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**| RESEARCH ARTICLE**

# Revisiting the Neighborhood Effects on Disadvantaged Households in Indonesia

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**| ABSTRACT**
The latest statistics of 2022 record 9,57 percent of the Indonesian population living in poverty. As most of the study in this field merely focuses on the internal factors of poverty, this study contributes to providing more perspectives for poverty alleviation by revisiting spatial linkages on poor households' income in East Java, the second most populated province in the economy. This study employs spatial econometrics analysis in a three-step procedure: (i) designing spatial weight matrix within nearest districts, (ii) doing Moran's I Test to identify spatial effects on the variables, lastly (iii) doing LM Test to find best regression model. Estimates on the SUSENAS 2017 database show that both Ordinary Least Square (OLS) and General Nesting Spatial (GNS) models provide similar results. Nonetheless, when compared with Akaike's Information Criterion (AIC) model, the GNS model provides better accuracy. This means accommodating spatial effect is imperative. This study also finds a positive spillover of poor households' income within neighboring districts. This implies the existence of multiplier effects in a household's economic activities that later might form clusters of poverty. These suggest that the Sustainable Livelihood Approach interventions in the province should take into account differences in social institutions and other socio-cultural characteristics.

**| KEYWORDS**

Poverty alleviation, sustainable livelihood approach, spatial-dependence, general nesting spatial model, Akaike's information criterion model.

**JEL Classification**: A11, A14

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## 1. Introduction

Poverty and income inequality alleviation are focal issues in the efforts to achieve sustainable development, especially for a developing economy like Indonesia. The issues are especially important for East Java Province, the second most populated in the economy, with levels of poverty and income inequality higher than the national average (see Figure 1).

Though the trend of poverty levels in the province has been declining during the past decade, the level of income inequality has only decreased in the last two years. This particular problem might be related to the relatively lower income per capita of households in the province. Therefore, to accelerate poverty alleviation in the province, it is important to pay more attention to efforts to increase the income of poor households.

According to the theory of poverty circle, the main cause of poverty is due to low productivity of households, which all together forms a vicious cycle. A poor household cannot increase savings and investments, so capital productivity is low, and the household remains poor (Jhingan, 2014; Nurske, 1953).

Later on, Amartya Sen (1974, 1999) introduced the capability approach, which criticizes the limited bases of traditional economic models in explaining the phenomenon of poverty. Sen argues that capabilities are the real freedoms that people have to achieve their potential of doings and beings. Hence, the core focus of the capability approach is on what individuals are capable of. The approach emphasizes functional capabilities, such as the ability to live to old age or engage in economic transactions, which are often missing in the life of the poor.

In Sen's theory, poverty is seen as capability-deprivation. It is noteworthy that the emphasis is not only on how humans function but also on their having the capability, which is a practical choice. Everyone could be deprived of such capabilities in many ways, for instance, by lack of financial resources or the failure of social institutions to provide equal chances for the people to grow their capabilities.

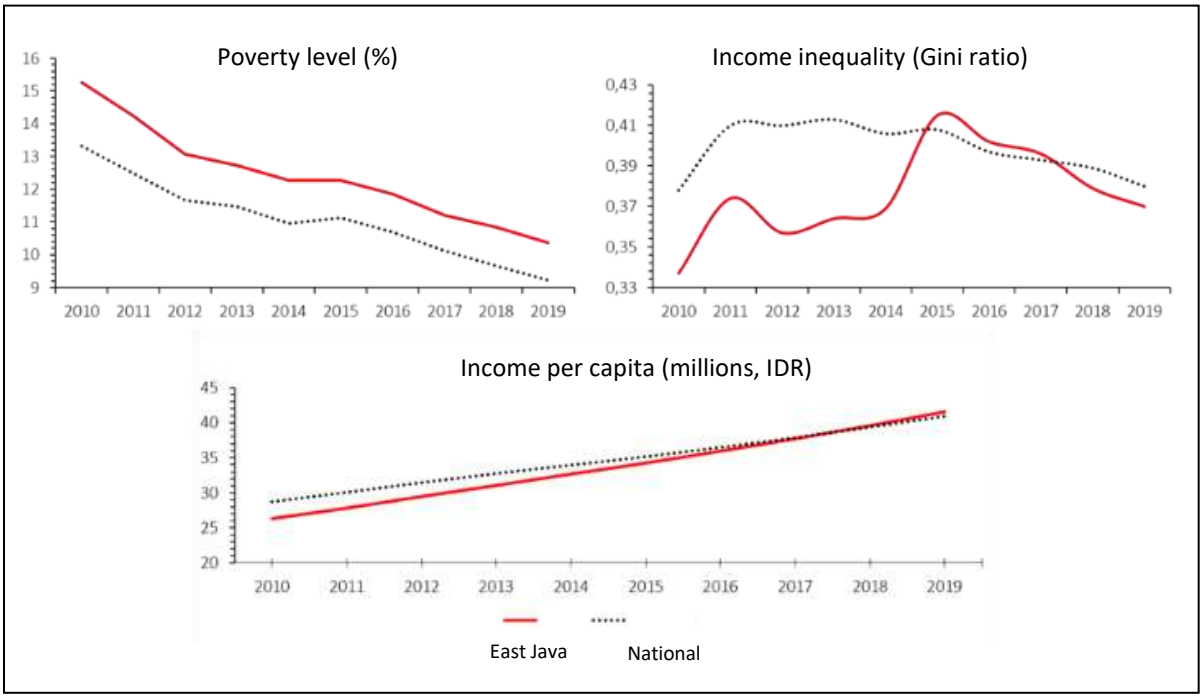


Figure 1. Comparison of poverty indicators between East Java Province and the national average (Source: Indonesian Central Bureau of Statistics, 2020)

Furthermore, Chambers & Conway (1992) explained the low productivity in five capital capacities of poor households, which is known as the Sustainable Livelihood Approach (SLA). SLA theory explains the important role of human capital, physical capital, financial capital, social capital, and natural capital in increasing households' capacities to resolve various economic problems and risks. Additional attention to the roles of social capital and natural capital is the main contribution of the theory.

The introduction of the SLA theory has attracted further discussions on the roles of neighboring effects on the poverty phenomenon. Yet, not many scholars observe the linkages among households that influence the phenomenon of poverty. Whereas Tobler (1970) posits that everything is related to all else, those that are near to each other are more related when compared to those that are far away.

To understand patterns of spatial relation, Tobler's law has become the basis for proximity or dependence analysis, which is also known as spatial dependence. In light of the wisdom of Tobler's law, this study focuses on getting evidence of the neighborhood effects on the poverty phenomenon in East Java Province. Research inquiries in this study include the following: (i) factors that could improve poor households' income in East Java Province, also (ii) does connection among the poor households' income exists in this case. Moreover, in particular, this study would like to find policy recommendations to accelerate poverty alleviation programs in the province.

## 2. Literature Review

In general, developing countries like Indonesia possess social institutions and display attitudes that are not conducive to economic development (Jhingan, 2014; Todaro & Smith, 2014). Institutional factors are characterized by factionalism, social division by caste

and class cleavages, ethnic or religious distinctions, differences in cultural tradition and social pattern, kinship loyalties, and regional identification. Such factors tend to inhibit social and geographical mobility and create a drag on social progress.

Moreover, poverty is not only related to the economic dimensions. Studies on the cause of poverty have expanded into social, health, education, and political dimensions. For instance, Todaro and Smith (2014) explain that poverty is the inability to meet minimum living standards that match the level of life needed for food, shelter, and clothing. Meanwhile, according to the Indonesian Central Bureau of Statistics (2020), poverty is the inability of individuals or households to meet minimum standards of necessities that include both food and facility needs as measured using the poverty line. Here, poverty is defined as a condition in which a person or group of people are unable to organize their lives to a level that is considered humane. This definition comes from a rights-based approach that recognizes that the poor possess the same basic rights as other community members. Hence, Todaro and Smith (2014) argue that the high level of poverty in a country depends on two main factors: (1) the average national income level and (2) the width and narrowness of the gap in income distribution.

According to Todaro and Smith (2014), variations in poverty in developing countries are caused by several factors, namely: (1) geographical differences, population and income levels, (2) historical differences, and some were colonized by different countries, (3) differences in resource wealth, natural resources, and the quality of human resources, (4) differences in the roles of the private sector and the state, (5) differences in industrial structures, (6) differences in the degree of dependence on the economic and political forces of other countries, and (7) differences in the distribution of power, political and institutional structures domestically.

The influence of institutional factors on poverty in Indonesia has been reported in several studies. For instance, the results of panel data analysis by SMERU Institute (2017), which covers the period 2005 to 2010, show that the level of poverty has decreased significantly in Indonesia. This is revealed particularly in districts that have a larger proportion of regional leaders with secondary education, a higher average level of education, established a local office for poverty reduction coordination (Tim Koordinasi Penanggulangan Kemiskinan Daerah, or TKPKD), a higher proportion of fiscal revenue, and a higher proportion of urban population. In addition, there appears to be a positive relationship between inequality and regional poverty, indicating that a successful poverty reduction strategy requires economic growth as well as sound and appropriate socio-economic interventions by the regional administration.

Broadly speaking, the poverty level is determined not only by individual characteristics, such as education, gender, and occupation but also by geographic factors, such as urban and regional location. Some overall income inequality is due to differences in the between-group characteristics, and some occur because there is inequality within each group. Therefore, for policy purposes, if most inequality is due to disparities across regions, then the focus of policy may need to be on regional economic development, with special attention to helping the poorer regions (Haughton & Khandker, 2009).

Studies in the field of spatial economics have rapidly developed since the 1990s. In principle, spatial economics advocates the analysis of the geographical distribution of economic activities. This field focuses on the geographical dimension of economic activities, an area that traditional economics does not treat well. In spatial economics, the interaction among economic activities in the neighboring area determines the geographical distribution of the economic activities. Or, in the words of Brakman, Garretsen, and van Marrewijk (2009), economic activities are not randomly distributed across space.

Spatial economics deals with arguments on why there are differences in the spatial distribution of wealth. It works in the search for an explanation for the uneven spatial development issues. The study goes along with the interest in regional development, which has significantly increased since the 1980s. In this regard, there have been several related subjects involved, such as governance, social institutions, and local leadership (Dinc, 2015).

Spatial dependence and spatial heterogeneity are the main characteristics that underlie the need to include an element of location in the model (LeSage & Pace, 2009). Hence, it is necessary to define a spatial weighting matrix that describes the configuration of the relative position of one cross-section unit with another cross-section unit. This matrix can be formed based on the concept of distance and the concept of continuity. Notably, the spatial econometric model assumes that the response variable is not only influenced by predictors at the same location but can also be influenced by responses at neighboring locations, predictor variables at neighboring locations, or unexplained factors that also come from neighboring locations (Fitriani & Efendi, 2019).

To better understand the phenomenon of poor households' linkages, many studies in this field employ the Sustainable Livelihood Approach (SLA) as the grand theory to show the roles of households' capital capacity as primary capital used in adapting to the development of economic, institutional, and environmental uncertainties (Serrat, 2017). SLA theory takes into account the household capacities of human capital, financial capital, physical capital, social capital, and natural capital.

Since the SLA theory was first introduced in the year 1992, there have been several research articles doing empirical research on the roles of SLA as households' key capital capacities. Research by Nawaz (2016) and Kuang et al. (2019) revealed that out of the five capital capacities in the SLA, human capital in the forms of education level and length of schooling is the most significant to increase poor people's ability to adapt and at the same time add the necessary life skills to improve the households' productivity. Educated poor households were found to have more capabilities to increase their productivity and better manage their available resources.

In line with the above findings, Jezeer et al. (2019) found that human capital could strengthen the capacity of other capitals. Households with aged workers have relatively more experience in managing available natural resources and also have more abilities to share knowledge with other households. Hence, a higher level of human capital drives the increase of natural capital, like preserving sustainable natural resources, as well as increasing social capital, like networking ability.

Meanwhile, Sowunmi (2016) found that women-led poor households and a higher number of child-aged members in the households proved to become burdens and associated with lower productivity. This is because the increase in consumption in poor households is not accompanied by the increase in working family members.

Otsubo (2016) found that physical capital capacity in the form of ownership of physical assets like jewellery, motor vehicles, and electronic goods could work as a safety net when, under difficult conditions, those liquid assets have to be exchanged for daily necessities. Moreover, the findings of Jezeer et al. (2019) show that households that have some financial capacities, like being able to deposit money or access bank credit relatively, have more capability to increase their income. Hence, both physical and financial capital, in principle, reflect the capacities of the households to escape from the poverty trap. Yet, it is noteworthy to consider Banerjee and Duflo (2011), who argue that there has been little evidence to support the claims of microfinance, with small loans, instant, and inflexible repayment schemes, in helping poor households to establish medium-sized businesses.

Other studies by Yang (2017), Alkire (2018), and Jezeer et al. (2019) found the roles of social capital like participation in social organization or close kinship. Social capital could increase social networks that later can be utilized by households to get financial assistance. However, Yang et al. (2017) and Kuang et al. (2019) found that the frequency of traveling, participation in social organization, as well as number of siblings in the family have minimal influence on the sustainable improvement of households' income.

Another study by Quandt (2018) found that natural capital in the form of fertile land and diversified agriculture products act as the main factor for households' income improvement. On the other hand, financial capital such as access to bank credit, ownership of physical assets and land, also employment status give no significant household income improvement for poor households in Kenya.

Donohue et al. (2015) combined the SLA theory on various geographical conditions in Nepal. The study found that in mountainous and hilly areas, human capital capacity has a relatively stronger influence on decreasing the poverty level, while in mainland areas, physical capital, like the availability of adequate infrastructure, becomes the main determining factor.

Based on the aforementioned studies on SLA, it could be argued that all five capital capacities interact with each other to influence the improvement of households' income. In the later part, a series of studies on the spatial effects of socio-economic variables will be introduced.

First, the study of Aspiansyah (2019), which uses the Spatial Durbin Model (SDM), found that positive spillover occurs in the regional income per capita in Indonesia. In this regard, positive spatial spillover is induced by the economic growth of nearby areas. Economic interactions among areas that exist through trade, flows of capital, as well as migration of labor, become channels for the improvement of income per capita within areas in the region. The finding is in line with the study of Ojede and Yamarik (2018), which employs the dynamic spatial Durbin model. Productive higher education and highway spending have statistically significant short- and long-run spillover effects on regional income growth in the United States of America.

On the other hand, Vidyattama (2014) found an indication of negative spillover on the interaction of income per capita among areas in the island of Java. The study used the Spatial Autoregressive (SAR) model. The phenomenon occurs because the absorption of financial capital and labor resources still leads to areas with high returns. Moreover, the concentration of resources in high-return areas has depressed investment and income in abandoned areas.
Next, the study of Wibisono et al. (2015), which uses autocorrelation detection of Moran's and Local Indicators of Spatial Association (LISA), found the existence of a growth spillover effect in East Java Province. Regencies and cities with high economic activities are concentrated in the middle area of the province.

The finding is consistent with Vidyattama (2014), who discovered the existence of a negative spillover effect of economic growth centers on Java island. This is because the deployment of various infrastructures of electricity and transportation are centralized around the centers of economic growth.

Furthermore, Wardhana et al. (2017) compared multiple spatial models, that is Spatial Autoregressive (SAR), Spatial Error Model (SEM), and Spatial Durbin Model (SDM), to test the spatial effects of households' income upgrading among farmers living in agriculture clusters in West Java Province. The study found that the development of agriculture clusters could upgrade the income of households living in the area as well as others living in the neighborhood areas. This is related to the presence of agriculture product specialization in the area, which encourages positive externality for productivity and income upgrading. The study shows that government policy strategy related to the agriculture sector needs to be selectively implemented by considering the spatial effect in the particular sector.

**3. Research Method**

Data for this study were sourced from the National Socio-economic Survey (SUSENAS) in March 2017, which covers 29,887 households. The samples in the database were distributed over 38 regencies or cities in the East Java Province. Considering that the study focuses on poor households, the sample in this study was sorted based on the World Bank's poverty line of $1.9 PPP or, equivalent to IDR 401,200.00 per month. By this criterion, the number of poor households in East Java Province was 5,007 households.

The method of analysis used in this study is spatial econometrics. Spatial dependence often appears in cross-sectional data or sample data of a census. Spatial data samples in this study represent related observations towards a point or region, for example, a home, a district, or a country. Spatial dependence reflects a situation when the observed value in one location or area, observation *i*, depends on the value of neighboring observations, which is the impact of spatial spillover from the presence of mobility factors such as time, distance, and regional conditions. Simultaneously, the value of $y_i$ will depend on the value of $y_j$, and vice versa.

Therefore, the spatial equation is presented in the following:

$$Y_i = \boldsymbol{\rho} W_{ij} Y_j + X_i + \boldsymbol{\theta}\, W_{ij} X_j + \boldsymbol{\lambda}\, W_{ij}\, \mu_j + \varepsilon_i \quad \text{(i)}$$

*where:*

$Y_i$: *level of* household's income per capita (n x 1)
$X_i$: capital capacity (n x 1)
$\mu \; and \; \varepsilon$: regression errors
$W_{ij}$: spatial weighting matrix (n x n)
$\rho$: spatial lag coefficient in the response variables
$\theta$: coefficient of spatial lag in predictor variables
$\lambda$: autoregressive spatial coefficient on errors

This research employs a household's capital capacity that influences sustainable improvement to income, as suggested in the SLA theory. Thereby four factors of capital capacity are included in this study, namely (a) human capital, which includes costs of education and dependency burden that imply households' productivity; (b) financial capital, which is related to the saving ability and access to bank credit; (c) physical capital, which refers to ownership of physical assets in the form of motor vehicles, jewelry, as well as electronics goods.

Financial capital capacity and physical capital show households' collateral; and (d) social capital, which is the ability in social networks to get information about public services, infrastructure, and job markets. Concerning natural capital, this factor is not specifically included in the model with the assumption that geographical conditions in East Java are relatively comparable. Descriptions of measurement variables in this study are presented in Appendix 1.

The first step in the spatial analysis was designing a matrix of spatial weight based on the proximity (contiguity) in the radius of a neighborhood to the closest neighboring areas. Whereas linkages between chosen areas test the interactions of a group of households in one area with its neighboring areas. So, weight one is the neighborhood between households in one area with its administratively neighboring areas, while others are weighted zero or treated as not neighbors of the area. The spatial weight matrix of this study can be seen in Appendix 2.

Furthermore, the second step was to test whether the interaction of household income among regions in East Java does exist; the Moran's I test was carried out in this step. This test was carried out to prove that the spatial weight matrix was not equal to 0 and indicates a relationship between regions, both in the response and predictor variables.

The third step was to choose the best model through the use of the Lagrange Multiplier (LM) test. Elhorst (2014) explains that a panel data regression model in which there is an interaction between spatial units will have a spatial lag-dependent variable or spatial error process. These are usually called a spatial lag model and a spatial error model. The spatial lag model shows the influence of the independent variable in area *j* on the dependent variable in area *i*. If the results of LM Lag are significant, then there are three alternative models formed, namely the Spatial Lag Model (SAR), Spatial Lag X (SLX), and Spatial Durbin Model (SDM).

Meanwhile, the LM error was known to be significant, which means the model considers random shock or error between observations; then there are three alternative spatial models, namely Spatial Error Model (SEM), Spatial Autoregressive Confused (SAC), and Spatial Durbin Error Model (SDEM). Furthermore, since it was known that both the LM lag and the error are significant, Robust LM error and Robust LM lag testing were conducted to obtain various considerations of the appropriate regression model. Lastly, this study applied Akaike's Information Criterion (AIC) value to test the accuracy of the model.

## 4. Results and Discussion

### 4.1. *Results of Spatial Linkages Test*

Based on the development of the spatial weight matrix of the neighbors of poor households to the nearest districts or cities, significant and positive Moran's values were obtained for all tested variables. However, the Moran's index obtained has a relatively small value (<0.5). The variables with the largest moran value are the income of poor households, education costs, and savings. The magnitude of the Moran value of these three variables indicates a correlation or relationship between income, education costs, and savings between neighboring households.

Table 1. Test Results Moran Index

| Moran's I Test | SCORE | P-VALUE | Sign. |
|---|---|---|---|
| Y<- Poor household income | 0.01 | < 2.2e-16 | *** |
| Cost of education | 0.03 | < 2.2e-16 | *** |
| Savings | 0.02 | < 2.2e-16 | *** |

*Signif.codes : 0.01* '***' *0.05* '**' *0.10* '*'

Source: Results of analysis using R Studio version 1.2.1335, 2020

Furthermore, the Lagrange Multiplier (LM) Test examines a more specific spatial relationship, namely in lag or error. The test results show that the lag and error models are known to be significant, with an error rate of <1%. Hence, it is necessary to continue with a robust model.

In the robust LM test, the error model has a better accuracy rate with an error of <1%. On the other hand, in the lag model, there are doubts about the accuracy of the model by 10%. This means that the selection of the best regression model is to consider the spatial interaction in the dependent variable, the independent variable, and the error interaction between households. Therefore, this study concludes by choosing the General Nesting Spatial (GNS) model, which considers the spatial relationship of poor household income, the spatial relationship on the variable x, and the relationship of errors between households.

Table 2. Test Results *Lagrange Multiplier*

| Langrange Multiplier Test | SCORE | P-VALUE | Sign. |
|---|---|---|---|
| LM Error | 224.2 | < 2.2e-16 | *** |
| LM Lag | 174.6 | < 2.2e-16 | *** |
| Robust LM Error | 52.69 | 3.896e-13 | *** |
| Robust LM Lag | 3.12 | 0.0771 | * |

*Signif.codes : 0.01* '***' *0.05* '**' *0.10* '*'

Source: Results of analysis results using R Studio version 1.2.1335, 2020

### *4.2. Results of Spatial Model Estimation*

In principle, this study finds that both the non-spatial model (Ordinary Least Square) and spatial model (General Spatial Nesting) are not much different in terms of the significance and direction coefficient of the relationship between variables. However, when the AIC value of the GNS model is considered, it is actually lower than the OLS model. By considering the spatial effect, the model being analyzed has a better level of accuracy. This is because the GNS model accommodates spatial effects on income variables and other independent variables as well as the effect of heteroscedasticity of errors between households.

Statistical results on the GNS model show the spatial lag coefficient (rho) is positive and significant at 0.84. That is, there is a positive relationship to the income of poor households in East Java, in which if household income increases by 1%, the income of poor households in the neighboring areas also increases by 0.84%. This, of course, illustrates the interrelationship of income between poor households to the nearest districts or cities. The income linkage of poor households arises from the existence of a multiplier effect process of economic activity between the closest poor households.

In basic economic theory, economic activity in an area is influenced by the growth of the base sector and supported by the development of non-base sectors such as trade, services, and infrastructure. It can be illustrated that when basic sector activities develop (industrial sector), inputs from other sectors (agriculture) and supporting sectors (trade and transportation) are needed. A poor household earns income through work activities in the developing industrial sector, and then the development of the base sector has the opportunity to increase the income of households working in the non-base sector. The process of income accumulation, also known as the multiplier effect, is what causes income linkages between households.

Meanwhile, there is a spatial error coefficient (lambda), which is negative and significant at the 10% level of significance. This coefficient indicates that household income is also influenced by non-economic factors outside of the variables studied, such as socio-cultural characteristics that differ from one household to another. This indicates the formation of poverty clusters in East Java.

Table 3. Model Estimation Results

| Concept | Parameter | OLS models | | GNS models | |
|---|---|---|---|---|---|
| | Intercept | 31.5854.48 | *** | 51,854.50 | ** |
| *Human Capital* | Dependencies_rat | -16,264,02 | *** | -17,686.35 | *** |
| | Cost_Pend | -37,804.01 | *** | -33,253.82 | *** |
| *Financial Capital* | Savings | 6,334.92 | *** | 6,062.39 | *** |
| | Kur | 8,272.40 | ** | 8047.97 | ** |
| *Physical Capital* | index_asset | 47,176.63 | *** | 45.130.17 | *** |
| *Social Capital* | Working hours | 188,17 | *** | 195.22 | *** |
| | city_village | 11,074,41 | *** | 11450.77 | *** |
| *Lag X ($\theta$)* | *Lag_Pend Fee* | | | -54,371.37 | ** |
| | *Savings lag* | | | -13,182.35 | X |
| Linkages Income between house ladder | Spatial Lag ( $\rho$) | | | 0.84 | *** |
| Heterogeneity between group house ladder | Spatial Error ( $\varepsilon$) | | | -0.84 | * |
| | AIC | 122,922 | | 122.880 | |

*Signif.codes : 0.01 '***' 0.05 '**' 0.10 '*'*

Source: Results analysis using R Studio version 1.2.1335, 2020

In general, all the variables tested, namely the capacity of financial, physical, and social capital, can increase the income of poor households. Financial capital capacity, as measured by the ability to save and access business credit, affects increasing the income of poor households. Households that can set aside income to save show better financial capabilities. Furthermore, households that can access credit facilities (Kredit Usaha Rakyat or KUR) receive benefits in terms of capital injections to start and conduct business activities.

The finding is in line with the study of Sowunmi (2016) and Kuang et al. (2019); poor households that cannot make loans tend to be trapped in poverty continuously. Access to microcredit initially increases income because it can stimulate households to save and accumulate assets in poor households.

Likewise, physical capital capacity, as represented in the form of ownership of motorized vehicles, jewelry, and electronic goods can show the amount of household collateral. This is in line with the research of Kuang et al. (2019) that ownership of physical assets can function as a safety net that is easily converted or sold to facilitate consumption during difficult conditions.

In line with the estimation results on physical and financial capital capacity, social capital capacity positively and significantly increases the income of poor households in East Java. Basically, the variables taken as measures of social capital reflect the level of accessibility of poor households in the labor market as well as the expansion of information and technology.

For poor households, work hours indicate the level of accessibility to the labour market. This means that the more households that allocate time to work, the less leisure time (leisure) and unemployment; as a consequence, there is an additional wage for daily life. However, it should be realized that the additional wages received are not large, as observed in the lower coefficient value compared to other variables.

There are advantages if poor households live in urban areas compared to living in rural areas. Considering more adequate facilities and infrastructure, better electricity supply, unlimited information and communication, and wider availability of market information. This is because the forms of social capital include networks and connections, mutually supportive relationships, and the ease of accessing market information and capital that does not experience obstacles both within the area and in the surrounding area.

In contrast, human capital capacity, which represents the dependence of family members and investment in human capital (education spending), still reduces the income of poor households. This can be explained by the fact that with the current fixed income, a household will reduce its consumption to support family members of non-productive age.

This is surely exacerbated if there is only one breadwinner in the household, where all of the income is distributed among family members. This is in line with the findings of Otsubo (2016) and Sowunmi (2016) that each additional family member aged children results in a decrease in the total consumption that can be enjoyed by the household.

Furthermore, improving the quality of education for household members is still a burden on households at this time, although in the future, education investment is expected to increase abilities and skills. This is supported by the findings of Nawaz (2016) and Ansong (2018) that income plays an important role in shaping education, where rich households will have more opportunities to provide quality education than poor households. Hence, it can be concluded that the magnitude of the burden of dependence and the high cost of education reduces household productivity and further reduces household income.

The finding is in relation to the proposition of Todaro and Smith (2014), who argue that education positively affects economic growth because the availability of skilled and educated workers is an important condition in the ongoing process of economic development. To attain sustainable development, the education sector plays a strategic role, especially in encouraging the accumulation of capital that can support production and other economic activities. Education and poverty indicate a considerable linkage because the former can enhance the ability of individuals to develop via mastery of knowledge and skills.

This study adds a lag to the variable x, namely lag_cost of education and lag_savings, which have a fairly large moran value among other variables. The estimation results show that the flow of human capital investment between households provides a demonstration effect. That is, if one household increases its consumption, other households will also increase the consumption pattern in the neighboring areas (Duesenberry, 2005). This is because the cost of education obtained by poor households comes mainly from government assistance, so there is a link between education costs among poor households. However, the flow of savings between households does not show a strong relationship; it is estimated that the ability to save households is more influenced by the level of income, not due to the demonstration effect.

**5. Conclusion**

The introduction part of this study highlights poverty and income inequality as focal issues in achieving sustainable development, especially in East Java Province, Indonesia. The province has higher levels of poverty and income inequality than the national average, and efforts to increase the income of poor households are important for poverty alleviation. In this regard, in contrast to the traditional economic models, the poverty circle and capability approach theories have shed light on more perspectives in explaining poverty.

There are several takeaways from the study. First, both the estimation of the non-spatial model and the spatial model are in line with the SLA theory in explaining the increase in the income of poor households. The influencing factors are a higher level of collateral (physical capital), ease of access to information in urban areas (social capital), and accessibility of business credit (financial capital). Second, empirical results using the GNS spatial regression model show that there is a positive relationship between income

between poor households and the neighboring district/city due to the multiplier effect of economic activities on poor households and the formation of poverty clusters which might be indicated by differences of social institutions and socio-cultural characteristics in the province.

Overall, this study contributes to providing more perspectives for poverty alleviation policies by revisiting spatial linkages on poor households' income in East Java Province. The study finds a positive spillover of poor households' income within neighboring districts or cities, implying the existence of multiplier effects in the household's economic activities that later form clusters of poverty.

However, it is worth noting that the study only considers the spatial relationship of poor household income, the spatial relationship on the variable x, and the relationship of errors between households. Other factors that may affect poverty, such as education, health, and access to resources, are not included in the analysis. The study also does not consider the impact of external factors, such as government policies or economic conditions, on poverty in the region.

Hence, while the paper provides valuable insights into the spatial linkages between poor households' income in East Java Province, further work is needed to address these limitations and provide a more comprehensive understanding of poverty in the region. Several future works that can build on the findings of this study include conducting similar studies in other regions or provinces in Indonesia to test the generalizability of the findings, incorporating other factors that may affect poverty, such as education, health, and access to resources, in the analysis to provide a more comprehensive understanding of poverty in the region.

It is also suggested for the future works to use more recent data to reflect the current situation of poverty in the region, considering the impact of external factors, such as government policies or economic conditions, on poverty in the region, and to explore the potential of policies that promote access to physical capital, social capital, and financial capital to help poor households increase their income and improve their livelihoods.

In addition, further works in this field could employ the SEM (Spatial Error Model) method to get more evidence on the influence of the spatial error coefficient (lambda). Careful measurement of the error is advised since it could reveal non-economic factors such as social institutions and socio-cultural characteristics. These future works shall help policymakers design more effective poverty alleviation policies that address the specific needs of different communities in East Java Province and other regions in Indonesia.

The paper has several practical implications for poverty alleviation policies in East Java Province, including the need to consider the spatial heterogeneity of poor households in the region, which is related to differences in social institutions and other socio-cultural characteristics. This can help policymakers design more targeted interventions that address the specific needs of different communities. That is for any intervention policy to target a group of poor households within a particular poverty cluster, compared to targeting all poor households in general.

Hence, there is a need to focus on factors that influence poor households' income, such as physical capital, social capital, and financial capital. Policies that promote access to these resources, such as collateral, information, and credit, may effectively help poor households increase their income and improve their livelihoods.

In addition, concerning the socio-cultural characteristics of East Java society, the cluster of poverty in the province could be divided into four clusters: (i) Java Matraman cluster (Ngawi Regency, Madiun Regency and City, Pacitan Regency, Magetan Regency, Kediri Regency and City, Nganjuk Regency, Tulungagung Regency, Blitar Regency and City, Trenggalek Regency, Tuban Regency, Lamongan Regency, and Bojonegoro Regency); (ii) Arek cluster (City of Surabaya, Sidoarjo Regency, Gresik Regency, Regency and City of Malang); (iii) Madura island cluster; and (iv) the Pandalungan cluster (Pasuruan Regency and City, Probolinggo Regency and City, Situbondo Regency, Bondowoso Regency, Lumajang Regency and Jember Regency).

Findings in this study also suggest that policymakers take into account the importance of accommodating spatial effects in poverty alleviation policies. The study finds a positive spillover of poor households' income within neighboring districts or cities, implying the existence of multiplier effects in the household's economic activities that later form clusters of poverty. This suggests that policies that promote economic activities in one area may have positive effects on poverty reduction in neighboring areas as well.

This provides support to the current approach in the regional economic development of East Java Province, which emphasizes the spatial aspect. For instance, physical infrastructure developments in the province are deployed based on spatial aspects. In this regard, there are three main strategic areas of development, namely Kawasan Strategis Nasional Metropolitan Gerbangkertasusila (GKS), Kawasan Strategis Pariwisata Nasional Bromo-Tengger-Semeru (BTS), and Kawasan Selingkar Wilis.

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**Appendices**

**Appendix 1. Measurement Variables and Data Description**

| Variable | | Measurement | Minimum | Average | Maximum | Standard deviation |
|---|---|---|---|---|---|---|
| Y<-expcap | | Rupiah per capita | 111.664,35 | 321.002,35 | 400.925,65 | 53.449,27 |
| *Human capital capacity* | Dependency ratio | $= \frac{U_{0-14+}U_{65}}{U_{15-64}}$ x 100 | 0,50 | 0,70 | 1,00 | 0,19 |
| | Education spending | Rupiah/income | 0,00 | 0,05 | 2,23 | 0,11 |
| *Financial capital capacity* | Saving | Person/capita | 0,00 | 0,22 | 1,00 | 0,52 |
| | KUR | 1: Yes<br>0: Others | 0,00 | 0,03 | 1,00 | 0,18 |
| *Physical capital capacity* | Index of Assets | $= \frac{1}{3}$ x 100 | 0,00 | 0,23 | 1,00 | 0,18 |
| *Social capital capacity* | Work hours | ….. hours/week | 0,00 | 36,52 | 97,00 | 22,05 |
| | Urban-rural | 1: Urban<br>0: Rural | 0,00 | 0,36 | 1,00 | 0,48 |

**Appendix 2. Design of Spatial Weight Matrix**

| | Kabupaten A | | | Kabupaten B | | | | Kabupaten C | | Kabupaten D | | | Kabupaten E | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | RTA_1 | RTA_2 | RTA_3 | RTB_1 | RTB_2 | RTB_3 | RTB_4 | RTC_1 | RTC_2 | RTD_1 | RTD_2 | RTD_3 | RTE_1 | RTE_2 |
| RTA_1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| RTA_2 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| RTA_3 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| RTB_1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| RTB_2 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| RTB_3 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| RTB_4 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| RTC_1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| RTC_2 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 |
| RTD_1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 |
| RTD_2 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 |
| RTD_3 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 |
| RTE_1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 |
| RTE_2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 |