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A Regional Income Convergence Process in East Java (Indonesia): Do Spatial Dependence and Spatial Regimes Matter?

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Abstract. East Java has experienced a high level of disparity across regions, and tend to increase over time. In addition, most of the studies on regional income convergence has ignored spatial dependence. The result found that spatial dependence was matter. A region's economic growth is affected by the performance of its neighbours. It reflects that spillover effects among regions are important for growth, and spatial interrelation can not be ignored in the analysis of regional convergence. This research also found the two spatial regimes which can be meant as spatial convergence clubs. It seems like a core and periphery structure in a new economic geography theory.

Keywords: Regional Income Convergence, Two Spatial Regimes, Spatial Dependence, Spillover Effects, JEL Classification: C21, O18, R11.

1. Introduction

Economic growth is a topic that has for a long time atrracted the attention of economists, more so in recent decades. The relationship between economic growth and its determinants has been studied extensively in economic literature. A large number of empirical studies, have found that economic growth is related to initial income, human capital, investment, physical infrastructure and institutions. However, the role of geography is an empirical issue that has been taken into consideration just only recently.

Rey and Montouri (1999) noted that traditionally, each of economies is assumed as independent unit, and has ignored the possibility of space interactions across regions. Arlinggaus (1996) stated that the main difference between spatial statistics and classical statistics is on assumption which says that an observational analysis unit is not independent. Thus, the assumption that a cross sectional unit is independent not relevant because the disturbance error may come from observed countries or regions. Furthermore, this situation will cause a correlation across the error of different cross sectional unit which says with spatial autocorrelation. Anselin (1988) noted that spatial correlation can be interpreted as an independece across observations in a panel data. A problem of spatial dependence causes the OLS estimator is bias and inconsistent.

Many economists have been interested in the use of spatial econometrics in a growth and convergence studies. One of the advantages of this method is its ablity to capture the spatial effect or spatial relationship

in a geographical economies. Tobler (1979) stated that everything is related to everything else, but near things are more related than distant things. The same opinion came from Moreno and Trehan (1997), he noted that spatial effect has been ignored in literature of traditional economic growth, then they think of testing the importance of location in economic growth. It is clear that spatial dependence has wider applications in an economic growth.

In recent decades, the so-called new economic geography and issues of regional economic convergence have increasingly attracted the interest of economists to the empirical analysis of regional and spatial data. It should be noted that spatial effects, particularly spatial autocorrelation and spatial heterogenity, must be taken into account when analyzing convergence process at regional scale.

Spatial effects are important in explaining economic growth, however it has been largely ignored in the traditional economic growth literature that pool data for large samples of countries or regions. Theoretical and empirical arguments suggest that regions, as well as not being homogeneous, are also not independent

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(Rey and Montouri, 1999). Regions can interact strongly with each other trough channels such as technological diffusion, capital iflows, other factors mobility, and economic policies. In such cases, externalities can spillover the limits among regions, and contributing in the explanation of regional economic growth.

Recently, some empirical studies have used the spatial econometrics framework for modelling the regional convergence and growth. The earlier studies recognized the importance of space and geography on regional economic convergence. Rey and Montouri (1999), studied the spatial dependence in the US regional economic percapita income-unconditional convergence for the 1929-1994 period. They found strong patterns of both global and local spatial autocorrelation, and show the magnitude of the spatial effects is significant and positively correlated with US regional income.

Magalhaes et al (2000), using state data for the 1970-1995 period in Brazil, found a similar result to US case, strong patterns of spatial correlation among Brazilian states during the period. Moreover, the research found that, although some convergence among states was taking place, it seemed to be more of regional phenomena or perhaps some type of club convergence than a global convergence process. Ramirez, and Loboguerrero (2002), based on a sample of 98 countries over the three decades (1965-75, 1975-85, and 1985-95), found that spatial relationship across countries are relevant. A country's economic growth is indeed affected by the performance of its neighbors among countries, and then are important for growth. In addition, the research found the two spatial regimes which can be interpreted as spatial convergence clubs.

Rumayya (2005), using 37 regencies and municipalities in East Java from 1983-2002 found the two spatial regimes which tend to be divergenced in each cluster. The cluster of high income regions was in central and eastern part of East Java, and the cluster of low income regions was in western part. Paas dan Schlitte (2007), found a core-periphery structure with relatively high income levels in the centre of the EU, and relatively low income levels in peripheral regions. However, regional growth rates tend to be higher in the periphery, indicating a catching up process.

Gajwani dan Kanbur (2006), compared the patterns of regional inequality and tried to comprehend the driving forces behind its changes in China and India. They found that largerly due to the difference in barriers to migration *(hukou system)*, China's regional inequality has been much higher than India's, while the India's states have become clustered into two clubs, more educated and less educated ones. While, Khomiakova (2008) found that the divergence in India was caused by structural divergence in India.

Marquez dan Yrigoven (2004) found that firstly, not only the initial percapita income strongly determined the evolution of percapita GDP of the cities throughout the period, but there are also other factors, such as capital growth, and technology level. Secondly, there is some kind of spatial polarization of urban economies within Spain, which is expressed as two different spatial regimes in percapita GDP distribution of Spanish cities. Thirdly, a spillover effect has been detected in income, and there is a convergence trend in the set of the main Spanish cities.

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Indonesia has experienced a complex regional disparities, eventually in East Java. Indonesia is an archipelago country which spatially has differences in resources ownership, population distribution, and any others economic concentration. It has been worsening with a sentralistic development policies, top down, and tend to emphasize on growth than income redistibution in the past. Based on the Williamson Index indicates that eventhough there was a slightly decreases, 0,77 in 2000 and 0,71 in 2007, however the East Java province experienced the highest regional disparity than other provinces in Java island. In addition, it has been more double than others, and it tends to increase over time.

Therefore, the aim of this paper is twofold, firstly, to observe the presence of spatial dependence in regional income convergence of East Java, and secondly, to identify and analyze the two spatial regimes or clubs convergence in East Java, whether divergence or convergence.

This paper presents the result of an empirical study of percapita income convergence in East Java based on data of 29 districts *(kabupaten)* and 9 municipalities *(kota)* troughout 2004-2010. A formal tools of spatial econometrics was used to identify and include the relevant spatial effects in the estimation of the appropriate income growth model. Effect in spatial cross-sectional context is used for testing the presence of spatial spillover effects, then the *Spatial Exploratory Data Analysis (ESDA)* is appropriate tools for testing the spatial dependence in the error term.

The main idea of the present paper concerns the importance of considering spatial dependence and taking it into account in modelling of regional convergence and growth in East Java. The present paper provides some interesting empirical results. First, spatial relationships or spatial dependence across regions indeed quite matter. The Spatial Durbin Model suggests that each region's growth rate related with that of its neighboring regions. Second, this research also found the two spatial regimes which can be interpreted as spatial convergence clubs. It seems like a core and periphery structure in a new economic geography theory. The two spatial regimes have different convergence process, and tend to be divergence as impact of local spillover effects.

The remaining of the paper is organized as follows. In Section 2 is devoted to a review of literature, in Section 3, data and methodology are explained. The results of ESDA are presented in Section 4, and Section 5 is devoted for empirical results in regional income convergence and growth. Finally, conclusions and policy implications are provided in Section 6.

2. Review of Literature

The most popular approach in the quantitative measurement of convergence is based on the concept of β *(Beta)* regression model. In this section, review of classical β-convergence approach and specifications of empirical growth regression will be explained.

2.1. β-Convergence

The β-convergence approach comes from the neoclassical Solow-Swan exogenous growth model, assuming a closed economic system, exogenous saving rates and a production function based on decreasing productivity of capital and constant returns to scale. A cross sectional specification of the neoclassical growth model, which is considered as a natural starting point of the analysis of regional disparities. Although debatable, the neoclassical convergence specification have a sound empirical track record.

The neoclassical growth theory predicts the decrease of disparities in income levels (called convergence optimism), because of decreasing returns to reproducible capital (Paas et al, 2007). In the absolute convergence hypothesis, the percapita income of countries or regions converge with one another in the long term regardless of the initial conditions. Poorer countries and regions grow faster than richer ones, and there is a negative relationship between average growth rates and initial income levels even if no other variables are included in the regression model as explanatory factors or without conditioning on any other characteristics of economies [Barro and Sala-I-Martin, (2004), and Paas et al (2007)]. They suggested the following statistical model:

$$\frac{1}{t}ln\left(\frac{y_{i,t}}{y_{i,0}}\right) = \alpha + \beta ln(y_{i,0}) + \varepsilon_i\ ; \varepsilon_i \sim i.i.d(0, \sigma_\varepsilon^2) \quad (1)$$

where

$y_{i,t}$ represents percapita GDP in regions i, year t, α and β are parameters to be estimated and ε_i is an error term. This unconditional convergence model is very basic as it does not consider either the possible existence of spatial spillovers or other explicative variables for income growth, or indeed the existence of spatial heterogeneity ("clubs"), or even some endogeneity in the regressors (Marquez and Yrigoven, 2004). Absolute convergence is said to be present, if the estimate of β is negative and statistically significant. If the null hypothesis ($\beta = 0$) is rejected, it would conclude that poor regions grow faster than rich ones, and that they all converge to the same level of percapita income (Arbia and Piras, 2005).

On the other hand, endogenous growth theory predicts persistent and even increasing inequality (called convergence pessimism) because of increasing returns to scale. Human capital is taken into account and technological progress is endogenised. When human capital is added to the model, there is no longer any reason to assume decreasing returns to capital, and therefore the percapita GDP levels of different regions may not converge with one another even if the preferences, saving rates, and technology are similar in this regions.

The integration theory, the classical theory and New Economic Geography *(NEG)* support clearly neither convergence optimism nor pessimism. However, there seems to be more support for convergence pessimism in NEG. NEG also claims that location plays an important role in the economic activity of a region. In addition to other factors, the economic situation of a region depends on its location and its neighbours, so poor regions have a greater chances for development if they are surrounded by the rich neighbours. NEG has particularly highlited location and agglomeration externalities, which can arise because of knowledge spillovers, various market effects, and input-output linkages between the firms operating at various spatial levels (e.g. regions, cities, districts of cities, rural areas, etc) (Paas et al, 2007).

2.2. Spatial Dependence in Cross-Sectional Models

The neoclassical growth model discussed in the previous section has been developed starting from the hypothesis that the economies are fundamentally closed. However, this hypothesis is too strong for regions within a country. Regional economic growth depends on three factors, population growth, capital accumulation, and technology. There is more capital in the richer regions, and therefore there are also lower marginal returns to capital, and slower economic growth. In open economies, labor should move to the richer regions because of the higher wage levels, while capital on the other hand moves to the poorer regions thus increasing their economic growth [Armstrong, (2007), Arbia and Piras (2005)].

Furthermore, another possibility for poorer economies to converge towards the richer ones is represented by technological diffusion and knowledge, even in the case of positive returs to scale. Richer countries (or regions) are usually the innovators, poorer ones only adopt these innovations are generally significantly lower than the costs of actually creating them (Rey, 2004).

A broader interpretation of knowledge spillover effects refers to positive knowledge external effects produced by firms at a particular location and affecting the production processes of firms located elsewhere. However, when investigating regional convergence problem and studying the effect of geographical spillover on growth, it must also distinguish between local and global geographic spillover. With local spillover, production processes of firms located in one region only benefit from the knowledge accumulation in that region. In this case, regional divergence is likely to be the otcome. On the contrary, with global geographical spillover, it means that knowledge accumulation in one region improves productivity of all firms whereever they are located. Thus, a global geographical spillover effect contributes to regional convergence (Arbia and Piras, 2007).

An indirect way to control for the effects of interregional flows (or spatial interaction effects) on growth and convergence is through spatial dependence models. The spatial dependence can arise because of technological spillovers, labor and non-labor migration, commoditi flows, and other spatial interaction (Rey and Janikas, 2004). A first way to take spatial dependence into account is the so-called spatial autoregressive *(SAR)* model, where a spatial lag of the dependent variable is included on the right hand side of the statistical model. In the SAR model, the spatial dependence comes into the model the spatially lagged dependent variable, and it is considered as being created by actual interaction among the regions (Magalhaes et al, 2000). In the model of income convergence the growth rate in one country (region) depends on growth rates in its neighbours, so the model recognizes the presence of global externalities in the process of growth [Paas et al (2007), Fingleton and Baso (2005)].

$$ln\left(\frac{y_{i0+T}}{y_{i0}}\right) = \alpha + \rho\left[W \cdot ln\left(\frac{y_{0+T}}{y_0}\right)\right]_i + \beta ln(y_{i0}) + \varepsilon_i \qquad (2)$$

where

ρ is the scalar spatial autoregressive parameter, that captures the spatial interaction effect indicating the degree to which the growth rate of percapita GDP in one region is determined by the growth rates of its neighboring regions, after conditioning on the effect of $lny_{i,0}$ (Arbia and Piras, 2007).

The second form of spatial dependence in a regression model concerns to the residuals. In this case, the spatial correlation between error terms is considered. Spatial dependence could be present in the residuals when there are some omitted unobservable variables that can be spatially correlated. A random shock in a country or region will not only affect the growth rate in that country, but also the growth rates of other countries or regions because of the presence of the spatial error dependence (Rey and Montouri, 1999).

$$ln\left(\frac{y_{i0+T}}{y_{i0}}\right) = \alpha + \beta ln(y_{i0}) + [I - \lambda W]^{-1}\mu_i, \text{ with } \mu_i \sim i.i.d\left(0, \sigma_\mu^2\right) \quad (3)$$

where

λ is a scalar spatial error coefficient. This expression indicates that a random shock introduced into a specific regions will not only affects its growth rate but through the spatial multiplier $[I - \lambda W]$, will impact the growth rates of other regions, even if a given region has a limited number of neighbours (Marquez and Yrigoven, 2004).

The third, the spatial cross-regressive model (SCRM) includes the spatial lag of initial income percapita as a right-hand-side variable.

$$ln\left(\frac{y_{i0+T}}{y_{i0}}\right) = \alpha + \tau[W \cdot lny_0]_i + \beta ln(y_{i0}) + \varepsilon_i \quad (4)$$

where

τ is the scalar spatial lag of initial income percapita parameter, that captures the spatial interaction effect indicating the degree to which the growth rate of percapita GDP in one region is determined by the inititial income percapita of its neighboring regions, after conditioning on the effect of $lny_{i,0}$. As the effect of the spatial lag of income percapita is restricted to the first order neighbours, externalities are in this case local (Fingleton and Lopez-Bazo, 2005).

Finally, the spatial Durbin model (SDM) makes explicit the large number of parametric constraints that are involved in the spatial error model when conditioning variables are included in the growth equation.

$$ln\left(\frac{y_{0i+T}}{y_{0i}}\right) = \alpha + \rho\left[W \cdot ln\left(\frac{y_{0+T}}{y_0}\right)\right]_i + \beta ln(y_{0i}) + \tau[W \cdot lny_0]_i + \varepsilon_i \quad (5)$$

where

$\rho[W \cdot lny_0]_i$ is the specification of *spatial autoregressive* which is used for modeling the global spillover effect, and $\tau lnW y_{0i}$ is the specification of *spatial cross-regressive* and it is used for capturing the local spillover effect.

There are three advantages of this specification. First, it yields some information on the nature of convergence through β parameter once spatial effects are controlled for. Second, it able to identify the presence and magnitude of regional spillover effects in regional growth process. Third, it can be associated to the structure of regional spillover effects, global and local spatial externalities (Rumayya et al, 2005).

2.3. Clubs Convergence

Club convergence is the club-specific process by which each region belonging to a club moves from a disequilibrium position to its club-specific steady-state position. At the steady-state the growth rate is the same across the regional economies of a club. The possibility of club convergence is ruled out by implication in standard neoclassical model, because agents are assumed to be homogenous (which means there are no different initial conditions and therefore no convergence club.

$$\frac{1}{t} ln\left(\frac{y_{i,t}}{y_{i,0}}\right) = \alpha^g + \beta^g ln\left(y_{i,0}\right) + \varepsilon_i \; ; \varepsilon_i \sim i.i.d.\left(0, \sigma_\varepsilon^2\right) \quad (6)$$

where

g represents the different clubs.

The club convergence hypothesis, on the other hand, allows multiple and only locally stable steady state equilibriums. Regional economies differ in their basic growth parameters (for example technological innovativeness and human capital development), or knowledge spillovers between them are weak, they may not converge to a common percapita income, but instead to different economy-specific equilibrium levels of percapita income. Under such circumtances there might be convergence among similar types of economies (clubs, regimes), but little or no convergence between such clubs. The concept of club convergence is in line with the phenomena which characterise modern economies, such as polarisation and clustering (Paas et al, 2007).

3. Data and Methodology

To estimate the growth equation, it was used pool cross sectional units from 29 districts and 9 municipalities in East Java, over the 2004 to 2010 period. The research used data on real percapita GRDP (Gross Regional Domestic Product) at costant cost of 2000, and the data was taken from Central Berrau of Statistic *(Biro Pusat Statistik or BPS)*. Incorporating with estimating the spatial regressions and the result of ESDA we used the GeoDa software package as proposed by Anselin (2005).

3.1. Spatial Weight Matrix

The spatial interdependence between regions can be taken into account by applying a spatial weight matrix, W, which is supposed to capture a spatial structure. There are various ways to specify a spatial weight matrix. This research used a general spatial weight matrix that is based on the geography of the observations, queen contiguity. In this method, two regions are neighbors in this sense if they share any part of a common border, no matter how short (Viton, 2010). Using a simple binary contiguity matrix, the element of the spatial weight matrix (w_{ij}) is one, if location i is adjacent to location j, and zero otherwise. Furthermore, the matrix is standardized so that the elements of a row sum to one (row standardized).

3.2. Exploratory Spatial Data Analysis (ESDA)

The exploratory spatial analysis framework is based on the spatial aspects of the database, allowing visualization and exploration of data where space matters. ESDA deals directly with the idea of spatial dependence and spatial heterogeneity. The objective of this method is to describe the spatial distribution, the patterns of spatial association (spatial clusters), verify the existence of different spatial regimes, and identify non-typical observations (outliers). It is possible to extract measures of spatial autocorrelation and local autocorrelation from this methods (Anselin, 1999).

First, spatial autocorrelation can be defined as a spatial clustering of similar parameter values. If similar parameter values, high or low, are spatially clustered, there is a positive spatial autocorrelation present in the data. Conversely, a spatial proximity of dissimilar values indicates a negative spatial autocorrelation. Moran's I statistic is used to measure of spatial clustering, and the structure is similar with the Durbin Watson autocorrelation test statistic.

$$I_i = \frac{N \sum_{i=1}^{N} \sum_{j=1}^{N} x_{i,t} x_{j,t} w_{i,j}}{N_b \sum_{t=1}^{N} x_{i,t}^2} \tag{7}$$

where

$x_{i,t}$, variable in question in region i and in year t (in derivations from the mean), N is number of regions, N_b is sum of all weights (because of using row standardized $N_b = N$.

Second, local spatial autocorrelation is analyzed by means of Morran Scatter-plot and local indicators of spatial association *(LISA)*. LISA satisfies in two criterias: 1) LISA has to provide for each observation an indication of significant spatial clusters of similar values around the observation unit (region, state, province), and 2) the sum of LISA for every region is proportional to the indicator of global spatial autocorrelation.

4. Exploring Spatial Dependence Across Regions

In this section, we explore the geographic pattern of percapita GRDP for all districts and municipalities in East Java in the initial period (2004), and in the final period (2010). Based on Fig. 1, some regions relatively experienced higher percapita GRDP than others, Surabaya, Gresik, Sidoarjo, Mojokerto, Probolinggo, Kediri, Malang, Batu, Tulungagung, Probolinggo and Banyuwangi. The highest percapita GRDP was Surabaya which was surrounded by rich regions, Gresik, Sidoarjo, and Mojokerto. On the contrary, most of regions in East Java had low level of percapita GRDP.

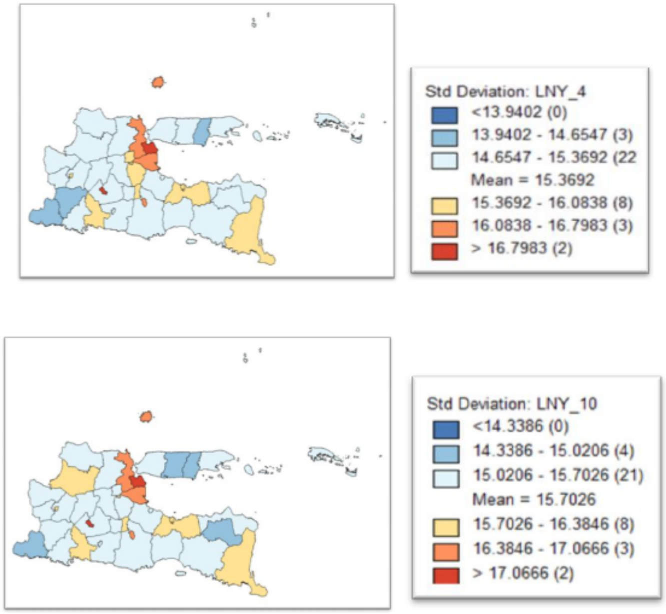

Fig. 1: Percapita GRDP of Districts and Municipalities in East Java, 2004 and 2010.

Similar results were found in the spatial distribution of percapita GRDP in 2010. Bojonegoro and Ponorogo had increased their percapita GRDP significantly. On the contrary, Mojokerto, Bondowoso, and Sampang had decreased their percapita GRDP. While, the others had relative persistent on percapita GRDP in recent 7 years.

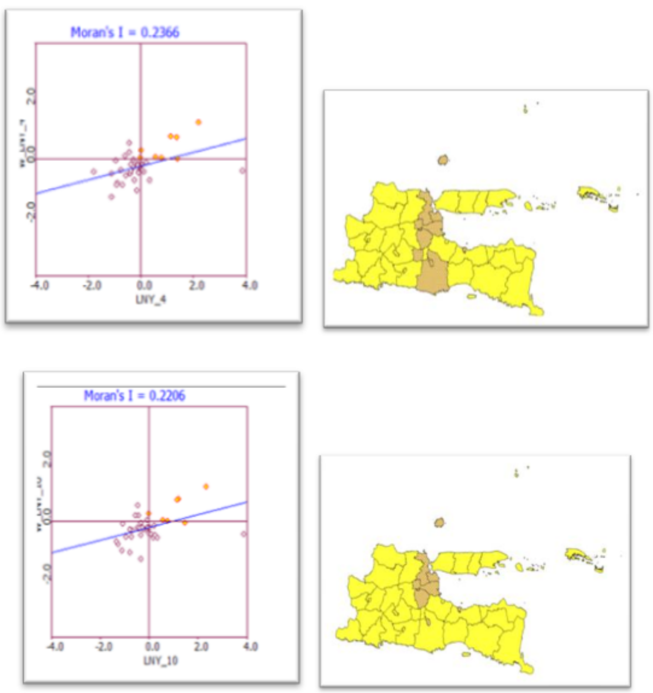

Fig. 2: Morran's I and Morran's Scatterplot of Percapita GRDP in East Java, HH Income, 2004 and 2010.

Given the evidence of income clustering provided by the map (Fig. 2), the next step is to test whether there is spatial dependence across regions. The spatial effect called, "spatial relationship" which can be defined as the coincidence of value similarity with locational similarity. There is a positive spatial autocorrelation when high or low values of a random variable tend to cluster in space, and there is a negative spatial autocorrelation when geographical areas tend to be surrounded by neighbours with very dissimilar values (Marquez and Yrigoven). The measurement of global spatial autocorrelation is based on the *Moran's I statistic*, which is the most widely known measure of spatial clustering. Thus, the spatial autocorrelation measures the interelationship of percapita GRDP across neighboring regions.

In the given period, the regions percapita GRDP showed a highly significant and positive spatial autocorrelation, the magnitude of Moran's I statistic = 0,2366 in 2004, and I = 0,2206 in 2010, with *p-value* = 0,001. It suggested that regions with high (low) percapita GRDP were localized near to other regions with high (low) percapita GRDP.

Moran Scatterplot was used to complete the diagnostics and to visualize the spatial clustering which displayed the percapita GRDP of a region in the horizontal axis, against its spatial lag in the vertical axis, both standardized. A region's spatial lag was a weighted average of the incomes of its neighboring regions, with the weights being obtained from a row standardized spatial weight matrix *(W)*.

The four quadrants of the graphs identified the relationship between a region and its neighbours as follows: 1) Quadrant 1, located at the top on the right, a region with high percapita income surrounded by regions with high percapita income (HH), 2) Quadrant 2, in the top left, a region with low percapita income surrounded by regions with high percapita income (LH), 3) Quadrant 3, in the bottom left, a region with low percapita income surrounded by regions with low percapita income (LL), 4) Quadrant 4, in the bottom right, a region with high percapita income surrounded by regions with low percapita income (LH). Quadrant 3 and 4 belong to positive forms of spatial dependence, while the remaining two represent negative spatial dependence.

An intuitive and useful way to start analyzing spatial dependence is by looking at the Figure 2, which showed a Morran's Scatterplot of percapita GRDP of East Java. It showed in all cases the presence of a positive spatial association among regions. This result suggested the existence of some kind of *spatial clubs or regimes*. Two spatial clusters were evident. In the first quadrant, HH, the Morran scatterplot demonstrated the high percapita income regions that were surrounded by the high percapita income neighbours. They were mainly located in the central *(core)* from the South to the North of East Java, consist of *kabupaten* Malang, *kota* Malang, Sidoarjo, *kabupaten* Mojokerto, *kota* Mojokerto, Gresik, and *kota* Surabaya. While, low income regions were mostly located in *peripheral* (western, eastern, and shoutern) of East Java. However, in 2010 *kabupaten* Malang did not belong to HH income.

ESDA has shown, firstly the existence of some kind of spatial polarization of economies in East Java, which was expressed as two spatial regimes in percapita GRDP distribution. It followed a *core-periphery structure* which was proposed by Krugman (1995). In the context of regional development, regions with low level of percapita income geographically dominate in the peripheral *(periphery)* regions, while the rich regions located in the central *(core)*.

Secondly, the results also suggested the existence of a strong spatial dependence pattern in the sample analysis. Then, it is necessary to include the spatial effects in the estimation of the growth equation. The presence of spatial correlation makes the OLS estimates inefficient, and ignoring the spatial dependence can result in significant model specification. Therefore, to assess this problem we applied spatial econometric techniques. Specifically, the spatial effect was introduced to the model by incorporating the spatial lag of income and endogenous variable *(Spatial Durbin Model)* which was proposed by Lopez-Baso et al (2004). The model was sepicified in equation (5).

5. Empirical Results

The estimation results for *Spatial Durbin Model* was presented in Table 1. The table showed that the coefficient of the initial percapita income level (β) for all regions of East Java, and the *High-High Income Club* are positive and statistically significant at α=0.05, while the *Low-Low Income club* is also positive and statistically significant at α=0.10. This results indicated the divergence process, not only in all regions of East Java, but also both in the High-High income club and the Low-Low Income Club. In other words, there was a wider inequality across regions in East Java and also in each club.

Spatial Durbin Model (SDM) was used to take into account a spatial effect which caused by the geographical spillovers across regions. The spatial effect was incorporated in the model through the spatial lag of initial income, and enogenous variable which was represented by the growth of percapita income. Table 1 showed that in both of clubs coefficients of spatial initial income (τ) were positive and strongly significant at α=0.01, while coefficients of spatial lag (ρ) were not significant. This result indicated that the growth of percapita income (GRDP) in East Java was more positively affected by initial percapita income of its region and its neighbour than the growth of percapita income of its neighbour.

Table 1: Income Convergence Estimation Results of East Java, 2004-2010: Dependent Variable is Growth Rate

Parameter Estimates (p-value in the brackets)	**All Regions of East Java**	**High High Income Club**	**Low Low Income Club**
Constant (α)	-0.092 (0.572)	0.060 (0.773)	0.528 (0.403)
Initial Income (β)	0.906 (0.000)*	0.086 (0.025)*	0.171 (0.082)**
Spatial Lag (ρ)	0.057 (0.062)**	-0.033) (0.424)	0.008 (0.935)
Spatial Initial Income (τ)	12.127 (0.481)	380.429 (0.000)*	266.328 (0.000)*
Goodness of Fit			
R^2	0.998	0.951	0.871
Log Likelihood	-36.546	-56.994	-90.864
AIC	81.093	121.988	189.729
Schwartz Criterion	87.643	128.539	196.279
Likelihood Ratio Test	3.186 (0.074)**	0.463 (0.538)	0.008 (0.928)

**) significant at $\alpha = 0.10$
*) significant at $\alpha = 0.05$

It can be concluded that the regional spillovers in East Java tend to be locally, and this result has been consistent with the *New Economic Geography (NEG)*, and also the *Endogenous Growth Theory*. Arbia (2005), and Rumayya (2005), stated that as a consequences of local spillover is the presence of divergence in the economies or an inequality of percapita income which tend to be persistent.

These findings also strenghtened the NEG theory that location has an important role in region economy activities. There is a high variability in agglomeration of economic activities in a geographical space dimension. In a regional development context, regions with low level of percapita income geographically dominates in the peripheral areas *(periphery)*, while the richer regions were located in the central *(core)*. Thus, there was a *core-perphery structure* in NEG (Krugman, 1991;and Krugman & Venables, 1995).

According to Matinez-Vazquez and Rider (2005), the economic powers drive a concentration in economic activities to the central which was strenghtened and facilitated with a devolution. Moreover, the inequality is much wider, an economic agglomeration more strenghten the motivation on resources concentration, capacities, and the competition ability progressively will attract to regions which more successful economically.

The findings empirically supports the previous researches. Magalhaes et al (2000), some convergence among states is took place in Brazil, however it seems to be more of regional phenomena or perhaps some type of club convergence than a global convergence process. Ramirez and Loboguerrero (2002), found three spatial clusters based on percapita income, high income (concentrated in Europe, North America, and Australia), middle income (Middle East), and the lowest income (Sub-Sahara Africa and East Asia). It also found that spillover effects among countries are important for growth. Paas and Schlitte (2007), found a *core-periphery structure* in EU. Finally, Rumayya (2005), found a club convergence in East Java, during 1983-2003 period, the rich club was located in the central and eastern, while the poor club was located in western of East Java.

6. Conclusions and Policy Implications

This paper used a spatial econometrics to estimate a convergence model that includes cross-regions interdependence. Based on a sample of 29 districts *(kabupaten)* and 9 municipalities *(kota)* over 2004 to 2010, the paper found some interesting results. First, that spatial relationship or spatial dependence are quite relevant. A region's economic growth is indeed affected by the the performance of its neighbors. This result suggests that the spillover effects among regions are important for growth, eventhough it was a local spillover effect. This results indicate, that spatial interrelation can not be ignored in the analysis of economic growth. Ignoring such relationships can result in model misspecification.

Second, this research also found two spatial regimes which can be interpreted as spatial convergence clubs. The first club, the central club (*core*, rich regions surrounded by rich regions), located in central from south to north, from Malang to Surabaya. The second club (*peripheral*, poor regions surrounded by poor regions), which is in western, eastern, and northern of East Java. It seems like a core and periphery structure in a new economic geography theory. The two spatial regimes have different convergence process, and tend to be divergence as impact of local spillover effects. In other words, there was a wider inequality in each club. The findings not only strengthened the endogenous growth theory and the new economic geography theory, but also important to develop a policy recommendation due to regional development planning.

Third, as a policy implication, the estimation showed that spatial dependence across regions was matter and will beneficial for the economic growth of the regions. It implied that all regions need to cooperate in resources sharing not only in the same club, but also across the club. The cooperations could be especially in the form of infrastructures provision, such as roads, bridges, flyover, and transportation mode which connect across the regions. The connectivity across regions is important to improve the factors mobility, and consequently growth in East Java.

For future research it might be interesting to take into account the other control variables as growth determinants which able to explain the income convergence process in the two clubs.

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