Imade Yoga Prasada*, Masyhuri
Program Studi Ekonomi Pertanian, Fakultas Pertanian Universitas Gadjah Mada, Indonesia

*) Email korespondensi: imade.yogap@gmail.com

The Conversion of Agricultural Land in Urban Areas (Case Study of Pekalongan City, Central Java)

ABSTRACT

Agricultural land in urban areas has a strategic role as a provider of food for city resident, as well as supporting the environment of the urban area. The important role of the existence of agricultural land in urban areas over the past few decades faces a serious threat, namely the occurrence of agricultural land conversion. Therefore, this research was carried out with the aim to analyze the trend of agricultural land conversion in urban areas and to find out the factors that influence the agricultural land conversion in Pekalongan City. The data used in this study were secondary data sourced from the Central Statistics Agency of Pekalongan City. Data were analyzed using trend model analysis and tobit models. The results showed that the trend of agricultural land conversion in Pekalongan City was positive, so there was a tendency for the agricultural land conversion to increase from year to year. The factors that influence the area of agricultural land conversion in Pekalongan City were the real price of paddy at the farmer level and paddy productivity. Both of these factors have a negative sign, it shows that an increase in real prices of paddy and paddy productivity could reduce the agricultural land conversion in Pekalongan City.

Keywords: Agricultural Land Conversion, Cities, Pekalongan City, Tobit, Trend

INTRODUCTION

Urban areas are a type of region that has characteristics with high economic growth rates and large population growth rates. In addition, urban areas will be very identical with the emergence of urbanization in the rural areas towards urban areas. Urban areas in general will consist of two regions, namely the centre of city areas and sub-urban areas. The centre of the city area inclined to have characteristics such as high industrial activities, trade, and other commercial activities. On the contrary, sub-urban areas tend to be regions that have high economic contribution from the agricultural sector. Sub-urban areas become areas that support the centre of city area. The sub-urban areas become the centre of agricultural production that fulfil the food needs of the people in the centre of city (Didomenica & Gordon, 2016; Rezai, Shamsudin, & Mohamed, 2016). Moreover, in order to meet the food needs of the community, there are several other roles possessed by the existence of agricultural land on the outskirts of the city. Those contributions of agricultural land included a buffer zone for pollution that occurs in the centre of city, decomposition of organic waste, rainwater catchment areas, flood control sites and life support environmental ecosystem (biodiversity) (Jamal & Mortez, 2014; Ramzi et al., 2017).

Even though agricultural land has a very important role to the community of urban area, there is no guarantee that the agricultural land on the outskirts of the city will remain available in the future. In fact, urban areas are the regions that have very high rates of agricultural land conversion. This was triggered by the increasing economic activity of the non-agricultural sector in urban areas which caused the demand for land from the non-agricultural sector increase. In addition, the high flow of urbanization in urban areas has contributed to increasing the rate of population growth

in urban areas and triggering an increase in demand for land for settlements or housing. Therefore, the sustainability of agricultural land will be increasingly threatened and it simultaneously threaten the loss of various strategic roles of the existence of agricultural land in urban areas.

Research related to the conversion of agricultural land has been carried out in various regions in Indonesia. Research in South Minahasa Regency shows that the conversion of agricultural land in the region is influenced by the per capita Gross Regional Domestic Product (GRDP) (Lagarense et al., 2015). These results were obtained using multiple linear regression methods. Furthermore, other studies were also conducted in Jember Regency. The results of the research show that the conversion of agricultural land in Jember Regency is influenced by the factors of the age of the farmer and the productivity of the cultivated land (D. E. Putra & Ismail, 2017). The results of the study were conducted using logistic regression methods with primary data. Research in Lamongan Regency shows that the conversion of agricultural land can occur due to the influence of the ratio of land price ratio to regional accessibility ratio and the results obtained using the GWR analysis method (Geographically Weighted Regression) (Kurniasari & Ariastita, 2014).

Over the past few years, the conversion of agricultural land has become a threat to the sustainability of agricultural land in various regions in Indonesia, especially in the urban areas. Theoretically, the sustainability of agricultural land in urban areas faces the threat of land use change caused by the occurrence of urban sprawl activities or urban expansion (Sudirman, 2012). The occurrence of urban sprawl will urge changes in the function of land that has low land rent to be another function that has a high land rent value in urban areas. Agricultural land is one of the uses of land that has a low land rent, so the conversion of agricultural land will threaten this land use. Therefore, this study aim to analyze the factors that affect agricultural land conversion that occur in urban areas by using case studies in the research area in Pekalongan City. This research belongs to the new research category because research related to agricultural land conversion in urban areas are still rarely conducted. In addition, this study uses the tobit analysis method, an analysis that allows the use of latent variables in the analysis model. This study also uses independent variables in the form of real paddy prices, number of industries, non-agricultural sector GRDP per capita, road length, rice productivity, and population, so that it is expected to provide more accurate results related to factors that affect agricultural land conversion in Pekalongan City. The purpose of this study was to 1) determine the development of agricultural land conversion that occurred in Pekalongan City, 2) determine the factors that influence the conversion of agricultural land in Pekalongan City.

METHODS

This research using secondary data sourced from the Central Statistics Agency of Pekalongan City in the period 1989 to 2017. The data used in this study were data on agricultural land area in Pekalongan City, agricultural land conversion data, real paddy prices in farmer level, number of industries, GRDP in the non-agricultural sector per capita, road length, paddy productivity, and population in Pekalongan City. Pekalongan City was chosen as the location of the study carried out by using a purposive sampling method because Pekalongan City is a city on Java Island which has the largest proportion of agricultural land area compared to other cities in Java.

Data were analyzed using a trend analysis tool to answer the first purpose, that was knowing the development of the agricultural land conversion in Pekalongan City. Trend analysis used to be able to know clearly the development of agricultural land conversion in Pekalongan City, both up and down in the long run. Trend analysis can be used to conduct analysis on data that tends to have a relatively long time series, so that trend analysis can provide the right results (Veno & Syamsudin, 2016). The trend equation model can be seen as follows:

$$Y = a + bX$$

Where Y is the agricultural land conversion areas (hectares) and X is time variable (years).

The second objective, that was to find out the factors that influence the conversion of agricultural land in Pekalongan City, it was done using the tobit regression analysis model. Tobit regression is carried out in this study because of the special characteristics of the data used in the research, namely the dependent variable of the data used has latent variables or unobserved variables, so it was zero values (Wooldridge, 2016). In general, the tobit model can be written using the following equation:

$$Y_i^* = \beta X_i + \varepsilon i, \, i = 1, 2, ..., N$$
$$Y_i = Y_i^* \text{ if } Y_i^* > 0$$
$$Y_i = 0 \text{ if } Y_i^* \leq 0$$

Where Yi was the dependent variable measured by using the Yi* latent variable which has a positive value, and is censored if it is the opposite. β was a vector of predictable parameters. Xiwas a vector of independent variables. εi is an error term that was normally distributed and N was the number of observations (Liu, Zhang, & Fu, 2017). Based on this theory, in this study the tobit model used was as follows:

$$ALC = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \, + \varepsilon i$$

Where ALC is the dependent variable of the agricultural land conversion areas (hectares), X_1 is the real paddy price at farmer level (Rp), X_2 is the number of industries (units), X_3 is the non-agricultural sector per capita GRDP variable (Rp), X_4 is the variable length of road (Km), X_5 is a variable of paddy productivity, and X_6 is a variable in the number of population in Pekalongan City (person). β_i (i = 1, 2, 3, ..., 6) is the parameter of the regression result of tobit and εi is the error term.

RESULTS AND DISCUSSION
THE DEVELOPMENT OF AGRICULTURAL LAND CONVERSION IN PEKALONGAN CITY

The urban sprawl phenomenon which also known as the expansion of the urban area, has led to the city developing into the suburbs. The expansion of the city area has an impact on increasing land requirements to transform into urban areas, thus it trigger some function of land to be sacrificed to meet those needs. The area of land in a region is basically permanent over time. This gives the consequence that the area of land will tend to be very difficult to add and very unlikely to decrease, but it will be very possible to alterits function. Therefore, land use in a region has a tendency to be dynamic. The utilization of a type of land can cause a trade-off in the use of land (Ghazouani, 2013). This trade-off on land use will occur when a type of land can be used for a variety of different functions, for example, a type of land can be used to build a settlement or can also be used for farming activities of plantation crops. If the land is used for residential land, then the land cannot be used for plantation activities. Otherwise, when the land is used for plantation crops, the consequence is that the land cannot be used as residential land. This trade-off on land use will always occur, and utilization decisions from the land will depend on the land rent value of each type of use that is possible. Land use which has the highest land rent value that will be chosen as the best land use decision (Daulay et al., 2016; Sumarga & Hein, 2016).

Urban sprawl in urban areas has led to the emergence of trade-offs on land use (D. R. Putra & Pradoto, 2016; Suprajaka & Fitria, 2012). Suburban areas that are identical to the land used as agricultural land will experience trade-offs with other uses with regard to the presence of urban sprawl like the commercial sector, both industrial activities and trade activities, or for the development of residential areas. When the land used for agricultural activities is thought to have lower land rent than other types of use, the impact that will occur is the conversion of agricultural land into non-agricultural land. The shift in function of agricultural land has occurred in various regions, especially in areas with characteristics of urban areas including Pekalongan City. Pekalongan City has experienced a phenomenon of conversion of agricultural land since 1989 (BPS, 2018). The development of agricultural land conversion areas in Pekalongan City can be seen in figure 1 below.
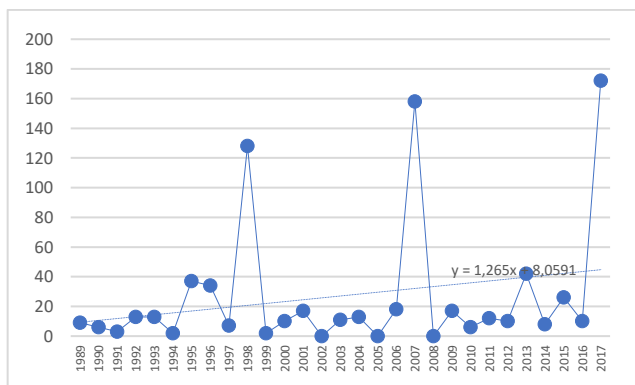
FIGURE 1. THE DEVELOPMENT OF AGRICULTURAL LAND CONVERSION IN PEKALONGAN CITY

Based on Figure 1, it can be seen that the area of conversion of agricultural land in Pekalongan City tends to increase from year to year, namely from the period 1989 to 2017. Figure 1 shows that in 1998, in 2007, and in 2017 the conversion of agricultural land in Pekalongan City experienced a significant increase. This is because in that year there was an increase in the number of large industries and an increase in land use for yards or building land (BPS, 2018). The results of the trend analysis in Figure 1 can be written in the equation as follows:

$$Y = 8.06 + 1.26x$$

Based on the equation above it can be seen that the regression coefficient has a positive sign, it means that there is a unidirectional relationship between the variable area of conversion of agricultural land with the time variable used. It can be illustrated when there is an increase in variable of time by one unit, it will increase the amount of agricultural land conversion areas in the Pekalongan City by 1.26%. This figure shows that the agricultural land conversion areas in Pekalongan City tends to increase from year to year. The increase in land use change in Pekalongan City area can be caused by several things, namely the high rate of population growth and the occurrence of economic transformation in Pekalongan City and also the incentives received by farmers. Pekalongan City in the period of 1994 to 2016 experienced an average population growth of 0.92% per year (BPS, 2018). The large population growth rate from year to year will drive an increase in variations in population needs other than food, and

trigger an increase in land requirements for settlements, thus causing the conversion of agricultural land in urban areas (Gardi et al., 2015; Jiang & Zhang, 2016). In addition, if it is viewed from the economic structure in Pekalongan City, Pekalongan City during the last few years has experienced economic transformation, which originally has a major contribution to the agricultural sector in Pekalongan City, but in recent years it experienced a sharp decline, and the contribution of agricultural sector to the economy of Pekalongan City has weakened as a whole. This can be seen from the value of the Gross Regional Domestic Product (GRDP) of the agricultural sector in Pekalongan City which has contracted from 2011 to 2016 with an average depreciation of 3.85% per year. The occurrence of economic transformation has drive the high conversion of land in Pekalongan City. This economic transformation has led to an increase in the demand for land from the non-agricultural sector, the fulfilment of these needs of the land can only be done at the expense of other land functions, which is agricultural land. Competition in land use between the agricultural sector and the non-agricultural sector can occur with regard to economic transformation. Not only between the agricultural sector and the non-agricultural sector, but land use competition can also occur between the agricultural sub-sectors such as the food crop sub-sector, horticulture crops, and plantation crops. Pekalongan City is well known as Batik City. This shows that Pekalongan City is very synonymous with the batik industry, so that land use for the batik industry is growing rapidly and has caused a decline in the area of agricultural land due to the conversion of agricultural land into batik industry centre.

The explanation is in accordance with many research that has been done. Research conducted in Australia related to changes in agricultural land use explains that agricultural land often experiences changes in function to non-agricultural land due to the presence of agricultural land tends to have a wider land area than other land uses, so that the potential to shift the land functions (Millar & Roots, 2012). In addition, studies in Kalimantan related to the costs

and benefits of oil palm plantation expansion in Central Kalimantan state that food crop land tends to have low land rent, so that it tends to shift into other uses that have higher rental values, namely for palm oil plantation activities (Sumarga & Hein, 2016). Research in Pandeglang District, Banten Province concluded that the conversion of agricultural land in the region was due to the economic transformation for the development of the tourism sector (Fahri, Kolopaking, & Hakim, 2014). The development of the tourism sector requires the construction of physical facilities and infrastructures such as airports, hotels and restaurants, so that a large amount of land is needed to be converted, that is by using paddy fields. Furthermore,beside the non-agricultural sector, the conversion of paddy fields can also occur due to pressure from other agricultural sub-sectors, such as the plantation sub-sector. The paddy fields conversion in Tanjung Jabung Timur, Jambi Province occurred due to the emergence of encouragement from the plantation sector, namely oil palm plantations which triggered the conversion of the function of paddy fields into oil palm plantations (Daulay, et al., 2016).

THE FACTORS AFFECTING AGRICULTURAL LAND CONVERSION IN PEKALONGAN CITY

The conversion of agricultural land that occurs in various regions can be caused by various factors. These factors can be in the form of external factors which happened when the agricultural land owners who are opressed by the needs of land from outside the agricultural sector or from within the land owner in the form of prices received by farmers and paddy productivity that can be produced by farmers. The results of the analysis of the factors that influence the conversion of agricultural land in Pekalongan City can be seen in table 1 below.

Based on table 1, it can be seen that the conversion of agricultural land in Pekalongan City is influenced by real paddy price factors and cultivated paddy productivity. The price of real paddy has a negative and significant effect, it means that the real paddy price variable at the farmer level has an opposite relationship with the area of agricultural land conversion that occurs in Pekalongan City. This

means that the lower the price of real paddy at the farmer level, the higher agricultural land conversion will occur.

TABLE 1. THE FACTORS AFFECTING AGRICULTURAL LAND CONVERSION IN PEKALONGAN CITY

Variabel	Coefficient	Std. Error	t	P> |t|
Real paddy price (X1)	-2.219*	1.233	-1.800	0.085
Number of industries (X2)	0.066[ns]	0.977	0.070	0.947
Non-agricultural GRDP per capita (X3)	1.205[ns]	0.955	1.260	0.220
Road length (X4)	-6.623[ns]	8.856	-0.750	0.462
Paddy productivity (X5)	-15266**	7.024	-2.170	0.040
Population (X6)	1.388[ns]	2.917	0.480	0.639
Constanta	141.286*	76.000	1.850	0.077

Source: Secondary data analysis (2019)

Description:

**	= Significant at 95% confidence level
*	= Significant at 90% confidence level
ns	= Not significant

Price is one of the incentives for farmers to carry out their farming activities (Prasada, Dhamira, & Nugroho, 2018; Purbiyanti, Muhammad, & Indri, 2017). The price of agricultural production, which is higher paddy prices, causes increased motivation of farmers in running farming in urban areas, and conversely lower prices can reduce the motivation of farmers in managing farming in urban areas. Therefore, the real paddy price at the farmer level needs to be improved, so that the motivation of farmers to maintain the sustainability of farming and agricultural land in urban areas can be maintained. The results of this study are consistent with research conducted in East Java which shows that agricultural land is very easy to convert when the value of the product produced is low. The value of this product will depend on the production and price of agricultural products produced (Rondhi et al, 2018)

The paddy productivity variable in Pekalongan City also shows that the variable has a significant influence on the extent of conversion of agricultural land in Pekalongan City. The paddy productivity variable has a coefficient with a negative sign, so it shows that the variable productivity of paddy has an opposite effect on the conversion area of agricultural land variable in Pekalongan City. This means that the decline in paddy productivity in Pekalongan City can lead to an increase in the extent of conversion of agricultural land. Paddy productivity is also an incentive for farmers to cultivate a farm.

Because of that, land conversion in Pekalongan City can be minimized by increasing paddy productivity in Pekalongan City. Paddy productivity will be very closely related to the level of efficiency in the use of inputs and the application of appropriate technology packages (Suharyanto, Rinaldy, & Ngurah Arya, 2015). That is why, to increase paddy productivity can only be done by increasing the farming efficiency and increase the uses of appropriate technology.

CONCLUSION

The conversion of agricultural land in Pekalongan City tends to increase from year to year. The high conversion of agricultural land in Pekalongan City needs to get serious attention so that the strategic role of agricultural land in urban areas can be maintained properly. The agricultural land conversion in Pekalongan City are influenced by several factors, namely the real paddy price factor at the farm level and paddy productivity. Both of these variables have a negative influence on the area of conversion of agricultural land. Therefore, this means that the higher real paddy prices at the farm level and higher paddy productivity can cause a decrease in the extent of agricultural land conversion that occurs in Pekalongan City. Based on these results, to reduce the occurrence of conversion of agricultural land in urban areas can be done by increasing the productivity of agricultural land by increasing efficiency in the use of inputs and the application of appropriate technology. In addition, the conversion of agricultural land in urban areas can also be reduced by ensuring the price of agricultural products at the farmer level, so that it becomes an incentive for farmers to maintain the sustainability of agricultural land owned and managed.

ACKNOWLEDGEMENTS

REFERENCES

BPS. (2018). Kota Pekalongan Dalam Angka. Kota Pekalongan, Jawa Tengah: Badan Pusat Statistik Kota Pekalongan.

Daulay, A. R., Eka Intan, K. P., Barus, B., & Pramudya, N. B. (2016). Rice land conversion into plantation crop and challenges on sustainable land use system in the East Tanjung Jabung Regency. Procedia - Social and Behavioral Sciences, 227(2016), 174–180. https://doi.org/10.1016/j.sbspro.2016.06.059

Daulay, A. R., P, E. I. K., Barus, B., & Bambang, P. N. (2016). The Acceptable Incentive Value To Succeed Paddy Land Protection Program in Regency of East Tanjung Jabung, Indonesia. ARPN Journal of Agricultural And Biological Science, 11(8), 307–312.

Didomenica, B., & Gordon, M. (2016). Food policy: Urban farming as a supplemental food source. Journal of Social Change, 8(1), 1–13. https://doi.org/10.5590/JOSC.2016.08.1.01

Fahri, A., Kolopaking, L. M., & Hakim, D. B. (2014). Laju konversi lahan sawah menjadi perkebunan sawit dan faktor-faktor yang mempengaruhinya serta dampaknya terhadap produksi padi di kabupaten Kampar, Riau. Jurnal Pengkajian Dan Pengembangan Teknologi Pertanian, 17(1), 69–79.

Gardi, C., Panagos, P., Van Liedekerke, M., Bosco, C., & de Brogniez, D. (2015). Land Take and Food Security: Assessment of land take on the agricultural production in Europe. Journal of Environmental Planning and Management, 58(5), 898–912.

Ghazouani, T. (2013). The capital structure through the Trade-Off Theory : Evidence from Tunisian firm. International Journal of Economics and Finance, 3(3), 625–636.

Jamal, M., & Mortez, S. S. (2014). The effect of urban agriculture in urban sustainable development and its techniques: A case study in Iran. International Journal of Agriculture and Forestry, 4(4), 275–285. https://doi.org/10.5923/j.ijaf.20140404.03

Jiang, L., & Zhang, Y. (2016). Modeling Urban Expansion and Agricultural Land Conversion in Henan Province, China: An Integration of Land Use and Socioeconomic Data. Sustainability, 8(9), 920. https://doi.org/10.3390/su8090920

Kurniasari, M., & Ariastita, P. G. (2014). Faktor - Faktor yang Mempengaruhi Alih Fungsi Lahan Pertanian Sebagai Upaya Prediksi Perkembangan Lahan Pertaniandi Kabupaten Lamongan. Jurnal Teknik Pomits, 3(2), 119–124. https://doi.org/10.1016/j.indmarman.2016.07.005

Lagarense, V. I., Kapantow, G. H. M., Kumaat, R. M., & Sondak, L. W. T. (2015). Faktor-faktor yang mempengaruhi alih fungsi lahan pertanian di Kabupaten Minahasa Selatan. Cocos, 6(3), 1–12.

Liu, J., Zhang, J., & Fu, Z. (2017). Tourism eco-efficiency of Chinese coastal cities – Analysis based on the DEA-Tobit model. Ocean and Coastal Management, 148(2017), 164–170. https://doi.org/10.1016/j.ocecoaman.2017.08.003

Millar, J., & Roots, J. (2012). Changes in Australian agriculture and land use: Implications for future food security. International Journal of Agricultural Sustainability, 10(1), 25–39. https://doi.org/10.1080/14735903.2012.646731

Prasada, I. M. Y., Dhamira, A., & Nugroho, A. D. (2018). Supply Response of Paddy in East Java : Policy Implications to Increase Rice Production. AGRARIS: Journal of Agribusiness and Rural Development Research, 4(2), 129–138.

Purbiyanti, E., Muhammad, Y., & Indri, J. (2017). Konversi lahan sawah di Indonesia dan pengaruhnya terhadap kebijakan Harga Pembelian Pemerintah (HPP) gabah/beras. Jurnal Manajemen & Agribisnis, 14(3), 209–217.

Putra, D. E., & Ismail, A. M. (2017). Faktor-faktor yang mempengaruhi petani dalam melakukan alih fungsi lahan di Kabupaten Jember. AGRITECH, XIX(2), 99–109. https://doi.org/10.1063/1.1448885

Putra, D. R., & Pradoto, W. (2016). Pola dan faktor perkembangan pemanfaatan lahan di Kecamatan Mranggen, Kabupaten Demak. Jurnal Pengembangan Kota, 4(1), 67–75. https://doi.org/10.14710/jpk.4.1.67-75

Ramzi, M., Hussain, M., Yusoff, N. H., & Tukiman, I. (2017). Urban farming and its importance for environmental sustainability. Proceedings of Academics World 76th International Conference, Kuala Lumpur, Malaysia, 3rd August 2017, 11(August), 13–16. https://doi.org/10.1088/1748-9326/11/12/120203

Rezai, G., Shamsudin, M. N., & Mohamed, Z. (2016). Urban agriculture: A way forward to food and nutrition security in Malaysia. Procedia - Social and Behavioral Sciences, 216(October 2015), 39–45. https://doi.org/10.1016/j.sbspro.2015.12.006

Rondhi, M., Pratiwi, P., Handini, V., Sunartomo, A., & Budiman, S. (2018). Agricultural land conversion, land economic value, and sustainable agriculture: A case study in East Java, Indonesia. Land, 7(148), 1–19. https://doi.org/10.3390/land7040148

Sudirman, S. (2012). Valuasi ekonomi dampak konversi lahan pertanian di pinggiran Kota Yogyakarta. AGRIKA, 6(1), 103–125.

Suharyanto, S., Rinaldy, J., & Ngurah Arya, N. (2015). Analisis Risiko Produksi Usahatani Padi Sawah. AGRARIS: Journal of Agribusiness and Rural Development Research, 1(2), 70–77. https://doi.org/10.18196/agr.1210

Sumarga, E., & Hein, L. (2016). Benefits and costs of oil palm expansion in Central Kalimantan, Indonesia, under different policy scenarios. Regional Environmental Change, 16(4), 1011–1021. https://doi.org/10.1007/s10113-015-0815-0

Suprajaka, & Fitria, M. D. (2012). Analisis dinamika pemanfaatan lahan pertanian di Kota dan Kabupaten Serang (Studi kasus : Kecamatan Kramatwatu, Kasem, dan Pontang). Jurnal Planesa, 3(1), 2012.

Veno, A., & Syamsudin. (2016). Analisis trend kinerja keuangan perbankan syariah tahun 2015 sampai dengan 2017. Jurnal Bisnis Dan Manajemen Islam, 4(1), 21–34.

Wooldridge, J. M. (2016). Introductory Econometrics A Modern Approach (6th ed.). Boston: Cengage Learning.