CONVERGENCE OF THE GOVERNMENT REVENUES AND EXPENDITURES: A DYNAMIC PANEL ANALYSIS ACROSS PROVINCE

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Abstract

This paper analyses the convergence of the government revenues and expenditures in Indonesia across 30 provinces over the period 2000-2012. We use a spatial weights matrix on spatial autoregressive specification and test the presence of spatial dependency using panel estimation method. The results conforms the presence of spatial dependencies across provinces; either using distance or income per capita as the weight. Moreover, this paper also conform the convergence across provincial spending and expenditures, but not on the real income per capita.

Keywords: Convergence, spatial dependency, panel estimation, Indonesia.

JEL Classification: H7, R1

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I. INTRODUCTION

Convergence occur when the gap or the disparity across region diminish gradually. In the context of economy, Schmitt and Starke (2011) argued the convergence will create similar conditions across several regions. We can observe the lower disparity either in economic growth or disparity in per capita income (Barro and Sala-I-Martin, 1992; Islam, 2003). Barri and Sala-I-Martin (1992) and Marques and Soukiazis (1998) argued the convergence as negative relationship between the initial income (per capita) and the economic growth over certain periods. The scope of convergence may also relate to other aspect such as the labor market (Estrada et.al. 2006; Sarue et.al., 2007; SkidmoreDan Deller, 2008), or convergence in fiscal decentralization (Skidmore et.al., 2003; Coughlin et.al., 2006; Sarue et.al., 2007; SkidmoreDan Deller, 2008).

The fiscal decentralization mainly relates to the authority of local government to manage revenues and expenditures. The scale of the government budget generally reflects the stages of the economic development which tends to increase along with this stage (Skidmore et.al., 2003). The government expenditure depends directly on the tax; therefore the tax convergence will lead to the convergence of the government expenditure (Sarue et.al, 2007). However, there is a possibility where the government expenditure does not fit the Wagner’s Law (Afxentiou and Serletis, 1996). Caughtin et.al. (2006) argued the Solow growth model implies the growth of the tax and the government expenditure will be equal to the growth of income, which allows the convergence on fiscal decentralization policy.

Fiscal decentralization relates to the provincial government revenues and expenditures. During 2000 – 2012, the average growth of revenues and expenditures realization shares similar pattern across the 30 provinces in Indonesia (see Graph 1). NAD or Aceh Province performed the highest growth in revenue and expenditure by 34.19% and 33.39% respectively. On the other hand, DKI Jakarta performs the lowest ones (respectively by 13.14% and 14.89%).

The average growth in revenue for all provinces reached 20.79% while for expenditure reached 20.91% during 2000 – 2012. Some provinces experienced larger growth in expenditure relative to their income; this includes province of Sumatera Utara, Sumatera Selatan, Kepulauan Bangka Belitung, DKI Jakarta, Bali, Kalimantan Barat, Gorontalo, and Maluku Utara. The largest deficit is in Gorontalo with 16.99% average growth in income and 26.69% in expenditure.
The fiscal size and sustainability for these provinces are important, as well as the effort to reduce the disparity across these regions. This paper will focus to analyze the latter in Indonesia. The next section of this paper outline the theory and related literature studies. Section three provides data and the method we apply on this paper. Section four discuss the estimation result and its analysis, while section five provide conclusion and will close the presentation of this paper.

II. THEORY

2.1. Convergence and Neoclassical Growth Theories

Convergence theory is derived using the Cobb-Douglas production function with constant return to scale. Following Barro and Sala-I-Martin (1992) and Onder et al. (2007), we can specify this production function as follow:

\[ Y_t = K_t^\alpha (A_t L_t)^{1-\alpha}, \quad 0<\alpha<1 \]  

(1)

\( Y \) is output, \( K \) is capital, \( L \) is labor, and \( A \) is technological progress. In Solow model, the saving rate, the population growth, and the technological progress are considered to be exogenous and constant, therefore:

\[ \dot{k}(t) = s\dot{y}(t) - (n + g + \delta)k(t), \delta = \text{depreciation rate} \]  

(2)
In steady state condition, \( \dot{k} = 0 \). By using the \( k \) value in steady state, we can derive the income per capita below:

\[
\ln \left( \frac{Y(t)}{L(t)} \right) = \ln A(0) + g_t + \frac{\alpha}{1-\alpha} \ln S - \frac{\alpha}{1-\alpha} \ln(n + g + \delta)
\]

(3)

If \( y^\prime \) express income level of steady state, then:

\[
\frac{d \ln y_t}{dt} = \lambda (\ln y^\prime - \ln y_t)
\]

(4)

Therefore according to neoclassical growth theory, the convergence model can be expressed as follow:

\[
\ln y_t = e^{\lambda \tau} \ln y_{t-1} + (1 - e^{\lambda \tau}) \ln y^\prime
\]

(5)

Based on the Equation 5, \( \tau \) is number of period while \( \lambda \) is the convergence rate. Barrientos (2007) argued the economic convergence as when two or more economies are in a process towards similar level of development and prosperity. On various studies, the convergence has been a subject of a debate among the neoclassical growth model, the endogenous growth model, and the distribution dynamic model.

Marques and Soukiazis (1998), Lall and Yilmaz (2000), and Paas et.al. (2007) expressed the two approaches to observe convergence; the sigma convergence and the beta convergence. The sigma convergence reflects a lowering disparity in per capita income over certain periods. To identify if the convergence exists, one can observe the dispersion using the coefficient of variance. The lower disparity is attributed with a smaller value of the coefficient, which proves the existence of sigma convergence. Moreover, the beta convergence reflects a more rapid growth of the poor region relative to the rich ones. Such condition is expressed by the negative value of beta; showing the negative correlation between the per capita income growth and the initial level of per capita income.

Lall and Yilmaz (2000) and Pass et.al. (2007) explained there were two types of beta convergence; first, the unconditional convergence or frequently known as absolute convergence, and second, the conditional convergence. The unconditional convergence assumes similarity in economic structure, demographic condition, savings level, and other economic variables, across the observed regions. On the other hand, the conditional convergence considers those variables not necessarily similar, hence affect the convergence across those regions (Lall and Yilmaz, 2000; Islam, 2003; Paas et.al., 2007; Onder et.al., 2007; and Schmitt and Starke, 2011). As for the former, the conditional convergence model requires more explanatory variables.
Skidmore et al. (2004) and Skidmore and Deller (2008) derived the convergence model of the current government expenditure \( G_t \) as a function of previous output \( Q_{t-1} \):

\[
G_t = a_t Q_{t-1}
\]  

Parameter \( a_t \) is constant therefore the current government expenditure reflects the past economic condition. With this specification, the present and previous economic conditions are both relevant determinant for the present government expenditure.

Per capita output \( \frac{Q_t}{L_t} \) is the function of private capital \( K_t \) and government expenditure \( G_t \). Furthermore, the private input and the government are separable and Skidmore and Deller (2008) formulate the per capita output as:

\[
\frac{Q_t}{L_t} = f\left( \frac{K_t}{L_t}, G_t \right) = v_p(k_t) v_g(g_t)
\]  

By substituting Equation 7 to 6, and using constant return to scale assumption in Cobb-Douglass production function, one can obtain:

\[
G_t \equiv a_t L_{t-1} q_{t-1} = a_t A L_{t-1} k_{t-1}^\alpha g_{t-1}^\beta
\]  

Using population to obtain per capita, and subsequently divide Equation 8 with previous government expenditure, one will get the following linearized form:

\[
\ln\left( \frac{g_t}{g_{t-1}} \right) = \ln A a_t - n_t + \alpha \ln k_{t-1} + (\beta - 1) \ln g_{t-1}
\]  

Based on the above equation, \( n_t = \ln(L/L_t) \) is the population growth rate. The growth of government expenditure per capita depends on both the public and the private inputs, the population growth, and the proportion of output provided by the government, \( a_t \). As long as \( \beta < 1 \), the diminishing return applies to the government input, where the previous government expenditure will lower the growth of the current one; therefore the convergence occur.

\[2.2. \text{Spatial Issue in Convergence}\]

A convergence model frequently ignores the possibility of spatial interaction, hence unable to capture the spatial aspect (Arbia, 2006). Ignoring the spatial interaction in empirical model potentially will lead to in accurate conclusion (Anselin, 1988).

The use of panel data need to concern about the spatial aspect to provide a more realistic analysis (see among others Battisti and Vaio, 2006; Ahmad and Hall, 2012; Vitton, 2010; and Feldkircher, 2006). Using the OLS estimation in the presence of spatial interaction would lead to bias or inaccurate result (Paas et al., 2007; Battisti and Vaio, 2006; and Coughlin et al.,
For the same case, Onder et.al. (2007) and Ahmad and Hall (2012) argued that the OLS estimator will be unbiased and consistent, but not efficient. Rey and Montouri (1998) also argued the OLS estimation would still generate unbiased convergence parameter, but not with the least parameter’s variance.

A general way to identify the spatial effect is to use spatial weight which represent the spatial interaction (Paas et.al., 2007; Coughlin et.al., 2006; Madariaga et.al., 2005; Battisti and Viao, 2006). According to Pass et.al. (2007), the simplest and the most widely used spatial weight is the contiguity matrix; a binary code of 0 and 1, where 1 is for geographically adjacent areas (neighbors), otherwise 0. However, the spatial weights also depend on the research scope. Coughlin et.al. (2006) formed spatial weights using the income, race, and age to observe the spatial effect of fiscal policy.

There have been many literatures observing the convergence in terms on any different contexts. The first beta convergence study was conducted by Barro and Sala-I-Martin (1992) to observe the convergence of the states in the United States over 1880 – 1988 and 1963 – 1986 periods. Barro and Sala-I-Martin tested the convergence of per capita income using unconditional convergence approach. Barro and Sala-I-Martin argue the use of beta convergence was suitable since those states shared similar characteristics. The output showed the convergence existed, yet very slow.


Related to fiscal policy or decentralization, Afxentiou and Serletis (1996) observed the convergence of European countries during 1961 – 1991 periods. They used sigma convergence model with several explanatory variables including government expenditure, tax, and subsidy. They found the convergence occurred in Belgium and Netherland.

Skidmore and Deller (2008) conducted a research to test the convergence of public expenditure in Wisconsin. They used panel data over 1990 – 2000 periods and calculate both sigma and beta convergence. They used several control variables including the school enrollment rate to proxy the technology, the subsidy from central government, the Gini coefficient, the poverty rate, and the manufacture and public professional labors. Skidmore and Deller distinguished the public expenditures into total public expenditure, protection services, road infrastructure maintenance, waste management service, and quality of life service. Skidmore and Deller found the convergence in Wisconsin, both with sigma and beta convergence. Their result confirmed previous literatures where a convergence is possible even in small region.

Literatures on convergence for the case of Indonesia among others are Kharima and Saleh (2013), Firdaus and Yusop (2009), and Aritenang (2009). Kharisma and Saleh (2013) analyzed the income dispersion using the absolute and the conditional convergences of 26 provinces in Indonesia, during 1984 – 2008 periods. They used the OLS and GMM estimations and found the occurrence of the absolute and the conditional convergences for these economies. Several provinces of Java Island were reported to perform higher speed of convergence relative to the other provinces out of Java Island. The determinants of income dispersion were found to be the economic crisis, the fiscal decentralization policy, the Bali bombing, the fuel price hike in 2005, and the earthquake in Yogyakarta in 2010. Kharima and Saleh (2013) did not use the spatial approach, therefore cannot analyze the interaction across regions.

Firdaus and Yusop (2009) analyzed the convergence in Indonesia over 1983 – 2003. They used OLS and GMM model to estimate the conditional convergence with several explanatory variable including the ratio of investment to GDP, the population growth, and the depreciation rate. Moreover, Aritenang (2009) used provincial panel data over 1993 – 2005 periods to observe the convergence of per capita income in Indonesia. He observed both unconditional and conditional convergences using OLS and fixed effect models (FEM). The research was intended to observe the impact of fiscal variable on economic growth. Firdaus and Yusop (2009) did not use spatial approach and ignore the spatial interaction on their research.

The use of spatial dependence in convergence literatures for Indonesian case is quite limited. Moreover, the existing studies general focused on per capita income and not on the revenues and the expenditure of the local government. On the other hand, many studies utilized geographical proximity (contiguity) or distance to form the spatial weight, which we argue inaccurate.2 This paper will cover the research gap explained above. Following Anselin (1988), the appropriate method for panel data analysis with spatial aspect is spatial lag model; frequently recognized as spatial autoregressive model or spatial error model.

### III. METHODOLOGY

#### 3.1. Sigma Convergence

The sigma convergence use coefficient of variation (see Lall and Yilmaz, 2000; Sarue et.al. , 2007; and lancu, 2007):

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2 See Coughlin et. al (2006) and Anselin (1999)
where \( CV = \text{Coefficient of Variation} \) of the observed variables; \( G_i = \) provincial revenues and expenditures; \( \bar{G} = \) average of the respective variables; \( P_i = \) population of provinces \( i \); \( P = \) total population; and \( N = \) the number of observed provinces.

Onder et.al. (2007) regressed the CV value on the time trend to test if the CV significantly decline across periods. For \( T \) represents the time over 2000 – 2012, Onder estimated the following equation:

\[
CV_t = a_1 + a_2 T + e_t
\]  

(10)

On this paper, we observe the sigma convergence on the provincial revenues and expenditures using the following variables: total revenue, tax, PAD, and central government transfers; while for expenditure we use personnel expenditure, goods expenditure, and total expenditure. These variables are available from 30 provinces during 2000 – 2013.

### 3.2. Beta Convergence

The beta convergence is a conditional convergence approach. We apply the beta convergence on total income and tax, and total expenditures on good. The model is a modified from Coughlin et.al. (2006):

\[
Y_{FPi,t} = \frac{\ln(FP/pop)_{i,t} - \ln((FP/pop)_{i,t-1})}{T}
\]  

(11)

We use \( Y_{FPi} \) above as our dependent variable,3

\[
Y_{FPi,t} = \beta_0 + \beta_1 FP_{i,t-1} + \epsilon_{it}
\]  

(12)

\[
\beta_1 = \frac{(1-e^{\beta T})}{T}
\]  

(13)

Where \( Y_{FP} \) is variable of growth of fiscal variable of the respective provinces; \( FP \) is fiscal variable (revenues and expenditures) of the respective provinces; \( T \) is the number of observation

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3 We can specify the convergence model in many ways; for instance, \( Y_i = \gamma_i + \beta_1 Y_{i,t-1} + \beta_2 \Delta X_i + \epsilon_{it} \). With a simple manipulation, we can obtain \( Y_i = \beta_0 + \beta_1 Y_{i,t-1} + \beta_2 \Delta X + \epsilon_{it} \). Or equivalently \( Y_i = \beta_0 + (1+\beta_1) Y_{i,t-1} + \beta_2 \Delta X_i + \epsilon_{it} \). See also Kharisma and Saleh (2013) or Madariaga et.al. (2005)
periods; \( \text{pop} \) is population of the respective provinces; \( e \) is natural logarithm; \( \varepsilon \) is error term; while \( i \) and \( t \) are the province \( i \) on period \( t \).

Equation (11) and (12) are the standard model for unconditional convergence or absolute convergence, which was firstly used by Barro and Sala-I-Martin (1992). On this model the convergence occurs if \( \beta_1 < 0 \) with the speed of convergence is represented by the value of \( \beta_1 \) or beta. Sarue et.al. (2007) argued the parameter \( \beta_0 \) is regional balance ratio, and in the case of \( \beta_1 \) is less than -2, then the strong convergence is evident. The speed of convergence measures the speed of economy reaching the steady state (Pass et.al., 2007)\(^5\).

The conditional convergence model is the unconditional model with additional explanatory variables reflecting the characteristic of the respective regions; see among others its application in Afxentiou and Serletis (1996), Sarue et.al. (2007), Skidmore and Deller (2008), Pass et.al. (2007), and Barrientos (2007). The specification for this model is:

\[
Y_{FP_{it}} = \beta_0 + \beta_1 FP_{i,t-1} + \Sigma \beta_i \Delta X_{it} + \varepsilon_{it}
\]

(14)

where \( \Delta X_{it} \) is a set of explanatory variables for province \( i \) on period \( t \). It may include the population growth, the economic growth, and the degree of provincial openness. Other explanatory variables to include are proportion of tax and central government transfer, since the government expenditures depends on the government revenues, particularly from the tax (Mankiw, 2013).

To capture the spatial effect in convergence model, Caughlin et.al. (2006) used the following model:

\[
Y_{FP_{it}} = \beta_0 + \beta_1 FP_{i,t-1} + \rho W Y_{FP_{it}} + \varepsilon_{it}
\]

(15)

\[\varepsilon_{it} = \lambda W \varepsilon_{it} + \nu_{it}\] (16)

We can modify the above models to capture the determinants of revenues and expenditures convergence:

\[
Y_{FP_{it}} = \beta_0 + \beta_1 FP_{i,t-1} + \rho W Y_{FP_{it}} + \Sigma \beta_i \Delta X_{it} + \varepsilon_{it}
\]

(17)

\[\varepsilon_{it} = \lambda W \varepsilon_{it} + \nu_{it}\] (18)

4 With certain value of \( \beta_1 \), one can identify the speed of convergence, \( \beta \).

5 Feldkircher (2006) and Pass et. al. (2007) used formula \( s = \ln(1+\beta)/T \) where \( s \) is the speed of convergence and \( T \) is number period. Besides the speed of convergence, it is also necessary to measure the half-life of time; i.e. a period required by the economy to reach the half of initial lag from the steady state; formulated by \( \tau = \ln(2)/\ln(1+\beta/T) \).
\( \rho W Y_{FP} \) is the spatial lag component, and \( W \) is exogenous spatial weight matrix. Case et.al. (1993) in Coughlin et.al. (2006) argued the weights matrix can be determined arbitrarily. Coughlin et.al. (2006) used three types of weight; the income, the race, and the number of old population (65 years old and above).

We will employ two types of weight on this paper; the real per capita income and the distance between provinces:

\[
W_{Inc} = \alpha W^d + (1-\alpha) W^C
\]

\( W^C \) is a matrix of distance across provinces; and \( W_{Inc} \) represents the real per capita income. \( W^C \) and \( W \) are both standardized. Coughlin et.al. (2006) used the value of \( \alpha \) from 0 to 1; for \( \alpha = 0 \), then \( W_{Inc} = W^C \), and when \( \alpha = 1 \), then \( W_{Inc} = W \).

Our spatial weight matrix is an \( n \times n \) size matrix with zero diagonal:

\[
W_{ij} = \begin{bmatrix}
  w_{11} & w_{12} & \cdots & w_{1j} \\
  w_{21} & w_{22} & \cdots & w_{2j} \\
  \vdots & \vdots & \ddots & \vdots \\
  w_{i1} & w_{i2} & \cdots & w_{ij}
\end{bmatrix}
\]

The spatial weight may use the distance, \( w_{ij} = 1/d^2 \), in which \( d \) is a distance between the capital city in kilometer unit. Most of studies with distance weight used cut-off distance to transform the distance matrix into binary numbers of 0 and 1, which is similar to contiguity matrix. According to Ahmad and Hall (2012), the use of cut-off distance is to reduce excessive calculations as the weight can be arbitrarily determined (Case, 1993; in Coughlin et.al., 2006).

For spatial weight matrix using the real per capita income, we follow Coughlin et.al. (2006) to calculate the matrix weight:

\[
W_{ij} = \frac{1/|PPK_i - PPK_j|}{\sum_j 1/|PPK_i - PPK_j|}
\]

where \( PPK \) is the real per capita income of the respective provinces.

Scalar \( \rho \) in equation (17) is spatial lag or spatial autoregressive. \( \rho > 0 \) represent positive spatial correlation in \( Y_{FP} \); \( \rho > 0 \) represent negative spatial correlation, while \( \rho = 0 \) represent no spatial correlation. Spatial error component in this model is represented by \( \varepsilon_t = \lambda W \varepsilon_t + \nu_t \). If

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6 See Ivanova (2012) and Anselin (1999)
7 \( Y_{FP} \) shows dependent variable that will be used in this study. If \( \rho = 0 \) then model 3.5 will be the same with model 3.3
there is no spatial correlation, then $\rho=\lambda=0^8$. According to Anselin (1988), equation (17) and (18) above are estimated separately to avoid any possible identification problem (Coughlin et al. 2006). To be precise, model in equation (17) is Spatial lag Model or Spatial Autoregressive Model while model in equation (18) is Spatial Error Model. We apply these two variants on this paper.

IV. RESULT AND ANALYSIS

4.1. Estimation of Sigma Convergence on Revenues and Expenditures (APBD)

Our calculation on the revenues and the expenditures of 30 provinces in Indonesia during 2000 – 2012 shows a convergence. The convergence exist in total expenditures, goods expenditures, personnel expenditures, total revenues, genuine regional income (PAD), tax, and central government transfer. Table 1 shows the coefficient of variation of the real per capita income to fluctuate over 2000 – 2009, and increased after 2009 period. This result conformed Kuncoro (2013) who found the spatial disparity in per capita income declined over 2001 – 2003

<table>
<thead>
<tr>
<th>Periods</th>
<th>Total Expenditures</th>
<th>Goods Expenditures</th>
<th>Personnel Expenditures</th>
<th>Total Revenues</th>
<th>PAD</th>
<th>Tax</th>
<th>Central Government Transfer</th>
<th>Per Capita Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>0.2606</td>
<td>0.3457</td>
<td>0.4148</td>
<td>0.2806</td>
<td>0.5517</td>
<td>0.4854</td>
<td>0.2026</td>
<td>0.1526</td>
</tr>
<tr>
<td>2001</td>
<td>0.2017</td>
<td>0.2734</td>
<td>0.2254</td>
<td>0.2135</td>
<td>0.3497</td>
<td>0.3560</td>
<td>0.1904</td>
<td>0.1544</td>
</tr>
<tr>
<td>2002</td>
<td>0.1860</td>
<td>0.2577</td>
<td>0.2340</td>
<td>0.1905</td>
<td>0.2681</td>
<td>0.2761</td>
<td>0.1849</td>
<td>0.1538</td>
</tr>
<tr>
<td>2003</td>
<td>0.1833</td>
<td>0.2767</td>
<td>0.2719</td>
<td>0.1731</td>
<td>0.2504</td>
<td>0.2559</td>
<td>0.1840</td>
<td>0.1498</td>
</tr>
<tr>
<td>2004</td>
<td>0.1848</td>
<td>0.2444</td>
<td>0.2439</td>
<td>0.1760</td>
<td>0.2395</td>
<td>0.2417</td>
<td>0.1746</td>
<td>0.1518</td>
</tr>
<tr>
<td>2005</td>
<td>0.1778</td>
<td>0.2404</td>
<td>0.2513</td>
<td>0.1768</td>
<td>0.2273</td>
<td>0.2312</td>
<td>0.1858</td>
<td>0.1503</td>
</tr>
<tr>
<td>2006</td>
<td>0.1713</td>
<td>0.2136</td>
<td>0.2608</td>
<td>0.1676</td>
<td>0.2087</td>
<td>0.2122</td>
<td>0.1686</td>
<td>0.1520</td>
</tr>
<tr>
<td>2007</td>
<td>0.1781</td>
<td>0.2263</td>
<td>0.2341</td>
<td>0.1413</td>
<td>0.1420</td>
<td>0.2019</td>
<td>0.1771</td>
<td>0.1513</td>
</tr>
<tr>
<td>2008</td>
<td>0.1544</td>
<td>0.1893</td>
<td>0.2174</td>
<td>0.1606</td>
<td>0.1852</td>
<td>0.1855</td>
<td>0.1769</td>
<td>0.1522</td>
</tr>
<tr>
<td>2009</td>
<td>0.1669</td>
<td>0.1959</td>
<td>0.1982</td>
<td>0.1557</td>
<td>0.1890</td>
<td>0.1876</td>
<td>0.1726</td>
<td>0.1512</td>
</tr>
<tr>
<td>2010</td>
<td>0.1553</td>
<td>0.1926</td>
<td>0.2037</td>
<td>0.1578</td>
<td>0.1847</td>
<td>0.1863</td>
<td>0.1763</td>
<td>0.1519</td>
</tr>
<tr>
<td>2011</td>
<td>0.1577</td>
<td>0.1906</td>
<td>0.2125</td>
<td>0.1630</td>
<td>0.2057</td>
<td>0.2086</td>
<td>0.1736</td>
<td>0.1528</td>
</tr>
<tr>
<td>2012</td>
<td>0.1562</td>
<td>0.1861</td>
<td>0.2130</td>
<td>0.1502</td>
<td>0.2121</td>
<td>0.2039</td>
<td>0.1485</td>
<td>0.1530</td>
</tr>
</tbody>
</table>

Source: Directorate General of Fiscal Balance, Republic of Indonesia. (www.djpjk.go.id), calculated

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8 In order to observe whether or not spatial dependence exists, it can use Moran’s I, Geary’s C, or Local Indicators of Spatial Association (LISA) (Fischer and Wang, 2011). According to Fischer and Wang (2011), LISA serves as Moran’s I and Geary’s C measurement. According to Aroca et al. (2006), LISA is Moran’s I of local version.
periods (measured by Theil entropy index), subsequently increased over 2004 – 2007 periods, and slowly declined during 2008 – 2010.

Referring to Table 1, the coefficient of variation for all variables declined where the largest was in personnel expenses and PAD, respectively by 0.1894 and 0.2019. Nevertheless, the relatively small portion of personnel expenditure over 2001 – 2002 increased from 0.2254 to 0.2340, while other variables declined.

The table shows the coefficient of variation started to fluctuate after 2002, and the largest increase was in goods and personnel expenditures. We suspect the regional autonomy implemented in 1999 and 2004 as the major reason for this trend. The regional autonomy enabled each province to widely manage their goods and service expenditures. Furthermore, the focus of budgeting performance was on the budget absorption and not on the impact of the budget itself. Graph 1 exhibits the dynamic of coefficient of variation for the budget realization during 2000 – 2012.
The result shows that coefficient of all revenues and expenditures variables experienced convergence during 2000 – 2012 periods at 1% level of significance. The negative coefficient of the trend variable indicates the occurrence of convergence, while the positive value of the coefficient indicates non convergence.
The $R^2$ of the models ranges from 0.4 – 0.6. The relatively small $R^2$ does not mean the absence of convergence. Other variables might significantly contribute but are excluded from these models\(^9\). Convergence of APBD expenditure is not significantly followed by the convergence of real per capita income. It indicates a less-powerful relationship between the provincial government expenditure and the per capita income. Each province applied specific policy of expenditures. In addition, during 2000 – 2012, there were other determinants of the per capita income that avoid the sigma convergence to occur. This would drive a larger gap between the per capita incomes across provinces even the convergence on expenditures existed.

### 4.2. GMM Estimation of Dynamic Panel Data of Beta Convergence

In GMM there are two option of estimation; the GMM DIFF with first difference transformation and the GMM-SYS with orthogonal deviation transformation. As GMM-SYS is an improvement over the GMM-DIFF. The GMM-DIFF is limited in instrument variables (Han and Philips, 2010; Roodman, 2009) and tends to be bias due to transformation in instrument variables (Hayakawa, 2009). Bun and Sarafidis (2013) argued that additional instrument variables in 2SLS and GMM models would generate higher bias estimator. The comparison between the GMM-DIFF and the GMM-SYS is explained in detail in Hayakawa (2009) and Roodman (2009).

The estimation result of conditional convergence on the total expenditure in regional budget (APBD) is exhibited in Table 3. It shows that convergence occurred on total expenditures across provinces during 2000 – 2012 as indicated with the negative and significant parameter $\beta_2$. 

---

Convergence is evident both when using per capita income or distance as the weight for the spatial matrix. The significant of parameter $\rho$ indicates that the per capita income and the distance across provinces positively affect the convergence in particular periods. The estimated $\lambda$ is significant on per capita income weight but not significant on distance. In conditional convergence, this reveals that the distance across provinces does not affect the convergence of total expenditures.

As we mention earlier, we apply two model specifications of the GMM-SYS; first is the spatial auto regressive (GMM-SYS-SAR) following Equation (17), and second, the spatial error model (GMM-SYS-SEM) following equation (18).

On these two models (spatial autoregressive and spatial error model), the tax, the central government transfer, the growth of population, and the openness positively affect the growth of per capita expenditure. The economic growth is not significant in GMM-SYS-SAR specification, but significant at 10% in GMM-SYS-SEM. The insignificant of the economic growth in GMM-SYS-SAR was due to the absence of its direct impact on the growth of total expenditure (per capita). The speed of convergence in the conditional convergence specification is larger

<table>
<thead>
<tr>
<th>Table 3</th>
</tr>
</thead>
</table>

*Estimation Result of Conditional Convergence for Total Expenditure (per capita)*

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Spatial Weight: Real Per Capita Income</th>
<th>Spatial Weight: Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GMM-SYS-SAR</td>
<td>GMM-SYS-SEM</td>
</tr>
<tr>
<td>$\beta_1$</td>
<td>0.0077</td>
<td>-0.0084</td>
</tr>
<tr>
<td></td>
<td>(0.0192)</td>
<td>(0.0186)</td>
</tr>
<tr>
<td>$\beta_2$</td>
<td>-0.6256***</td>
<td>-0.6658***</td>
</tr>
<tr>
<td></td>
<td>(0.0194)</td>
<td>(0.0302)</td>
</tr>
<tr>
<td>$\rho$</td>
<td>0.3951***</td>
<td>0.5731***</td>
</tr>
<tr>
<td></td>
<td>(0.0311)</td>
<td>(0.0310)</td>
</tr>
<tr>
<td>$\lambda$</td>
<td>-0.4005***</td>
<td>1.8666</td>
</tr>
<tr>
<td></td>
<td>(0.1053)</td>
<td>(1.3652)</td>
</tr>
<tr>
<td>Tax</td>
<td>0.4295***</td>
<td>0.4257***</td>
</tr>
<tr>
<td></td>
<td>(0.0262)</td>
<td>(0.0299)</td>
</tr>
<tr>
<td>Perimb</td>
<td>0.0813***</td>
<td>0.0838***</td>
</tr>
<tr>
<td></td>
<td>(0.0052)</td>
<td>(0.0082)</td>
</tr>
<tr>
<td>Tumb_Ek</td>
<td>0.0650</td>
<td>0.2635*</td>
</tr>
<tr>
<td></td>
<td>(0.1166)</td>
<td>(0.1356)</td>
</tr>
<tr>
<td>Open_Econ</td>
<td>0.1354***</td>
<td>0.2514***</td>
</tr>
<tr>
<td></td>
<td>(0.0417)</td>
<td>(0.0386)</td>
</tr>
<tr>
<td>Tumb_Pddk</td>
<td>0.0444***</td>
<td>0.0487***</td>
</tr>
<tr>
<td></td>
<td>(0.0072)</td>
<td>(0.0149)</td>
</tr>
<tr>
<td>Speed of conv.</td>
<td>0.9826</td>
<td>1.0960</td>
</tr>
<tr>
<td>Half life</td>
<td>0.7054</td>
<td>0.6324</td>
</tr>
<tr>
<td>$\chi^2$ (Hansen J-Stat)</td>
<td>0.2127</td>
<td>0.1704</td>
</tr>
<tr>
<td>SER/SSR</td>
<td>0.080/1.879</td>
<td>0.0844/1.896</td>
</tr>
</tbody>
</table>

a. ***significant at 1%, **significant at 5%, *significant at 10%

b. Values in parentheses represent error standard

SAR is spatial autoregressive model and SEM is spatial error model
compared to the unconditional one. Hansen $\chi^2$ statistic is lower than in the table, showing the set of instruments used in GMM has been appropriate.\footnote{10}

In spatial error specification (GMM-SYS-SEM), $\lambda$ and population growth are not significant when using distance weight. The economic growth is significant at 10%, which is similar when using per capita income weight. The important difference between the two weights is the significance of the population growth. With per capita income weight, the population growth is significant (both in autoregressive and error specification), while when using distance as the weight, the population growth is insignificant. Table 4 shows that $\beta_2$ is negative and significant. This indicates the convergence on goods expenditure (APBD) is evident across provinces during 2000 – 2012. The positive and significant $\rho$ show the spatial dependence across provinces both in per capita income and distance. This indicates the per capita income and distance affect the convergence in goods expenditure.

The $\lambda$ is significant when using per capita income as the weight, but not when using distance. The set explanatory with positive impact on goods expenditure growth (both in per capita income and distance) includes $\beta_1$, $\beta_2$, $\lambda$, Tax, Perimb, Tumb_Ek, Open_Econ, Tumb_Pddk, Speed of conv., Half life. $\chi^2$ (Hansen J-Stat) is significant at the 10% level.

\begin{table}
\centering
\caption{Estimation Result of Conditional Convergence for Goods Expenditure (APBD)}
\begin{tabular}{|l|c|c|c|c|}
\hline
\multicolumn{1}{|c|}{Dependent Variable: Per Capita Goods Expenditure} & \multicolumn{2}{|c|}{Spatial Weight: Real Per Capita Income} & \multicolumn{2}{|c|}{Spatial Weight: Distance} \\
\hline
Parameter & GMM-SYS-SAR & GMM-SYS-SEM & GMM-SYS-SAR & GMM-SYS-SEM \\
\hline
$\beta_1$ & -0.1050*** & -0.0888*** & -0.1189*** & -0.0891*** \\
 & (0.0323) & (0.0293) & (0.0348) & (0.0261) \\
$\beta_2$ & -0.2490*** & -0.2957*** & -0.1895*** & -0.3139*** \\
 & (0.0275) & (0.0233) & (0.0282) & (0.0199) \\
$\rho$ & 0.4920*** & 0.7231*** & 0.1160 & 0.0331 \\
 & (0.1247) & (0.2159) & (0.2580) & \\
$\lambda$ & -0.6509*** & -0.3054*** & 0.2250*** & 0.3465*** \\
 & (0.0102) & (0.0090) & (0.0102) & (0.0065) \\
Tax & 0.2729*** & 0.3054*** & 0.2250*** & 0.3465*** \\
 & (0.0474) & (0.0496) & (0.0487) & (0.0375) \\
Perimb & 0.0379*** & 0.3555*** & 0.3566*** & 0.3343*** \\
 & (0.0120) & (0.0090) & (0.0102) & (0.0065) \\
Tumb_Ek & -0.3539 & 0.0074 & 0.2075 & -0.2121 \\
 & (0.2364) & (0.2308) & (0.2085) & (0.2201) \\
Open_Econ & -0.1473*** & -0.1506*** & -0.1445*** & -0.1528*** \\
 & (0.0458) & (0.0468) & (0.0421) & (0.0421) \\
Tumb_Pddk & -0.1346 & 0.0176 & -0.0431 & -0.0473 \\
 & (0.1357) & (0.1331) & (0.1325) & (0.1096) \\
Speed of conv. & 0.2865 & 0.3506 & 0.2102 & 0.3768 \\
 & 2.4196 & 1.9772 & 3.2980 & 1.8396 \\
Half life & 0.2793 & 0.2599 & 0.4091 & 0.2178 \\
$\chi^2$ (Hansen J-Stat) & 0.107/3.365 & 0.106/2.966 & 0.104/3.164 & 0.106/2.997 \\
SER/SSR & & & & \\
\hline
\end{tabular}
\end{table}

\text{a. ***significant at 1%, **significant at 5%, *significant at 10%}
\text{b. Values in parentheses represent error standard deviation.}

\footnote{10 The estimation is run using E-views 7 program. The program uses default instrument, @dyn(X,-2). Changes in instrument list will alter the result regarding significance, parameter signs, and the coefficient.
capita and distance weight) are tax, central government transfer, and economic openness. On the other hand the economic growth and population growth are not significant.

The significant $\lambda$ in GMM-SYS-SEM model (with real per capita income weight) explained that the unobserved variables across provinces possess a spatial dependency and negatively affect the growth of goods expenditure. Similarly stated, the growth of goods expenditure in certain provinces is negatively affected by the unobserved variables on the other provinces.

Population growth and economic growths are not significant in the two weights. This implies the growth of population growth and the economic growth do not affect the growth of expenditure.

The economic openness measured by the ratio of export and import to regional GDP negatively affected the goods expenditure. Generally the export, the import, and the regional real GDP increased, but their goods expenditure declined. This is possibly driven by the imbalance increase between the goods expenditure and the growth of population. Another possible reason is their consumption basket is weakly related to the import and export activities.11

The following section presents the convergence test both for total expenditure and tax income. As shown in Table 5, the negative and significant $\beta_2$ show the convergence in total revenue is evident across the 30 provinces in Indonesia during 2000 – 2012. The result is similar in spatial autoregressive (GMM-SYS-SAR) and spatial error specification (GMM-SYS-SEM), both when using real per capita income and distance weights.

The $\rho$ is positive and significant on when using the real per capita income as spatial weight (model GMM-SYS-SAR), which indicates that the inter dependency in income across provinces affects the growth of their total income. On the other hand, the parameter $\lambda$ is negative and significant when using the per capita income as weight (GMM-SYS-SEM model), while when using distance weight is not significant. This indicate the presence of unobservable spatial dependency across provinces, with negative impact on the provincial growth of total income.

When using the per capita income as weight, the set of explanatory variables; economic growth, openness, and the population growth are significant on affecting the total income growth (both in spatial autoregressive and error model). However, when using the distance as the weight, the openness is only significant at 10% in spatial error specification (GMM-SYS-SEM).

The $\chi^2$ on Hansen J-stat shows that instrument variables used on both weights are appropriate. The speed of convergence in spatial autoregressive specification with the real per capita income as weight is 11.27% and the half-life is 6 years. On the other hand, the speed of convergence in spatial error specification is faster by 17.84% with half-life of 4 years.

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11 Skidmore et al. (2003) analyzed the OECD and developing countries during 1960-2000 and found negative relationship between the growth of government spending and their economic openness.
The estimation of convergence on provincial tax revenue during 2000-2012 is presented in Table 6. The result shows the convergence in provincial tax is evident, as reflected with the negative and significant $\beta_2$. On spatial autoregressive specification, the convergence level for tax revenue is 7.81% while for spatial error specification the convergence level is 2.40%.

The estimated $\rho$ and $\lambda$ are positive and significant in both weight types. This indicates the presence of unobservable spatial income dependency across provinces, which positively affect the growth of tax revenue. Similarly, the positive and significant $\rho$ and $\lambda$ when using the distance weight shows that the presence of unobservable distance dependency across provinces positively affecting the growth of tax revenue.

On estimating the convergence of the tax revenue, we found the economic growth and the openness negatively affected the tax revenue (per capita). Two possible reasons for this are: (1) the economic growth fail to increase the tax revenue. The regional GDP is mostly driven by the increase in government expenditure and private consumption; therefore the positive trend of economic growth does not necessarily imply a positive growth of tax, (2) the population grows more rapidly than the tax revenue; this causes the per capita tax decreases even when the economic growth increases.
The estimation shows the population growth positively affected the tax revenue, but it negatively affects the total income. The population growth tends to be constant during 2000 – 2012, while the growth of the revenue tends to decline over the same periods even though the total revenue remains declining. This cause the proportion of tax within the revenue still increase.

The empirical research within this paper shows the speed of convergence for the tax revenue is longer than the convergence in the total revenue. This is reasonable since the tax is part of regional income (PAD), while most of the total revenue in APBD comes from the central government transfers.

### V. CONCLUSION

This paper analyzes the sigma convergence and the beta convergence for some components of the revenues and the expenditures of the provincial governments in Indonesia. This paper is an empirical research, and we expect the following empirical findings will intensify the discussion on economic convergence particularly in Indonesia.
Within the sigma convergence, empirical findings are: (i) there is no sigma convergence for variable income per capita in Indonesia; thus the per capita income disparity across provinces tends to increase and to fluctuate; (ii) however, for other components of revenue and expenditure, the sigma convergence is evident with various levels (degrees) and speeds convergence.

Within the beta convergence (conditional convergence approach), this paper finds that: (iii) there is spatial dependence among the provinces in Indonesia, and this applies to all variables used in the study, i.e. total expenditure, spending on goods, total revenue, and tax revenue. Furthermore, the estimation of spatial error model indicates that: (iv) there are unobservable variables, which interacts both with the real per capita income weight and with the distance weight.

From a set of explanatory variables internalized in the conditional convergence model, this paper found that: (v) the coefficient of elasticity for the central government transfer (equalization fund) is lower than the coefficient for tax; this shows the role of central government transfer on the growth of total expenditure (per capita) and spending on goods (per capita) is smaller than the role of per capita tax; (vi) the degree of openness negatively effects the growth of total revenue (per capita) and per capita tax, and this will significantly influence the convergence across the province. This also indicates that the openness of the area is more of a challenge than an opportunity.

Moreover, (vii) the economic growth significantly affects the growth of per capita income and the growth of per capita tax. These results encourage the efforts to boost the economic growth, which is highly related to the infrastructure development, particularly for the lagging are such as Eastern Indonesia.

The followings are the limitations of this study, which calls for further research:

a. The time span of the study is limited to the period of 2000-2012.

b. The spatial weight in this study use linear distance between the provincial capital. A more accurate approach is to use travel time between or the weighted linear distance and travel time.

c. Related to robustness test, we emphasize the estimation results are sensitive to the type of weight used in the spatial model. Moreover, the choices of instrument variables in the estimation using GMM estimates also affect the results.
REFERENCES


