Impact of Agglomeration on Labour Productivity: Food and Beverage Industry in Indonesia

(Impak Penumpuan terhadap Produktivi Buruh: Industri Makanan dan Minuman di Indonesia)

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ABSTRACT

The aim of this study is to elucidate the impact of agglomeration on labour productivity. Company-level panel data covering 67,619 food and beverage industry in Indonesia were used in the analyses in the period 2000-2017. The level of agglomeration impact on productivity was measured using the spatial EG index by Ellison and Glaeser (1997). The study established that the agglomeration of food and beverage sub-industries presents a positive and significant effect on labour productivity. It also revealed that the productivity of governmental companies is higher than that of private ones. In terms of company size, when the agglomeration level is constant, small enterprises tend to gain larger benefits from productivity improvement, as a consequence of agglomeration externalities, compared to larger businesses.

Keywords: Agglomeration; industry; food and beverage; productivity; labour; Indonesia

ABSTRAK

Tujuan dari penelitian ini adalah untuk menjelaskan impak aglomerasi terhadap produktiviti buruh. Data yang digunakan dalam penelitian ini adalah data panel tingkat syarikat yang mencakupi 67,619 industri makanan dan minuman antara tempoh 2000-2017. Dalam mengukur tingkat aglomerasi terhadap produktiviti, penelitian ini mengguna pakai indeks spasial EG oleh Ellison and Glaeser (1997). Penelitian ini mendapati bahawa aglomerasi sub-industri makanan dan minuman berpengaruh positif dan signifikan terhadap produktiviti buruh. Penemuan lain juga menunjukkan bahawa produktiviti perusahaan milik kerajaan lebih tinggi daripada perusahaan swasta. Dari segi saiz syarikat, ketika tingkat aglomerasi konstan, syarikat kecil cenderung memperoleh manfaat yang lebih besar kesan peningkatan produktiviti akibat kesan luaran aglomerasi dibandingkan dengan syarikat besar.

Kata kunci: Penumpuan; industri; produktiviti makanan dan minuman; buruh; Indonesia

INTRODUCTION

The food and beverage industries are among the processing industries involved in changing raw materials, substances or components into new products. These industries have high potential and should deserve official encouragement as they make a significant contribution to the national gross domestic product or GDP (Indonesian Statistic Centre-BPS 2018) which reached 9.23% in 2017, an increase from 6.46% in 2000. This development proves that food and beverage have contributed positively to economic development over the years. The progress of this sector is the result of productivity improvement, which is the driver of economic growth in Indonesia.
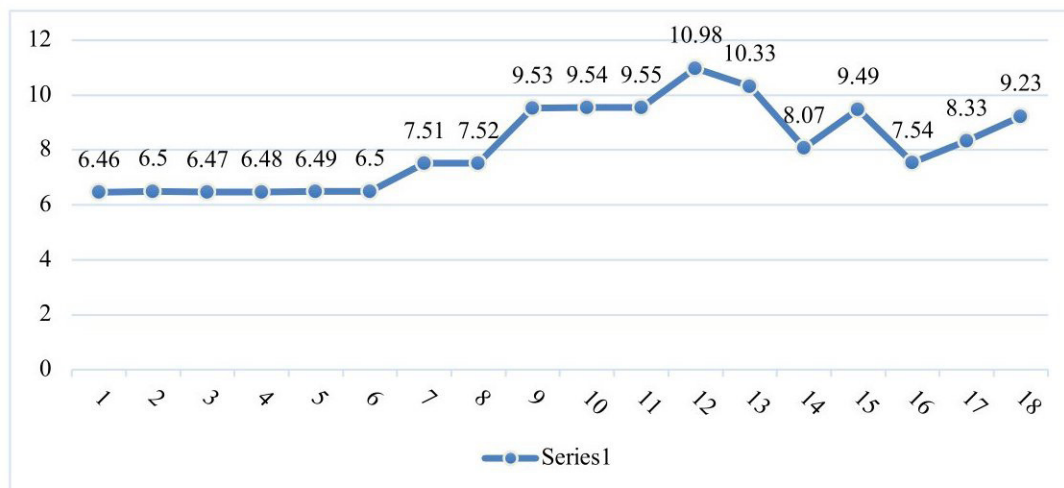
FIGURE 1. Contribution of the food and beverage industry sector to Indonesia's GDP in 2000-2017
Source: Indonesian Statistic Centre-BPS (2018)

Various approaches in gauging productivity improvement of an industrial sector are seen from the assumption of economic distance. These approaches estimate the correlation between regions and the main determinants of industrial utility (Peng & Hong 2013). The proximity of economic distance reveals that the spillover among sectors is greater than that of economic distance (Moretti 2004). Agglomeration design assumes that productivity spillover occurs due to spatial or geographical proximity among industries (Peng & Hong 2013). A new theory in economic geography states that communal representative trades in specific regions possess an insignificant supply burden compared to the diverse representative economy in various regions (Martinez-Galarraga et al. 2008).

Agglomeration is commonly understood as the grouping of similar companies in a particular region (localisation) and the grouping of different companies in another specific region (urbanisation). According to Glaeser et al. (1992), there are three types of dynamic externalities that represent companies' profits from the external economy, namely Marshal-Arrow-Romer (MAR), porter externality and Jacob's externality.

A higher agglomeration index signifies higher economic activities or centralisation in a region. The increasing concentration leads to a correlation between agglomeration degree and companies' or industries' performance in a particular area. Porter (1990), Ciccone and Hall (1993) and Indiastuti (2016) mentioned that industrial agglomeration presents a significant and positive impact on the improvement of productivity and competitiveness. The proximity factor among industries or companies is one of the aspects which enables companies' productivity improvement (Diez-Vial & Alvarez-Suescun 2011). This proximity results in a positive externality through innovation and learning among companies.

Industrial concentration for all sub-sectors tends to increase over a long-time period, according to empirical evidence (Setiawan et al. 2013). This concept agrees with a statement from Bird (1999) which stated that the concentration of industries in all Indonesian economic sectors is relatively high, and among these are the food and beverage industries.

The food and beverage industries are labour-intensive that absorb much more labour compared to other sectors. This sector engages about 21.34% of the total employment of Indonesian manufacturing industries. The figures were derived from the total number of Indonesian citizens, which reached 268 million in 2019. However, the workforce distribution in the food and beverage industries showed wide regional variation. In 1990, it was calculated that 90.45% of the industries were located in Java Island and Bali. The rest comprised 7.42% in Sumatra, 1.01% in Sulawesi, 1.01% in West Nusa Tenggara, 0.55% in East Nusa Tenggara, 0.21% in Kalimantan and 0.27% in Maluku. In Papua, the industries were localised in small areas in Papua and West Papua. The pattern of labour distribution is presently highly concentrated in Java Island and Bali.

Given the significant role of food and beverage industries in the economy, and the tendency of increasingly uneven regional concentration, the correlation between companies' proximity and productivity improvement becomes an interesting topic for elucidation. The proximity among industries or companies serves as an important factor in gauging companies' productivity improvement (Diez-Vial & Alvarez-Suescun 2011). It potentially yields a positive externality through innovation and learning among companies.

Increasing a company's productivity is a subject of the extensive study reported in the economics literature. The link between regional proximity variables and higher production is one of the most intriguing issues of discussion. Several studies have shown that industrial agglomeration is associated with improved community welfare and economic development in the surrounding areas due mainly to the greater concentration of industrial

activity. Such regional concentration produces positive externalities if fostered by innovation and learning between businesses. Further, the clustering of employees with specialised skills contributes to efficiency that significantly reduces labour training expenses. Due to knowledge spillover in the same sector companies in neighbouring areas, businesses will be able to acquire new technologies and expertise with relatively greater ease and efficiency. The ultimate positive effects include an increase in productivity and the creation of economic efficiencies, such as the reduction of local input costs (raw materials and labour) and advertising expenses. However, Baldwin et al. (2010), Fleisher et al. (2010), and Rosenthal and Strange (2004) maintained that population density issues actually create a negative link between industrial agglomeration and productivity.

This study shall estimate the effect of agglomeration on labour productivity in the food and beverage sectors in Indonesia. The paper consists of six sections: The first section is the introduction, followed by a review of the relevant literature. Section three includes information on data and statistical description. The fourth section contains empirical specifications. Section five presents the findings of the study, and section six, presents the discussion.

LITERATURE REVIEW

Productivity is described as the relationship between output and input, which includes resources that are used, such as labour, capital, materials, and energy. In other words, productivity accounts for the ratio of output volume to input volume used in production. A production equation that shows output $= f$(input), indicates increased productivity. Higher input volume will lead to higher output volume and, thus, will cause increasing returns to scale. If a company experiences production inefficiency, decreasing return to scale will occur, and production cost will indicate diseconomies of scale (Pindyck & Rubinfeld 2008). Various data are available at the company level to allow for productivity measurement (Diewert 1980).

The "New Economic Geography" written by Krugman (1991) stated that industries tend to agglomerate in areas with zone responsibilities and capacities in fulfilling industrial needs through achieving the benefits of location proximity. Marshall theory (Marshall 1920) explained some advantages of agglomeration in industries. First, information alternation becomes easier due to knowledge spillover from industries with close location proximity. Second, labour that agglomerates in a location with specific capacities will reduce workers' learning burden. Third, it is related to the advantage of input and output transactions among companies in vertical contact (Peng & Hong 2013). Some benefits of agglomeration for companies are pressing input costs and the acquisition of new technology and knowledge from other companies so that company productivity increases.

According to the economic agglomeration factor, it is necessary for location-oriented companies to alter their site to parallel regions so as to allow them to achieve an internal scale of economies and comparative advantage (O'Sullivan 2003). This idea relates to the effort of locating companies optimally in order to maximise their profits in the expectation that the area will progressively become a marketing centre to the surrounding region.

The concept of agglomeration is rooted in location theory (Theory of Industrial Location) which, according to Weber (1962), postulates that industries will be established in areas with transportation and available workforce, which incur the least cost. Meanwhile, the economic growth centre conceived by Perroux (1950) relates to the strategy to develop the economy in certain areas. The concept of location theory refers to regional equitability, which argues that the escalation of industrial growth is not necessarily realised in one locality alone. The centre of economic growth is a region subjected to opposing centrifugal and centripetal forces.

The concept of agglomeration in the Marshall model is correlated to the concentration area of economic activities. Huang and Bocchi (2008) viewed it as spatially related to segmenting various companies and workforces in order to reduce economic burdens such as costs of transportation, information, and communication. The theory of agglomeration is evolving, and Pressman (1991) defined its theoretical concept as the geographical segmentation of a group of companies and related institutions in terms of specific products and/or economic activities.

Several empirical investigations analysed the impact of agglomeration on company-level productivity, which mostly showed a positive correlation. Lin et al. (2011) examined how agglomeration affects the productivity of the textile industries in China. Panel data sets on Chinese textile industries were used for the period 2000 to 2005. They revealed that industrial agglomeration generated a positive but non-linear correlation with company productivity. Furthermore, the coefficient of interaction between the EG index and company size was significantly negative, which implied that small businesses tended to gain more profits from positive externalities of industrial agglomeration.

Indiastuti (2016) examined the influence of industrial agglomeration on productivity at regency and district levels in West Java. The geographical areas included in the study were Bogor, Depok, Bekasi (Bodebek) region and Bandung Raya region. Data at the company level were surveyed for medium and large manufacturing industries, with 99 workers sampled between 2008-2012. Industrial productivity served as the dependent variable, while the independent variables included industrial agglomeration with index as the basis of calculation (Ellison & Glaeser 1997) and also capital intensity, scale and structure of business ownership.

Labour productivity is higher for industries which are local-centralised (localisation), more diverse

(urbanisation) and operating in the larger labour market. Maré and Timmins (2006), who studied heterogeneity control of industry, location and company, found a positive effect on productivity from both localisation and urbanisation, although not all results were statistically significant.

Some studies were carried out to examine the importance of business ownership on productivity (Jefferson et al. 2000; Li et al. 2007). Foreign companies tended to have higher productivity than domestic ones due mainly to their adoption of advanced technology and more efficient management. A study on manufacturing industries in China related to state-owned enterprises disclosed that private businesses were significantly positive on productivity, which should suggest that they are able to improve labour productivity that leads to economic growth (Chen & Feng 2000). On the basis of business ownership, it can be concluded from the studies that the most productive companies are those funded by foreign businesses, followed by private companies, domestic companies, and finally, state-owned enterprises which show the lowest productivity.

Company size positively influences productivity, with large companies owning market access, experienced management and eliciting fast responses towards changes in the business environment. This trend is supported by past research into various national industries such as Indonesian weaving (Pitt & Lee 1981), Indian textile (Baker & Nofsinger 2012), and Chinese furniture and plastic (Fan & Scott 2003). In addition, Greenstone et al. (2010) revealed that U.S. companies with "Million Dollar plants" located in foreign countries showed productivity increases of up to 12% after five years of competitive operation since establishment. A study by Lin et al. (2011) revealed that large companies produced a negative impact on labour productivity compared to that of small companies in textile industries in China.

DATA

Data were sourced from 33 regions based on the Law Number 32 of 2004 regarding Regional Government. Cross-sectional panel data and time series data were used. These were collected from the Indonesian Statistic Centre-BPS, which regularly publishes the results of the Medium and Large-scale Manufacturing Industry Survey from 2000-2017. The medium and large-scale manufacturing companies were preferred for the study based on their consistency in providing annual information and employment of a substantial workforce of between 20 and 100 employees. During the study period, there were four types of Standard Classification of Indonesian Business (KBLI) adopted respectively in 2005, 2009, 2015 and 2017. These classifications were converted into the standard in 2009 for the study. The industrial classification used in the food and beverage industry survey was based on the 4-digit International Standard Industrial Classification of all Economic Activities (ISIC). Each company has a code with which its performance can be followed until the present.

This study explores the impact of agglomeration on company-level labour productivity in Indonesia within the period 2000-2017, using panel data covering 67,619 food and beverage industries. The spatial index by Ellison and Glaeser (1997) was used in calculating the level of agglomeration on productivity. For industry categorisation, the study used a survey based on the International Standard Industrial Classification of all Economic Activities (ISIC) with four digits. The development of each company can be traced through its code called PSID. As stated earlier, the implementation of the Indonesian standard industrial classification or *Klasifikasi Baku Lapangan Usaha Indonesia* (KBLI) is based on the KBLI 2005, 2009, 2015 and 2017. For standardisation in this study, all data were converted into KBLI 2009.

TABLE 1. Descriptive statistics

Variables	Obs	Mean	Std. Dev	Mim	Max
EG	67,603	0.642	0.108	-1.656	4.623
EG^2	67,603	0.016	0.252	1.889	21369
EGH	67,619	0.449	0.497	0	1
EGM	67,619	0.277	0.448	0	1
Pem	67,619	0.081	0.273	0	1
Asing	67,619	0.042	0.201	0	1
Size	67,619	0.225	0.417	0	1
lnLPROV	67,619	7.996	1.518	2.996	11.403
lnKL	67,619	3.675	0.766	0.121	8.656
lnLP	67,619	6.64e-11	0.006	-0.039	0.041

Source: Processed data

Prior to estimating the agglomeration and productivity models, the average size (mean), data distribution (standard deviation), and minimum and maximum values of the research variables are first presented. The variables used are labour productivity (lnLp), Ellison Glaeser Index (EG), EG2 index Square, EG Index Classification comprising Ellison Glaeser High Index (EGH), Ellison Glaeser Middle Index (EGM), Ellison Glaeser Low Index (EGL), ownership, company size, the interaction between dummy EG, EGH, EGM and labour, the total workforce of companies in the food and beverage sub-sectors (lnLPROV) and capital intensity.

Industrial agglomeration is calculated by measuring the number of industries in the same area (Krugman 1991), while the Ellison Glaeser (EG) index is used in the technique for computing the level of industrial agglomeration. The EG index is based on the pattern which determines economic activity location by employing two measurements of industrial agglomeration, namely geographical and industrial concentration, which are expressed in the unit. The industrial agglomeration is calculated from the indicator share of the industrial sector from sub-region on share region and is represented in the index (Ellison & Glaeser 1997). Index EG is measured based on geographical concentration by considering the proximity. Different distances produce dissimilar impacts on the external economy and result in different agglomerations. Even with the same concentration, industries or companies may generate varying agglomeration effects due to different distances. In measuring agglomeration based on distances between companies, the latitudes and longitudes are required to determine their location. However, due to the limitation of data, the author could not base the agglomeration on distance. The index used in the study was obtained from a comparison between geographical distributions of labour-based companies and calculated using the following formula:

$$\gamma_j = \frac{\sum_k \left(s_{jk} - (x_k)\right)^2 - \left(1 - \sum_k x_k^2\right) \sum_i z_{ij}^2}{\left(1 - \sum_k x_k^2\right)\left(1 - \sum_i z_{ij}^2\right)} \tag{1}$$

$$\gamma_j = \frac{G_j - \left(1 - \sum_k x_k^2\right) H_j}{\left(1 - \sum_k x_k^2\right)\left(1 - H_j\right)} \tag{2}$$

γ_j defines the agglomeration level of the-j industry with j as the order. At the provincial level, s_{jk} refers to the share of labours from each sector of food and beverage industries on the total workforce in the related province, and X_k denotes the share of all labours from all sub-sectors of food and beverage industries on the total workforce of the province. Meanwhile, G_j shows the concentration of a company within each geographical region (geographical concentration), and H_j indicates the qualification of market capability from various industries.

Company concentration at the regional or provincial level is represented with symbol i, j, and k, while z describes the company output which is divided by total industry output.

To analyse the agglomeration level and tendency of higher company productivity in food and beverage industries, a valid and reliable method to calculate productivity is necessary. The concept of productivity is defined as the correlation between outputs, or goods being produced, and input, or used resources such as labour, capital, and energy. The index of labour productivity depicts the relative productivity of each company.

This study focuses on labour productivity, and the calculation is based on empirical evidence (Aw & Lee 2008) in which an adjustment of labour productivity measurement is taken into account. To reduce the impact of fluctuated output price on the estimated productivity, the equation is formulated as follows:

$$lnLP_{ijt} = \left(lnVA_{ijt} - \overline{lnVA_{jt}}\right) - \left(lnL_{ijt} - \overline{lnL_{jt}}\right) \tag{3}$$

$\ln Lp$ which represents labour productivity employs real value which is computed by dividing the average values of the index of big trade prices or *Indeks Harga Perdagangan Besar* (IHPB) of food and beverage in 2010. IHPB is an overview of price changes in the commodity cost marketed in a particular country or region. Meanwhile, VA is the additional value measured from the sale minus input. Labour, company, industry, and time are symbolised with L, i, j and t. Average additional value and workforce in the sub-sector of food and beverage industries are represented with $\overline{lnVA_{jt}}$ and $\overline{ln\,VA_{jt}}$.

METHODOLOGY

The estimation technique in panel data regression between the Ordinary Least Square (OLS) method with Fixed Effects and the OLS method with Random Effects were conducted. The estimation method chosen refers to the results of the Hausman test in determining the right model chosen from the panel data regression. The Hausman test showed that the value of Prob > Chi² was smaller than the significance level, where (Prob > Chi²) <α, as such H0 could be rejected. Therefore, the best method adopted to perform regression on this model was the Fixed Effects Model (FEM).

The empirical model used to analyse whether industrial agglomeration contributes to company-level productivity refers to the research model (Lin et al. 2011). Specification for labour productivity (lnLP), which was previously calculated, served as the dependent variable. The industrial agglomeration index and other controlling factors were independent variables. The primary variable in this study, among other independent variables, was the Ellison Glaeser (EG) index of provincial-level

industrial agglomeration. If the externality of industrial agglomeration increases productivity, EG variable is correlated with a significantly positive coefficient. The empirical model used is shown below:

$$LP_{ijkt} = \alpha_0 + \alpha_1 EG_{jt} + \alpha_2 EG_{jt}^2 + \alpha_3 EG_{jt} \, x lnL_{ijkt} + \alpha_4 \, lnPem_{ijt} + \alpha_5 Asing_{ijt} + \alpha_6 size_{ijt} + \alpha_7 \, lnPROV_{jkt} + \\ \alpha_8 \, lnKL_{ijt} + \sum \gamma YEAR_t + \sum \sigma DISIC_j + \mu_i + \varepsilon_{ijkt}$$

(4)

In the above equation, i, j, k and t respectively represent company, industry, province, and time. The Square of EG (EG^2) index is used to assess the non-linear correlation between industrial agglomeration and productivity. Agglomeration diseconomies occur if industrial agglomeration is very large and negatively affects companies in the form of economic loss during production. The loss is an unbalanced comparison between output increase and the average cost of decrease, which may sometime incur a higher average expense.

In lieu of agglomeration variation in industry sub-sectors in different locations in Indonesia, this study employs LnPROV variable to showcase labour productivity and examine these sub-sectors located in each province. This study addresses agglomeration and profits gained from externalities. The study also deals with a spatial factor or proximity among sub-sectors where they gain external benefits by having close proximity with other sub-sectors.

The measurement of agglomeration in a province with company-specific characteristics, such as size, is labelled as a dummy variable. If the company workforce is higher than the median, the dummy value is one (1). If it is smaller than the median, the dummy value is zero (0).

The ratio of capital on labour (lnKL) is defined as the capital intensity using the ratio measurement between capital and labour or workforce. KL variable refers to the comparison between capital input and workforce input. When inputs of capital and workforce increase to the same degree, the ratio stays the same (capital widening). If capital input is larger than workforce input, capital deepening occurs.

To examine the impact due to different types of companies, this study also includes foreign company ownership. The dummy variable transpires when foreign ownership receives the same terms as a company with positive foreign capital value. The next variable is governmental ownership, including state-owned enterprises or BUMN, or regional-owned enterprises or BUMD.

RESULTS

The result of equation regression model is stated in the following:

TABLE 2. Estimated agglomeration impact on labour productivity of food and beverage industries in Indonesia

lnLP	Coefficient	Robust Std. Err
EG	0.00362*	(0.00185)
EG²	0.0000938	(0.000139)
Governmental	0.000750***	(0.000225)
Foreign	7.78e-06	(0.000342)
Size	-0.000722***	(0.000162)
EG lnL	-0.000795	(0.000424)
lnLPROV	0.0000355	0.0000517
lnKL	0.00109***	0.0000661
Dyear	-	-
Dsic	-	-
DProv	-	-
Observations	67,215	
Number of psid	10,947	

In this paper, only one model specification is presented, as shown in Table 1. It will examine the degree of influence agglomeration exerts on labour productivity in the food and beverage industries at the company level. The robust standard error regression analysis method was also applied in this study, specifically to overcome constraints that are resistant to Heteroscedastic Multicollinearity Problems and Autocorrelation in the model. It also provides solutions to conditions related to the estimation results of the regression coefficients when it is no longer efficient, such that statistical inference can still be carried out. Robust standard error regression analysis basically corrects the calculation of standard error without changing the results on the estimation of the regression coefficient.

The robust standard error application only changes the standard error and test statistics (t-stat and p-value) of the estimated regression coefficient. The estimation results of the regression coefficients remain unchanged and may solve difficult problems that arise due to violations of the homoscedasticity assumption, although the results remain inefficient.

The finding reveals that EG index coefficient is significantly positive at 10% level of significance. The value of EG coefficient is 0.00362, which means that if EG index increases by 1 point, labour productivity will increase by 0.0362% (the average EG index is 0642) given that capital intensity, company size, and company ownership status remain the same. This finding proves that agglomeration exerts a positive impact on company-level labour productivity. This finding is consistent with those of other empirical studies (Ciccone & Hall 1993; Lall et al. 2004; Fan & Scott 2003; Lin et al. 2011; Lu & Tao 2009; Ruan & Zhang 2009; Fleisher et al. 2010).

Companies located in a relatively concentrated area are expected to possess higher productivity. This is attributed to some benefits that the companies may gain from positive externalities, such as increasing labour market opportunity, decreasing transaction cost of semi-finished goods, and availability of technology and knowledge. However, proximity and spatial concentration, which are extreme, will cause agglomeration diseconomies, meaning that increasing urbanisation may create a crowded environment resulting in heavy traffic, competitive companies, high land cost, intense competition in the output market, and increasing trade cost. These impacts may consequently lead to lower company productivity. This finding also agrees with the theory on the correlation between agglomeration and productivity and may serve as proof for the implementation of an agglomeration economy in developing countries. It is also consistent with the findings of numerous studies which used company-level panel data in developed countries. Such studies have been conducted by Ciccone and Hall (1993), Henderson et al. (1995) in the United States, and Maré and Timmins (2006) in New Zealand. Duranton et al. (2011) also conducted a study using company-level data to measure the influence of agglomeration in France. They found a positive and significant impact on labour productivity. There is an assumption that labour which forges strong bonds with others will result in higher productivity. Therefore, labour in large cities will tend to produce greater productivity and agglomeration compared to that in smaller cities. A study by Fan and Scott (2003), however, showed that agglomeration in China was not totally supported by provincial-level data.

Variable EG squared (EG^2) 0.0000938 was employed to examine the non-linear correlation between industrial agglomeration and productivity and to examine whether the value rises or falls. It is assumed that the productivity level is constant at a point called the diminishing return to scale. EG^2 was shown to be positively but non-significantly correlated, indicating that labour productivity does not correlate in a non-linear way with the index. If the EG^2 is significantly positive, it suggests that there is a maximum condition of a particular agglomeration level which may improve labour productivity since the increase is proportional in the food and beverage industries.

The finding also indicates that company ownership status plays an important role in company-level productivity. The business ownership structure (Pem) variable is represented in the business ownership dummy. State company is represented as one (1) while non-government company is zero (0) with a positive correlation at a 1% level of significance at 0.000750. The result shows that state-owned businesses possess higher labour productivity with a gap of 0.075% above non-government companies. This finding is consistent with that of Jefferson et al. (2003), who found that state-owned companies with high country asset concentration generate low work performance. In contrast, companies with lower country asset concentration produce greater work performance.

The foreign ownership variable has the same ownership dummy coefficient if a company owns a positive and significant value in foreign capital. In consequence, the existence of foreign capital in a company will not improve productivity in the food and beverage industries. Several studies on foreign ownership conducted by Jefferson et al. (2000) and Li et al. (2007) have indicated that foreign companies generally tend to have higher labour productivity compared to domestic companies, and they utilise more modern technology and have advanced knowledge. However, in the food and beverage industries, foreign capital does not increase labour productivity, as mentioned. This situation is due to several problems in policy regulation in which the realisation of foreign investment is lower than domestic investment despite the great interest of foreign investors in Indonesia.

The interaction between EG index and company size is quite interesting if the association is negatively correlated. It indicates that when the agglomeration level remains constant, small companies benefit from improving productivity due to agglomeration externalities since they bear the higher cost of sourcing for qualified workforce and input transactions. Industrial agglomeration reduces transaction unit costs on labour and input market and thus produces greater productivity improvement for smaller companies than for larger ones. The finding also agrees with those of Lin et al. (2011) and Andrews (1952), who showed a negative correlation between company size and company development in Taiwan and Germany, respectively. Conversely, a study by Van Biesebroeck (2005), who investigated African manufacturing companies, revealed that big companies achieved higher productivity and will survive indefinitely.

Interaction between EG index and workforce (EGlnL) at -0.000795*, which generates a negative and significant correlation, implies that regions with agglomeration have

lower productivity compared to those without one. It also indicates that the number of workforces in a company in the agglomerated region is smaller than that in the non-agglomerated region.

To investigate the numerous agglomeration levels in the food and beverage sub-industries in different areas, this study applies the lnLPROF variable, which constitutes the algorithm of the total workforce in a province. It can calculate geographical variation using the frequency of labour in each province. The variable yields a statistically non-significant positive effect on labour productivity. This suggests that companies located in a province with good agglomeration and high index are not able to enjoy benefits from positive agglomeration externalities, and in consequence, labour productivity in the food and beverage sub-industries will not improve.

LnKL or capital-labour ratio is the capital and labour input and workforce ratio which is calculated by the amount of capital per labour. The results show that LnKL is positively and significantly correlated with labour productivity at a 1% statistical level and a coefficient value of 0.00109. It indicates the growth of capital intensity on workforce capital ratio in the food and beverage sectors by as much as 1% and with an escalation in labour productivity of 0.011%.

DISCUSSION

This study established that agglomeration plays a significant role in improving company-level labour productivity. This is attributed to the benefits that companies may gain from positive externalities, such as increasing labour market opportunity, decreasing transaction costs of semi-finished goods, and accessibility of technology and knowledge. However, high-level proximity and spatial concentration will cause agglomeration diseconomies. As such, increasing urbanisation will create a dense environment leading to traffic congestion, increased competition among companies, high land cost and associated input factors, intense competition in the output market, and increased trade cost. These impacts may result in lower company productivity.

Other studies also discovered that state-owned companies generate higher labour productivity compared to non-governmental companies. Further, the existence of foreign capital companies does not improve productivity in the food and beverage industries since foreign capital does not increase labour productivity. This outcome is due to several problems in policy regulation in which the realisation of foreign investment is lower than domestic investment despite the great interest shown by foreign investors in Indonesia.

Small companies tend to gain more benefits due to greater productivity occurring from agglomeration externality effects compared to larger companies. This is also attributed to small companies bearing higher costs while searching for a qualified workforce and input transactions. Industrial agglomeration reduces transaction unit cost of labour and input market.

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