The effect of foreign direct investment spillovers on the performance of food and baverage industries in indonesia using stochastic frontier analysis

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Abstract

This study examine the spillovers effect of foreign direct investment to productivity of food and baverage industries in Indonesia using firm-level panel data covering 5.581 firms and 29.890 observations. The data were analysis using a stochastic frontier approach. The foreign share variable in the inefficiency equation has a statistically significant effect and show a negative relationship. That means foreign companies are more efficient than domestic companies. This is because foreign companies in Indonesia have a large scale and more advanced on technology in the production process. The horizontal spillover coefficient show a significant effect with a negative sign on the inefficiency function. However foreign companies cause domestic companies to be more efficient in the same industries. The competition of foreign and domestic companies make domestic companies will increase production optimally.

Key words: Foreign direct investment; productivity; horizontal spillovers; food and baverage industries

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INTRODUCTION

There are many benefits that we can get from the foreign direct investment. One of them is to funding various sectors that are underfunded. Foreign direct investment also opens up a lot of new job opportunities (Widyananda and Sari 2020). The advantages of Foreign direct investment by spillovers effect also bring transfer of technology and knowladge. Policy markers in many countries provide the regulatory convenience to increasing foreign direct Investment (Nguyen et al. 2020). Particularly in developing countries, many policies to support foreign direct investment have been introduced since the early 1980s. Developing countries are still focused on attracting foreign direct investment (FDI). Foreign direct investment increase the domestic economic growth of the host country (Rismawan, Haryanto, and Handoyo 2021). Because foreign direct investment is important source of capital inflows that are more stable than other capital flows (Juda and Kudo 2020). Policymakers hope that foreign investors will bring advances in technology, capital, as well as expertise in management systems through interactions with domestic companies aimed at increasing the productivity of domestic comanies (Karentina 2019).

Foreign direct investment have experienced a very significant increase and have become part of private capital inflows to developing countries. Foreign direct invetment in developing countries contributes to the development and improvement of the food industries in these developing countries (Javorcik et al. 2012). When multinational companies are in the same industry as domestic companies and are unable to internalize technology transfer to their subsidiaries, it results in an increase in productivity for domestic companies in similar industries, this is called horizontal spillover (Harianto and Sari 2021). First, foreign direct investment generates sources of funding that are used in the development of the food industries. Second, foreign direct investment can increase the productivity of the food industries in destination countries with superior production processes and technology management that have been obtained by companies that receive foreign investment. Even have positive effects on economic, foreign direct investment may also bring negative direct investment on the domestic food industries (Yuliani, Siregar, and Rifin 2019).

There are three motives behind foreign direct invetment inflows to a country. First is resource seeking. Investments are made to find production factors that are more efficient in other countries compared to using more expensive domestic production factors. Second is market seeking. Investment is finding new markets or maintaining old markets. This strategy can also be used as a defense strategy. Investments with a market-seeking background are realized in the form of mergers and acquisitions. Third is efficiency seeking. Investment in which a company seeks to increase its efficiency by taking advantage of economies of scale and scope. This motivation is widely used in developing countries (Suyanto, Sugiarti, and Setyaningrum 2021).

Foreign companies are synonymous with advanced technology, good managerial knowledge, marketing capabilities, operational efficiency, reputation, and other capabilities that allow domestic companies to benefit in increasing the productivity of local companies. From an industrial perspective, the presence of foreign companies in the domestic market provides benefits through non-market mechanisms or theoretically known as knowledge spillover. Governments in developing countries compete to attract foreign investment, with the hope that this investment will increase the productivity of domestic companies(Harianto and Sari 2021).
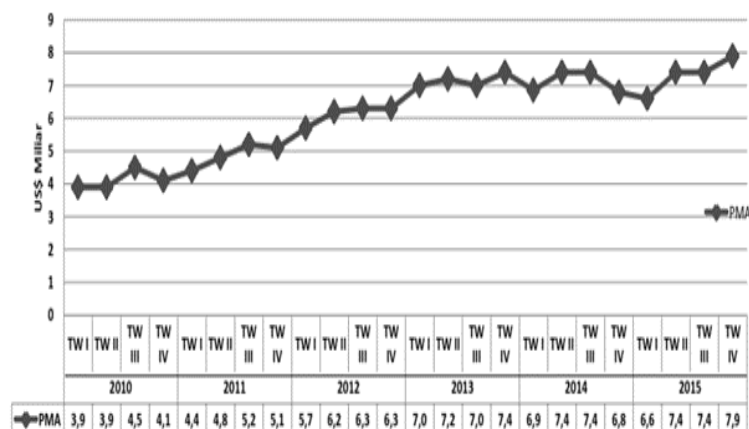
Figure 1.
Realization of Foreign direct investment (US$) in 2010-2015

The data from BKPM Indonesia shows that from year to year the realization of foreign investment continues to increase. Starting from 2010 to 2014 the trend of foreign investment shows an upward trend. The high volume of foreign investment in Indonesia has the potential to become a debate about the impact of foreign direct investment. In the secondary sector, the food industries is one of the biggest contributors. In 2014 the number of spillovers for developing countries. Other studies have shown that FDI is taking over from domestic firms. Other studies have concluded that the negative impact of foreign foreign investment in the food industries reached US$1521.8 million with a total of 1306 projects. Although it does not always rank first, the food industries is always in the top 3 competing with the chemical and pharmaceutical industries as well as the metal, machinery and electronics industries in 2011 to 2014. Based on this background formulation, it is known that the presence of foreign direct investment in Indonesia is increasing, especially in the food industries. The role of the food industries which is the leading industry in the manufacturing sector is one of the reasons why this research is needed. It is also related to the uncertain impact of foreign direct investment spillover, so the focus of this research is to find out how the impact of foreign direct investment spillovers both vertically and horizontally on the food industry in Indonesia. So far, there has been little research on the role of foreign direct investment on horizontal spillover in the food industry sector in Indonesia, so that the analysis of the role of foreign direct investment on the food industry is an interesting research to study further.

Foreign direct investment (FDI) is defined as long-term investment made directly by foreign investors in certain industries in other countries. Foreign direct investment is an international flow of capital in which companies from one country establish or expand their operations or business networks in other countries(Masron, Zulkafli, and Ibrahim 2012). One salient feature of this foreign direct investment is involves not only the transfer of resources, but also the imposition of foreign controls. This means that the branch or subsidiary company is not only bound by financial obligations to the parent company, but overall the branch company is an integral part of the organizational structure of the parent company, so that the subsidiary or branch company is an extension of the parent company in its home country.

According to Nicholson (2016), the spillovers effect or externality is the effect that arises as a result of economic transaction activities carried out by one part that effect to the welfare of the other part. The spillover effect arises because of the interaction between multinational companies and domestic companies. Spillovers can occur with the presence of foreign investment in the form of establishing subsidiaries or joint ventures, namely foreign and domestic capital. Spillover effects can be divided into positive spillovers and negative spillovers. The positive spillover effect will be seen from the increase in output generated by domestic companies in the host country. This positive impact has caused most governments in investment destination countries to try to attract foreign investors to conduct foreign direct investment into their countries. The negative spillover effect will be seen from the decrease in output produced by domestic companies. One example of the spillover effect of foreign

direct investment comes from the disciplinary effect, where domestic companies are forced to increase the efficiency of their company's performance to be able to compete with foreign companies that tend to be more efficient (Baskoro, Hara, and Otsuji 2019). There are four spillover channels that can increase the productivity of destination countries (Suyanto, Sugiarti, and Setyaningrum 2021). The first channel of productivity spillovers is through competition where the presence of foreign companies increases competition in the domestic market which encourages domestic companies in an industry to maintain their market share through increasing the productivity of their companies in order to compete with foreign companies. The second channel for the emergence of productivity spillovers is the demonstration effect. The presence of foreign companies in the domestic market can produce demonstration effects in two ways, namely, domestic companies can directly adopt the technology used by foreign companies through an imitation process or through indirect stimulation by conducting innovation and research and development on their production activities. With the demonstration effect, domestic companies can improve managerial capabilities and production technology which in turn can increase company productivity. Spillovers can also occur through worker skill mobility (labor mobility). Proficiency in workforce skills is an intangible asset owned by MNCs. The technology found in multinational companies can trickle down to domestic companies through labor turnover. This means that workers who have quality skills can easily move from multinational companies to domestic companies or these workers establish their own entrepreneurs.

The fourth channel for the emergence of productivity spillover is through vertical linkage, the production activities of foreign companies in the domestic market related to or related to upstream and downstream industries in the country. This linkage can create opportunities for domestic companies to get productivity spillover. Productivity spillover to domestic suppliers will arise when foreign companies require inputs that have certain quality standards and in general the quality standards of these inputs are higher than those of domestic companies(Li, Luo, and Luo 2019). This demand for input from domestic suppliers encourages domestic suppliers to produce more efficiently so that their productivity can increase and ultimately produce quality inputs. Foreign companies sometimes also provide technical and managerial training to domestic suppliers to ensure that the inputs produced by domestic companies are in accordance with the qualifications of foreign companies. This linkage can cause productivity spillover to domestic suppliers. This channel is known as the backward linkage. In addition to domestic suppliers, productivity spillover can also occur to domestic buyers in the downstream sector (downstream industry). The entry of foreign companies into an industry also provides quality inputs that are suitable for local producers. The existence of greater access to a variety of inputs, especially inputs with better quality(Rismawan, Haryanto, and Handoyo 2021), allows for an increase in productivity for domestic companies in the downstream sector. The linkage between foreign companies and local producers in the downstream sector is generally known as forward linkage. These two linkages (backward linkage and the choice of foreign investors to invest in the form of foreign direct investment compared to other capital in a country are influenced by the conditions of the foreign direct investment recipient country (pull factor) which can consist of market conditions, resources, competitiveness, policies related to trade and industry as well as foreign direct investment policy itself, in addition, are also influenced by the conditions and strategies of foreign investors (push factors), which include the investment strategy and production strategy of investors, as well as the perception of risk to the recipient country.

Horizontal spillover is a spillover or externality that occurs in an industry by the presence of multinational corporations in the industry. The emergence of multinational corporations in an industry will provide externality to domestic firms through the existence of competitive disciplinary effects and knowledge spillovers. Competitive disciplinary effect is an increase in business competition in the industry from the more efficient use of technology and or resources by foreign companies so as to encourage domestic companies to increase the efficiency of company performance, while knowledge spillovers are externalities that occur from the dissemination of knowledge about products and production processes(Karentina 2019).

The horizontal spillovers occur through several pathways(Suyanto, Sugiarti, and Setyaningrum 2021). First, local companies can learn from multinational corporations in designing, producing, and selling their products, so that domestic companies can imitate the behavior of multinational corporations which tend to be more efficient. Second, multinational corporations will train their

workers so that these workers will gain certain knowledge or skills that will later be able to help domestic companies when these workers move to domestic companies by sharing the knowledge or skills they have acquired in multinational corporations. Third, the existence of multinational corporations will also be able to cause horizontal spillovers even without interaction between multinational corporations and domestic companies through increased competition in related industries, thus motivating domestic companies to increase their productivity in order to protect their market share and profits.

Production includes all activities to create a good or service. In simple terms, production can be interpreted as: "All activities to create or add to the use of an object, or all activities aimed at satisfying others through exchange". In terms of the comparison between the use of capital and labor, the production process can be divided into two. If the production process uses more or more intensive use of human labor than the use of capital, then such a process is called a labor intensive production process. In the production process, there is a saving of capital goods, so it is called a capital saving production process. Conversely, if in the production process, capital goods are used more than the use of human labor, it is called a labor saving production process. The production function is a technical relationship that connects the factors of production or also called inputs or inputs with the results of production or products (output). Mathematically the relationship between the number of outputs (Q) with a number of inputs used in the production process (X1, X2, X3,...,Xn) is formulated as follows:
Q = f(X1, X2, X3,..., Xn)

Where Q is the output while X1, X2, X3,..Xn indicates the input production factor. The production function describes the technology used by a company, an industry or an economy as a whole. In certain technological conditions the relationship between inputs and outputs is reflected in the formulation of the production function.

METHOD

The data used in this study is data sourced from the Badan Pusat Statistik (BPS) in the form of industrial survey data of firms in Indonesia. The food and beverages industries data then goes through a data cleaning process to get balance data. There are 5581 food and beverage firms in Indonesia during 2010 to 2014. The output variable is obtained from the amount of output produced by each food industry company every year with a base year of 2010. The study containing 29.890 observations.

This output value is obtained from the price of the entire output produced in rupiah. Inputs include Capital (K), Labor (L), Energy (E), and Materials (M). The capital variable is the amount of capital used by each food industries company every year with a base year of 2010. This capital value is obtained from the price of all capital used in the production process in rupiah. The labor variable is the number of workers used in the production process of each company every year. These variables are Foreign size, foreign share, HHI, and Horizontal spillovers. Foreign ownership can be measured using the variable percentage of company ownership. According to the OECD (2009), a company is categorized as a foreign company if the foreign equity stake is 10 percent or more in the ownership structure.

Market concentration can be measured by the Herfindahl-Hirschman index (HHI). A larger HHI value indicates a higher level of market concentration among firms due to lack of competition, or vice versa. The first argument shows that a high HHI value is associated with a larger firm's production capability, while the last argument shows that a high HHI value is associated with a lower firm's production capability. Furthermore, the HHI value can be calculated as follows:

$$\mathbf{HHI} = \sum_j (\mathbf{Output_{ijt}} / \sum_j (\mathbf{Output_{jt}})$$

$$\mathbf{Horizontal\ Spillovers_{jt}} = \frac{\sum_{i\in j} \mathbf{ForeignShare_{ijt}} \times Y_{ijt}}{\sum_{i\in j} Y_{ijt}}$$

The econometric function of translog model:

$$y_{it} = \alpha_0 + \sum_{k=1}^{k} \beta_k X_{kit} + \frac{1}{2}\sum_{k=1}^{k}\sum_{l=1}^{l} \beta_{kl} X_{kit} X_{lit} + \sum_{k=1}^{k} \beta_{kt} X_{kit} t + \beta_t t + \frac{1}{2}\beta_{tt} t^2 + v_{it} - u_{it}$$

$$u_{it} = \delta_0 + \sum_{m=1}^{m} \delta_m Z_{mit} + \omega_{it_{it}}$$

Where:

y	= logarithm natural form of output
X	= logarithm natural form of input
t	= time trend
v	= random error
u	= inefficiency
Z	= exogenous variables in production function
α, β, δ	= intercept
ω	= error term

RESULT AND DISCUSSION

The variables included in the model can be described in to table 1. Then the model estimated using Stochastic Frontier Analysis. These variables are output (Y), capital (K), labour (L), materias(M), energy (E), firm size, HHI, foreignshare, and horizontal spillovers.

Table 1.
Summary Statistic

Variable	Units	Obs	Rata-rata	Std. Dev.	Min	Maks
Y	ln (juta rupiah)	29890	0.0000	2.1471	-6.9462	9.0894
K	ln (juta rupiah)	29890	0.0000	2.4148	-7.9807	11.5494
L	ln (jumlah pekerja)	29890	0.0000	1.0872	-1.0421	6.5835
M	ln (juta rupiah)	29890	0.0000	2.2123	-7.1704	9.1285
E	ln (juta rupiah)	29890	0.0000	2.2653	-7.7155	9.4410
T	Trend	29890	0.0824	1.8406	-2.5000	2.5000
FSize	Rasio	29890	0.0139	0.0648	0.0000	1.0000
HHI	Rasio	29890	0.1105	0.1652	0.0044	1.0000
FOR	biner dummy	29890	0.0602	0.2378	0.0000	1.0000
HorSpill	Rasio	29890	0.1180	0.1466	0.0000	0.9266

Stochastic frontier analysis is method of econometric that using various models to identified the best model. The variables are tested on four models, translog models, Hicks-neutral, No-technological progress, Cobb-Douglas, and No-inefficiency effect. The result of estimation showed by likelihood test to compare models. Choosen model is used to explained the research.

Table 2.
Hypothesis testing of Stochastic Frontier Analysis models

Models	Ho	λ	$X^2 1\%$	Conclusion
Hicks-neutral	$\beta_{kt} = 0$	1622.3	9.21034	Ho Rejected
No-technnological progress	$\beta_t = \beta_{tt} = \beta_{kt} = 0$	352.04	16.81189	Ho Rejected
Cobb-Douglas	$\beta_{kl} = \beta_{kt} = \beta_{tt} = \beta_t = 0$	7327.88	31.99993	Ho Rejected
No-inefficiency effects	$\gamma = \delta_0 = \delta_z = 0$	319	18.47531	Ho Rejected

Before interpretation stage, to ensure that the estimation results of the variable coefficients in the study are accurate, it is necessary to ensure that the stochastic production function is selected correctly. Table 2 show the rate of calculation generalized likelihood from every models. The comparation of λ and Chi-square to make conclusion which one model will used in estimation. The test to comparing the Log-Likelihood of translog model as H1 with the Log-Likelihood of other models in the production function. Overall, the model shows that the value of Log-Likelihood is greater than Chi-square so it rejects H0. The conclusion is that using the translog model to estimate the model.

Table 3.
Maximum Likelihood Estimates of Stochastic Production Frontier

Variables	Parameters	Model 1		Model 2		Model 3		Model 4	
Constant	b0	0.1008	*	-0.0150	*	-0.0163	*	0.0598	*
		0.0046		0.0040		0.0040		0.0033	
K	bk	0.1190	*	0.0862	*	0.0705	*	0.0758	*
		0.0019		0.0016		0.0015		0.0014	
L	bl	0.1239	*	0.1340	*	0.1357	*	0.1318	*
		0.0025		0.0027		0.0027		0.0023	
m	bm	0.6495	*	0.6722	*	0.6822	*	0.6247	*
		0.0024		0.0024		0.0023		0.0022	
E	be	0.1588	*	0.1666	*	0.1694	*	0.2176	*
		0.0018		0.0021		0.0021		0.0022	
k2	bkk	0.0071		-0.0204	*	-0.0233	*		
		0.0018		0.0015		0.0015			
l2	bll	0.0028	*	0.0039		0.0051			
		0.0029		0.0033		0.0033			
m2	bmm	0.3331	*	0.3309	*	0.3379	*		
		0.0035		0.0041		0.0042			
e2	bee	0.1921	*	0.2104	*	0.2149	*		
		0.0037		0.0045		0.0047			
kl	bkl	0.0028		0.0095	*	0.0111	*		
		0.0019		0.0017		0.0017			
km	bkm	-0.0629	*	-0.0382	*	-0.0376	*		
		0.0021		0.0017		0.0018			
ke	bke	0.0548	*	0.0518	*	0.0529	*		
		0.0019		0.0016		0.0017			
lm	blm	-0.0392	*	-0.0466	*	-0.0489	*		
		0.0027		0.0026		0.0026			
le	ble	0.0181	*	0.0162	*	0.0166	*		
		0.0027		0.0025		0.0027			
me	bme	-0.2517	*	-0.2659	*	-0.2717	*		
		0.0030		0.0038		0.0040			
T	bt	-0.0301	*	-0.0196	*				
		0.0010		0.0010					
t2	btt	-0.0354	*						
		0.0015							
kt	bkt	-0.0205	*						
		0.0011							
lt	blt	0.0000							
		0.0013							
mt	bmt	0.0310	*						
		0.0014							
et	bet	-0.0125	*						
		0.0013							
Inefficiency Function									
Variables	Parameters	Model 1		Model 2		Model 3		Model 4	
Constant	d0	0.0663	*	0.0362	*	0.1053	*	0.0639	*
		0.0022		0.0015		0.0043		0.0138	
Fsize	dFSize	-0.1680		-0.0629	*	-0.0228	*	-0.0343	
		0.0015		0.0213		0.0238		0.0627	
HHI	dHHI	0.0004	*	0.0390	*	0.0368	*	-0.0014	
		0.0070		0.0171		0.0160		0.0341	
FOR	dFOR	-0.0490	*	0.0421		0.0187	*	-0.0250	*
		0.0042		0.0156		0.0181		0.0262	
HorSpill	dHorSpill	-0.3738	*	-0.8126	*	-0.8326	*	-0.8438	*
		0.0083		0.0396		0.0415		0.0664	

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Variables	Parameters	Model 1		Model 2		Model 3		Model 4	
Sigma-squared	s2	0.0662	*	0.0769	*	0.0782	*	0.0998	*
		0.0005		0.0009		0.0008		0.0010	
Gamma	g	0.0102	*	0.0996	*	0.1036	*	0.1025	
		0.0008		0.0096		0.0100		0.0064	
Log likelihood function		-2000.11		-3016.71		-2837.22		-6685.32	
LR test of the one-sided error		319.97		261.10		268.06		251.77	
Keterangan									
* signifikan 1%									
** signifikan 5%									
*** signifikan 10%									

The most important part of empirical studies is a variable measurement. Validity of results from empirical studies is highly dependent on variable measurement accuracy. Variables input classified into three sets groups. Firts variables is output. Then input variables such as raw materials, labor, capital, and energy. Exogeneous variebles are horizontal spillovers, include size company, HHI, and foreign share.

Tabel 3 show the result of estimation. The foreign share variable has a negative sign and is significant to inefficiency. In other words, the greater foreign share of company, more better the company's performance. The positive impact arising from the ownership of foreign companies can boost the company's performance for other companies(Harianto and Sari 2021). Companies owned by foreigners are considered to have better company performance than domestic companies (Esquivias and Harianto, 2020). The Foreign share variable in the inefficiency equation has a statistically significant effect and shows a negative relationship. The point is that local companies are more inefficient than foreign companies that are competitors with the assumption that other variables are constant. In other words foreign companies are more efficient than local companies. This is because foreign companies in Indonesia have a large scale and more advanced technology in the production process. They are more intensive than local companies.

The test results show that foreign size has a significant negative effect indicating that the larger the size of the company, the more efficient it will be. This is because the larger the size of the company, the more optimal the company will be in terms of capital, knowledge, and technology used in the production process (Sari 2019). The HHI variable represents the level of market concentration in high-tech industries. The level of market concentration has a significant effect and has a positive sign on technical efficiency. The positive direction indicates the higher market concentration will increase technical inefficiency or will reduce company performance. A positive sign on the HHI coefficient indicates that a low level of market concentration or intense business competition will make the company's production capability better. Furthermore, the estimation results show that the effect of HHI on efficiency is that the higher the concentration of a company, the more efficient the company will be. This is in accordance with the estimated positive significant value.

The horizontal spillover coefficient shows a significant effect with a negative sign on the inefficiency function, so it can be said that there is an influence from the presence of foreign companies on local companies. The point is that foreign companies cause local companies to be more efficient in the same industry because of this competition, local companies will increase production optimally and as well as possible. This finding has policy implications in promoting foreign investment, although it is found that the presence of foreign companies does not fully support all sectors in the manufacturing industry. The government is expected to consider whether the presence of FDI brings benefits to domestic companies, especially in productivity. Chain The supply linking sectors between manufacturing industries also needs special attention, so that the provision of incentives for FDI can encourage an increase in output productivity for dometic suppliers and buyers.

CONCLUSION

Based on research that has been conducted on horizontal foreign direct investment in the food and beverages industries sector during the period 2010-2014, it is concluded that foreign direct investment has a positive impact on the productivity of the food industries in Indonesia. The

government should open up foreign investment in the most downstream industries, such as other food industries, non-alcoholic beverage industries, etc. In addition, foreign direct investment must also cooperate with domestic companies in the downstream sector, bring technology transfers, and conduct training on advanced technology in the domestic industries. The government can open foreign investment in the food and baverages industries where foreign investors are required to transfer technology as well as introduce and provide training on advanced technology in the domestic food industry. In order for domestic companies to have a positive impact from horizontal FDI, the government needs to support the domestic industries by financial facilitation in order to strengthen capital, domestic companies must also improve the quality of their workforce, and provide training on advanced technology in order to increase production capacity to be more competitive.

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