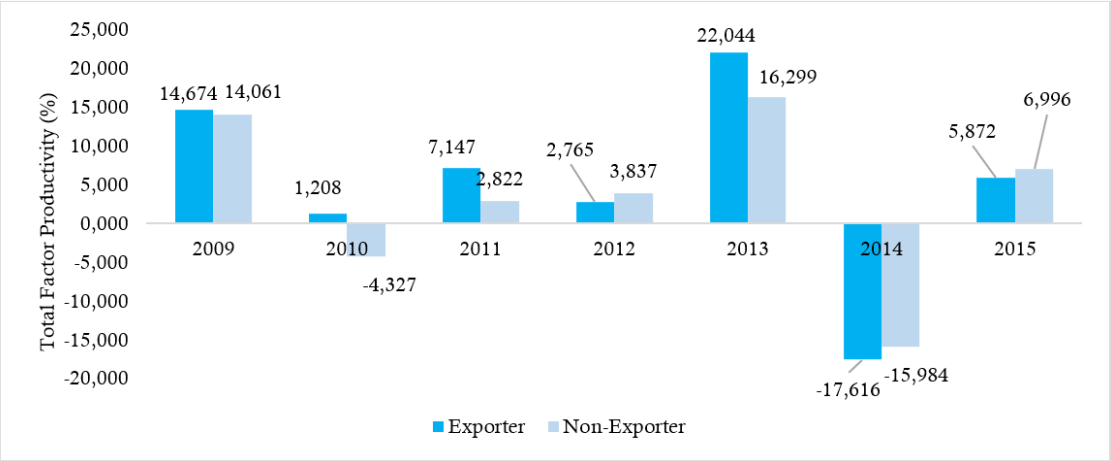

Figure 4. The Average TFP Growth in 2009-2015 based on Exporters and Non-exporters
Source: Author's calculation

beverages industries.

Market concentration, proxied by the HHI, has a significant positive effect. This finding implies that higher market concentration means less competitive market that will increase the TFP growth of firms. This finding supports the argument of Teece (2011) that higher market concentration comes from the competition that is dynamic and progressive, that technically removes less high-yielding firms from the industry. Therefore, only highly productive firms that survive in the industry. Setiawan, Emvalomatis & Lansink (2013) contend that the foods and beverages industries in Indonesia are classified as an industry with oligopoly market structure that might provide less incentive for firms to be more efficient. Thus, higher market concentration will not motivate them to be more efficient. Consequently, less productive firms cannot compete with more productive firms, removing them from the industry.

Capital ownership reveals insignificant effect on productivity. It shows that foreign firms have insignificantly different magnitude of TFP growth compared to the local firms. This finding is in contrast to the study by Dachs & Peters (2014) arguing that a foreign firm is affiliated in ownership to a parent company headquartered in a foreign country. In this sense, the parent company may provide the subsidiary company, the foreign-acquired firm, with an access to new technologies. However, our finding is supported by the argument of Fu & Gong (2011) suggesting that a parent company may give its subsidiaries the access merely to apply and adapt the advanced technology, while the parent company continues its core technology development in the headquarter. In this sense, a foreign high-technology firm cannot achieve higher productivity that captures technological progress. Figure 4 exhibits TFP growth based on the capital ownership.

According to Figure 5, firms with foreign capital ownership lead higher TFPs in 2009, 2011, 2012, and 2013, also experienced by variables of imports and exports. This finding strengthens the argument that 2011 and 2013 are the periods in which international factors such as imports, exports, and foreign investment highly contribute to TFP growth of firms of the foods and beverages industries.

There is an emphasized implication from the aforementioned findings. The negative effect of foreign ownership on TFP growth implies the potential spillover effects that may occur from foreign company, such as Multinational Corporations (MNC), on the local company. Sari (2019) argues that the entry of foreign firms in the form of capital investments might create externalities, either positive or nega-

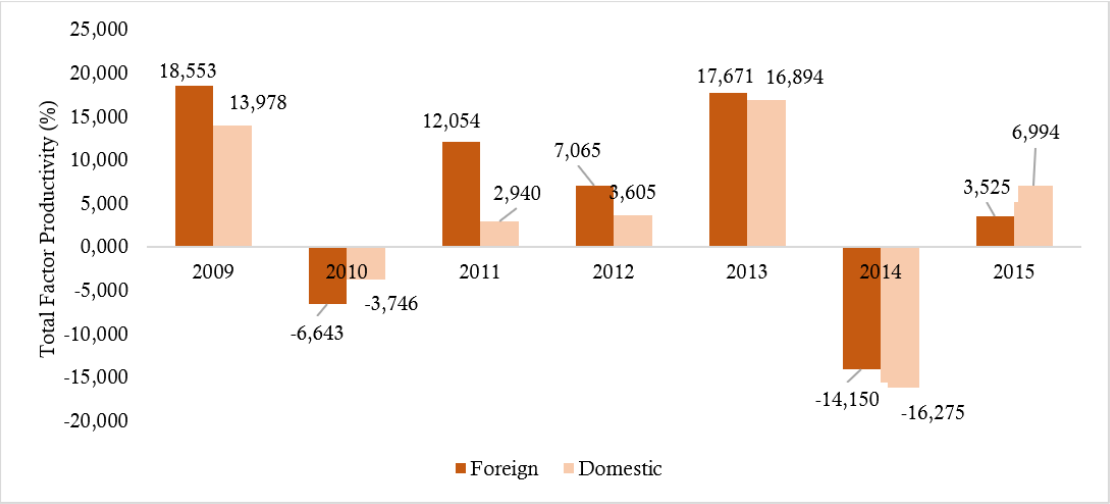

Figure 5. The Average Total Factor Productivity in 2009-2015 based of Foreign Capital Ownership and Domestic Capital-Owned
Source: Author's calculation

tive, known as spillover effects. Positive spillover occurs when the incoming MNCs are encountered as motivation by local companies to be more innovative and to intensify R&D. However, negative spillover may also happen when the incoming MNCs lead to the decline in the performance of local firms (Suyanto, Bloch & Salim 2012). As the result of this study shows that foreign companies are relatively less productive than the local companies, further studies are essential to investigate whether this performance brings positive or negative spillover for the domestic companies (see Sari 2019; Sari, Khalifah & Suyanto 2016; Suyanto, Bloch & Salim 2012).

5. Conclusion

This study has demonstrated that the foods and beverages industries experienced positive TFP growth from 2008-2015. During this period, variables of absorptive capacity, firm size, and market concentration promote TFP growth of firms. Meanwhile, import intensity discourages TFP growth. However, within a certain threshold, firms with import activities perform better than non-importer firms. This study could not discover the significant effect of exports and capital ownership in promoting productivity. This study suggests policy implications in several points. *First*, regarding the significant finding of absorptive capacity, it is essential to increase the managerial capabilities of firms through a more massive training program as well as provide incentives to workers in the form of rewards or relief of income tax. This strategy may enable to attract high-skilled workers to the firms, hence the increase in productivity.

Secondly, the findings of insignificant exports and negative impact of imports indicate that the foods and beverages industries should prioritize domestic market to boost TFP growth. However, even though the economy of Indonesia is dominated by domestic consumption, the policy implications of these findings might not totally discourage import and export activities although the empirical results of this study show that both variables do not promote TFP growth. This is because imports and exports may entail transfer of technology and knowledge and will be the bridge between the firms and the advanced market, as well as the contributor of TFP of the firms supposing the exporter firms employ more domestic component. On the other hand, this study recommends improving export and import indicators by increasing product competitiveness

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through more intensive programs on the Indonesian National Standard (SNI), providing incentives for export duties, improving infrastructure specifically for the flow of goods and services, and applying anti-dumping customs policies. Moreover, the finding that importer firms have better performance than non-importer firms within a certain threshold implies that imported materials cannot be thoroughly ignored. In this regard, it remains necessary for the government to regulate TKDN as an effective channel to promote TFP growth of local firms.

Third, as capital ownership shows insignificant effect on TFP growth, it can be acknowledged that TFP growth between local and foreign firms is not significantly different. In this regard, FDI spillover might not be the effective way to improve local firms as the local firms have similar performance with foreign firms. Instead, the significant positive impact of market concentration indicates that a higher concentration of the foods and beverages leads to a better TFP growth. Since foods and beverages industries are categorized as an oligopoly market structure, the government might have given less incentive for firms to be more productive and efficient. Thus, higher market concentration will not motivate them to be more well-performed. Consequently, less productive firms cannot compete with more productive firms, removing them from the industry. In this sense, the government regulation through the Commission for the Supervision of Business Competition (KPPU) should be intensified to ensure that market mechanism in the foods and beverages industries works appropriately.

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Appendix

Table A1. Descriptive Statistics

Variables	Units		2008	2009	2010	2011	2012	2013	2014	2015
Production Function Variables										
Output (Y)	Billion Rupiah	Mean	21.2	39.4	28.3	36.7	44.0	107.0	50.9	63.3
		Std. Dev.	162.5	325.5	173.7	262.3	331.7	1002.3	434.6	743.9
Capital (K)	Billion Rupiah	Mean	5.8	274.5	8.2	15.7	67.8	46.5	1256.9	23.3
		Std. Dev.	52.7	6872.8	70.0	266.1	2880.0	1184.1	28976.2	219.7
Labor (L)	Workers	Mean	109.7	101.2	100.8	111.4	110.0	122.9	121.9	124.2
		Std. Dev.	341.3	336.5	290.8	339.5	269.1	365.0	306.3	308.9
Energy (E)	Billion Rupiah	Mean	0.4	0.5	0.4	0.5	0.5	1.4	0.6	0.6
		Std. Dev.	2.1	4.4	2.1	4.3	4.4	12.1	6.7	6.3
Material (R)	Billion Rupiah	Mean	14.7	25.0	18.1	24.4	29.2	73.6	32.3	37.1
		Std. Dev.	105.6	182.9	107.1	168.7	215.2	851.2	285.6	309.0
TFP Determinants Variables										
Imported Raw Intensity	Ratio	Mean	0.02	0.02	0.03	0.03	0.02	0.02	0.02	0.02
		Std. Dev.	0.12	0.12	0.14	0.13	0.12	0.13	0.12	0.12
Export	Dummy	Mean	0.12	0.12	0.10	0.10	0.12	0.12	0.13	0.14
		Std. Dev.	0.33	0.32	0.30	0.30	0.32	0.33	0.33	0.35
Absorptive Capacity	Ratio	Mean	14.91	15.45	15.18	14.30	16.14	16.73	15.61	15.78
		Std. Dev.	0.82	0.82	0.88	2.10	0.71	0.69	0.86	0.82
Firm Size	Ratio	Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Std. Dev.	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.01
Market Concentration (HHI)[1]	Ratio	Mean	0.02	0.03	0.02	0.02	0.02	0.03	0.03	0.06
		Std. Dev.	0.01	0.01	0.02	0.01	0.01	0.01	0.02	0.01
Ownership	Dummy	Mean	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.05
		Std. Dev.	0.20	0.19	0.19	0.19	0.20	0.21	0.21	0.22
Number of Firms			2766	2919	3138	3223	3295	3300	3177	2998

Note: [1]The average market concentration of Foods Industry and Beverages Industry.

Table A2. Three-Digit KBLI

Code	Subsector
101	Meat Processing and Preservation Industry
102	Fish and Water Biota Processing and Preservation Industry
103	Fruit And Vegetable Processing and Preservation Industry
104	Manufacture Of Vegetable and Animal Fat as well as Edible Oils
105	Milk Processing Industry, Milk and Ice Cream Products
106	Grain, Flour, and Starch Milling Industry
107	Other Foods Industry
108	Pet-food industry
110	Beverages Industry