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Agglomeration Externalities in the Productivity of Indonesian Furniture Companies: Survey of Medium-Large Manufacturing Companies in 2010-2015

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Abstract: *This study aimed at measuring the externalities of agglomeration on productivity of furniture companies in Indonesia. The data used is a pannel data obtained from the survey of medium-large manufacturing companies during 2010 to 2015. The company's productivity is measured through Wooldridge One-Stage Production Function Estimation Method (2009). Productivity calculated based on the results of the estimated production function is used as the dependent variable to see the impact of agglomeration. The size of the agglomeration used in this study is the number of similar companies, the number of related weighted companies, the average output of similar companies, and the average output of related weighted companies in one Regency/ area. The results of this study indicate that the agglomeration size of the number of related companies, the average output of similar companies, and the average output of related weighted companies had positive externalities on the productivity of furniture companies, while the number of similar companies showed negative externalities.*

Keywords: *Productivity, Agglomeration, Process Manufacturing, Furniture*

I. INTRODUCTION

The Indonesian furniture industry is highly concentrated in certain regions which is possibly able to obtain benefit from an agglomeration economy. This industry is highly concentrated in Central and East Java, especially in Jepara, Semarang and Pasuruan Regencies. The concentration of this industry provides positive externality to the companies within through an agglomeration economy. These benefits arise from the access to natural resources, transportation, cost savings, to the exchange of knowledge between companies or workers in the region.

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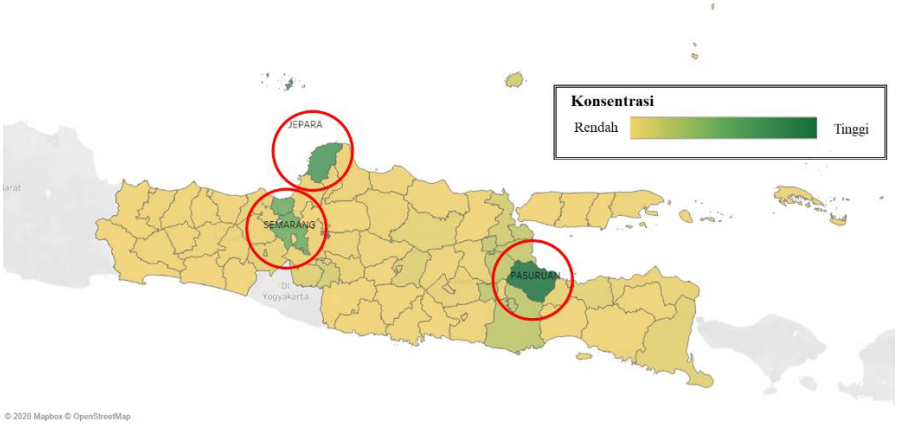
Figure 1

Map of Concentrations of Furniture Medium-Large Enterprises in Central and East Java Provinces

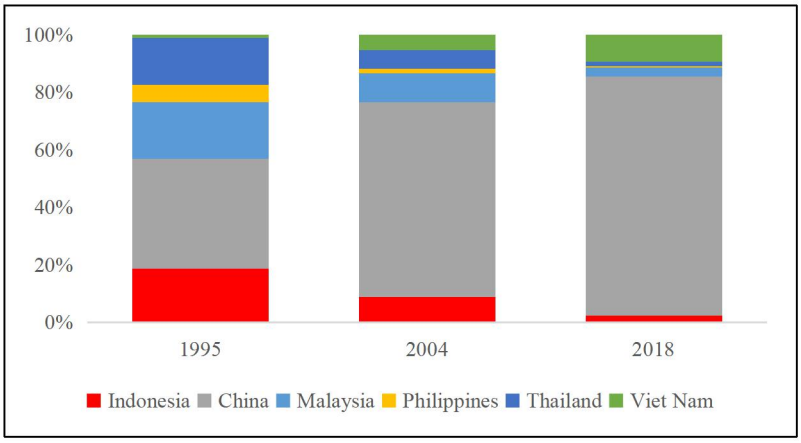


Source: Survey of IBS BPS 2015, processed

The furniture industry has existed for a long in Indonesia. Based on existing records, Indonesia has been an exporter of furniture products since the 1990s. The value of Indonesia's exports was quite large compared to the ASEAN 5 + China, however the portion was getting lower. Indonesia's share is getting lower compared to other countries because the value of Indonesia's exports is not well developed, while the world furniture export market is growing rapidly.

Figure 2

The portion of exports of furniture products in ASEAN 5 + China in 1995, 2004 and 2018



Source: UNCTAD Stat, processed

Studies of agglomeration and productivity have been broadly carried out. Several studies have found that agglomeration has a positive externality on company productivity in the region (Andersson & Lööf, 2011; Burger, Kameo, & Sandee, 1999; Cingano & Schivardi, 2004; Combes, 2000; Henderson, Lee, & Lee, 2001; Van Der Panne, 2004; Vernon Henderson, 2003; Widodo, Salim, & Bloch, 2014). Based on the results of the research collected, most of them found that MAR externality has positive impacts on productivity namely the agglomeration of similar industries while Jacobs's externality do not have a significant positive relationship.

In the contrary to the findings of previous studies on the industry generally, Widodo, Salim, & Bloch (2014) found that the level of local competition actually obstructed the productivity of Indonesian furniture companies, while in general the local competition supported industrial productivity in Indonesia. This finding shows that the prediction of the MAR externality theory applies to the Indonesian furniture industry. The theory states that specialization and

monopoly are more supportive because they allow internalization of externalities, while Jacobs externalities are not proven to have an impact.

The Jacobs externality concept explains that interaction between different industries is a source of knowledge development that increases the productivity of companies in the region, but the benefits of agglomeration can be less than the negative impact of competition that occurs, thus the diversity of industries in one region causes negative externalities on productivity. Hu, Xu, & Yashiro (2015) found that the negative externality of congestion and competition due to agglomeration is greater than the positive impact of the agglomeration. It shows that the diversity of industries in a region gives negative externalities on productivity, especially if the existing industries are not interrelated.

In some of the literature, the concept of Jacobs externality is expressed as the diversity of industries in a region, while the concept of MAR externalities is a specialization between the similar or related industries (Kuncoro, 2009; Van Der Panne, 2004; Widodo et al., 2014). Furthermore, the interrelated industries can be interpreted as a diversity of industries which possibly have interactions. This study assume that if the calculated diversity comes from related industries, the positive impact of Jacobs externalities is more visible. This assumption emerges due to interactions can occur more frequently between interrelated industries than those unrelated. This interaction includes the demand and supply of inputs among the industries, thus knowledge accumulation is more likely to occur. For the case in China previously Hu et al., (2015) used this linkage information in calculating the externality of agglomeration on the productivity of companies.

Some differences between this study and the existing research on agglomeration are (1) this study explicitly takes into account the inter-industry linkages in calculating the impact of Jacobs externalities, (2) this study uses different and more recent data periods than previous studies in Indonesia, and (3) this study specifically discusses the furniture industry which highly concentrated in several regions of Java Island. The further parts of this paper are (2) literature review, (3) research methods, (4) results and discussion, and (5) conclusions.

II. LITERATURE REVIEW

The relationship of industrial agglomeration and productivity by Marshall (1890) is explained through the accumulation of shared knowledge, more efficient sharing of inputs, and better labor markets. The accumulation of knowledge used by all companies in one region is sourced from interactions between companies or workers. The Marshall-Arrow-Romer (MAR) theory explains that the interaction occurs between companies within the same industry, while the Jacobs' externality theory explains that interaction occurs between companies within different industries.

Marshall-Arrow-Romer (MAR) externality is Marshallian externalities formalized by Glaeser et al (1992). This model states that the localization of similar companies will create knowledge capital that can be used by every company in a limited area. Externalities only occur in a limited area because the MAR model considers the exchange of knowledge can only occur through social interaction. This interaction requires companies to be close in one region, although the communication technology is advanced, but it is still relevant on the basis of Combes (2000). This concept is considered relevent since the companies that are close together exchange information one another.

Furthermore, the model formulated by Jacobs states that the exchange of knowledge actually emerges from complementary interactions among industries. Jacobs believes that the exchange of knowledge among related industries in one region will spur innovation through complementary knowledge. This externality is interpreted as industrial diversity and is different from MAR externalities. Kuncoro (2009) mentions that localization of similar and related industries has a greater effect than urbanization, thus related industrial agglomeration is interpreted as industrial localization which is similar to MAR externalities. Other studies (Cingano & Schivardi, 2004; Henderson et

al., 2001; Van Der Panne, 2004; Widodo et al., 2014) also use diversification as an indicator to show Jacobs' externalities.

Some studies found that Jacobs's externality was less evident than MAR's externality, because agglomeration can also have a negative impact/externality, namely congestion and competition in using public facilities or the same input. Thus, companies from diverse industries can obstruct the production process, while interactions are less likely to occur if industries in a region are not connected. Hu et al., (2015) explicitly consider the inter-industry linkages in calculating the externality of agglomeration, the results of his research show that the related industrial agglomeration provides greater positive externalities than the same industrial agglomeration.

Rather than differentiating MAR and Jacobs externalities with specialization and diversification, this study sees the two externalities as emerging from interactions between companies in the same or different industries. These interactions occur through social interactions in the same area. The same industry interacts by viewing each other's products and labor that can move from one company to another. Whereas interaction between different industries is more likely to occur if the industry has connection, by this relationship the development of knowledge of one industry will improve the quality of other industries.

III. RESEARCH METHODS

The data used in this study is the company's data sourced from Survey of Medium-Large Manufacturing Companies of the Indonesian Central Statistics Agency for the period of 2010 to 2015. The data is processed annually to get companies that have data availability during this period, thus a balanced panel data is formed. The variables formed to answer the research objectives are as follows.

Variables	Definitions
Productivity(prod)	Calculated based on estimated production function parameters using a single stage method (Wooldridge, 2009)
Output Value (Y)	Output is the total production of a company divided by the deflator of the nearest city consumer price index.
Number of Worker (L)	Labor is the average number of workers per day for one year for each annual survey. The unit used is the number of people
Fixed Capital (K)	Capital is the total estimated value of all company assets at the time of the survey divided by using the deflator of the nearest city consumer price index.
Value of Raw Materials (R)	The overall value of raw materials used is divided by using the deflator of the nearest city consumer price index.
Size of Companies	The natural logarithm of the company's workforce.
Companies' Age (Age	The natural logarithm of the years since the company was first established.
Local Competition (hhi)	Herfindahl–Hirschman Index per Regency/ City.
Number of Similar Companies (agg)	Number of companies included in the furniture industry group within the Regency / City area.
Number of Related Companies (agg_t)	The number of companies related to the furniture industry within the boundaries of Regency / City area with the degree of relevance.
Average Size of Similar Companies (agg2)	The average size of companies included in the furniture industry group within the Regency / City area.
Average Size of Related Companies (agg2_t)	The average size of a company related to the furniture industry within the boundaries of a Regency / City area with the degree of relevance.

The Cobb-Douglas production function is used to calculate productivity. The production function parameters are estimated using the one resistant estimation method formulated by Wooldridge (2009). This estimation method uses the same productivity proxy as the model formulated by Olley Pakes and Levinsohn Petrin (LP). To execute the estimation of this study, a module built by Mollisi & Rovigatti (2017) is applied. The Cobb-Douglas production function used $Y = AK^aL^b$ AK^aL^bthen the total productivity is prod$prod = A = \frac{Y}{K^aL^b}$od=Y/K^aL^b.

To see the externality of agglomeration on company productivity in the furniture industry, several panel data estimation methods used namely the random effect model, fixed effect model, and maximum likelihood. These estimation is done to see the consistency of relationships between variables in the model. The econometric model used in this study is as follows.

$$prod_{it} = \alpha + \beta_1 ukuran_{it} + \beta_2 umur_{it} + \beta_3 hhi_{it} + \beta_4 agg_{it} + \beta_5 agg\_t_{it} + \beta_6 agg2_{it} + \beta_7 agg2\_t_{it} + \omega_i + \epsilon_{it}$$

where$\omega_i$is the variations among individuals, while$\epsilon_{it}$is white *noise error*.

The model feasibility test is carried out to ensure that the results comply the the good estimation requirements known as the Best Linear Unbiased Estimator (BLUE). To ensure that estimation results have fulfilled, series of tests, namely (1) Normality Test, (2) Multicollinearity Test, (3) Heteroscedasticity Test, and (4) Autocorrelation Test are taken. After these tests are carried out, and the results has complied the requirements, then a statistical hypothesis test will be conducted in the next section.

IV. RESULTS AND DISCUSSION

One of the differences of this study is that it explicitly considers the interrelationships of furniture industry to take into account the positive externality of agglomeration of related industries. This study calculates the degree of industry connection using input-output data. Based on this calculation, several manufacturing industries that have strong links with the furniture industry are as follows: textile industry, apparel industry, leather and leather goods industry, wood industry, chemical industry, other chemical industry, rubber industry, base metal industry, and machinery and equipment industry.

Table 1

7 Largest Sectors Related to the Indonesian Furniture Industry (Backward Linkages)

No	Indonesia	
	Sectors	Degree of Connection
1	Chemical industry and chemical products	0,11
2	Manufacture of wood, wooden and cork goods (excluding furniture) and woven goods from bamboo, rattan and the like	0,10
3	Rubber industry, rubber and plastic goods	0,04
4	Basic metal industry	0,04
5	Metal goods industry, excluding machinery and its equipment	0,04
6	Machinery Industry and excluding its equipment	0,04

No	Indonesia	
	Sectors	Degree of Connection
7	Textile, apparel and leather goods industry	0,03

Source: World Input-Output Database, processed

Based on the industrial agglomeration counts using weights in Table 1 and the following calculation of productivity are descriptive statistics of the variables used in the model.

Table 2 Descriptive Statistics Variables

Variables	Observations	Average	Std. Dev.	Min	Max
prod	2.652	13,55	1,10	9,80	18,79
size	2.652	4,02	0,97	2,99	7,69
age	2.652	2,37	0,64	0	4,57
hhi	2.652	0,33	0,31	0	1
agg	2.652	29,11	35,15	1	94
agg_t	2.652	1,70	1,32	0	8,84
agg2	2.652	3.626.543	5.675.937	5.081	3,46e+07
agg2_t	2.652	2.181.157	6.864.090	0	1,90e+08

To ensure that multicollinearity problems do not occur in the model, a matrix of correlations between independent variables is presented. Based on the values in this matrix, it can be concluded that multicollinearity problem do not exist because the correlation level of all pairs of variables is below 0.8. Thus, all independent variables in the model can be included.

Table 3 Correlation Matrix of Independent Variables

	Size	*Age*	*hhi*	*agg*	*agg_t*	*agg2*	*agg2_t*
Size	1						
Age	0.26	1					
hhi	0.07	0.05	1				
agg	-0.10	-0.13	-0.55	1			
agg_t	0.01	0.05	0.15	-0.12	1		
agg2	0.05	0.04	-0.12	0.26	-0.24	1	
agg2_t	0.13	0.05	0.10	-0.09	-0.05	-0.01	1

Estimation results obtained indicate that there are positive and negative externalities of agglomeration. The number of companies of the furniture industry variable has a significant negative externality on the productivity of

furniture companies, while other agglomeration variables show a positive externality, namely the number of related companies, the average output of similar and related companies. This conclusion is supported by the significance value of each coefficient using either the maximum likelihood estimation method or the random effect.

It proves that the more companies related to furniture industry, the more it give positive externality on the productivity of the furniture companies in the area. In addition to the number of related companies, the average output value of companies in the furniture industry and related industries also has a positive externality. These results confirm the externalities of MAR and Jacobs have positive externalities from similar companies and related companies.

The results of this study differ from the conclusions of previous studies. Widodo et al., (2014) concluded that there was no Jacobs externality found in the furniture industry and the level of local competition had a negative relationship. This research shows that the number and size of related industries have a positive externality on the productivity of furniture companies in the region, it also shows that companies that have higher local competition tend to have higher productivity. The results of this study are in line with Hu et al., (2015) which shows a positive relationship on the presence of related industries in the region. It also supports Burger et al., (1999) on small agricultural product processing companies which show a positive externality on agglomeration, while this study shows positive externality of agglomeration on medium-large furniture companies.

Table 4 Estimation Results

Variables	*Maximum Likelihood*			*Random Effect*		
	Coefficient	Std. Error	Z	Coefficient	Std. Error	Z
size	0,686**	0,021	32,22	0,689**	0,021	32,20
age	0,304**	0,036	8,44	0,292**	0,033	8,86
hhi	-0,204*	0,094	-2,16	-0,184*	0,090	-2,04
agg	-0,001†	0,000	-1,85	-0,001†	0,000	-1,81
agg_t	0,090**	0,019	4,61	0,092**	0,018	4,85
agg2	3,22e-08**	3,13e-09	10,71	3,20e-08**	3,11e-09	10,30
agg2_t	4,20e-09†	2,38e-09	1,77	4,30e-09†	2,37e-09	1,82
constant	9,907**	0,126	78,61	9,911**	0,123	80,30
LR chi2		983,74**			1574,02**	

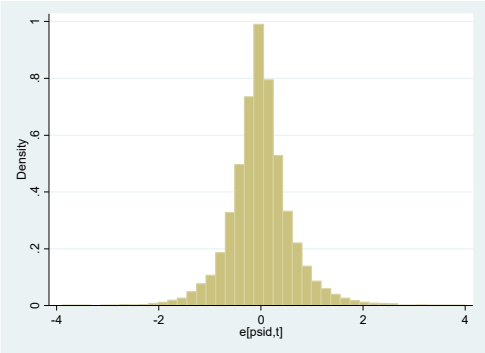
*Note: the † / * / ** signs are each significant at 0.1 / 0.05 / 0.01*

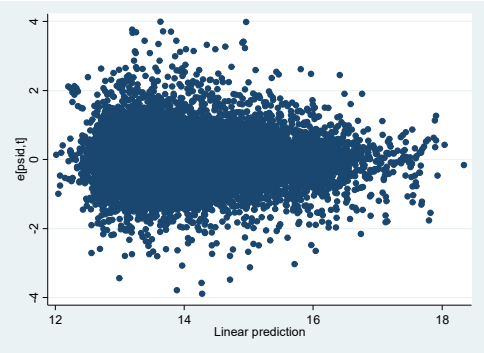
To confirm the fineness of the above estimation results, the following is the residual and scatter histograms of predicted and residual values. Based on these two images, it shows that residuals tend to follow normal distribution patterns which the values centered in the middle, and the second picture shows no patterns formed from scatter, thus it indicates homoscedastic properties.

Figure 3

(a) Histogram Residual Model and (b) Scatter Predictive Value and Residual Model

(a) (b)





V. CONCLUSION

This study shows that the number of related companies, average value of output of similar companies, and the average value of the output of the related company gives positive externalities to the productivity of furniture companies, while the number of similar companies tends to provide negative externalities. It also shows that local competition supports the productivity of furniture companies, in which the result is different from Widodo et al., (2014).

The results show that the presence of related companies in certain regions provides positive externalities to the productivity of furniture companies, thus the initial assumption that interactions are more likely to occur in interrelated industries is proven. Interactions that occur allow the accumulation of shared knowledge, therefore the productivity of companies in the region increases.

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