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Tourism Spatial Spillover Effect and Economic Growth in Indonesia[1]

Abstract. Economic growth and prosperity are often associated with the development of key sectors such as agriculture, construction, and manufacturing. The importance of tourism in driving economic growth and prosperity is often overlooked. The study focuses on Indonesia and its diverse tourism resources, pointing out that different provinces have varying impacts on the overall economy due to their distinct tourism assets. Therefore, this study investigates the influence of tourism diversity on regional economic growth. Data were collected from the Central Agency of Statistics (BPS), Ministry of Tourism, and Ministry of Public Works and Housing from 2010 to 2017, using such variables as economic growth, physical investment, population, human capital, and the tourism competitiveness index. Moreover, we considered spatial effects by employing a Spatial Durbin Model (SDM) to account for the interdependence of different regions in Indonesia. The results reveal that tourism spillovers occur between provinces, meaning that tourism development in one area is influenced not only by its own resources but also by neighbouring provinces. The spatial regression analysis demonstrates that neighbouring areas have a positive impact on each other, reinforcing the idea that tourism development tends to cluster geographically. This suggests that regional tourism development policies should consider these spatial dependencies, aiming for integrated programmes that have an impact not only within a single area but also between regions. The suggestion for further research is to use a type of spatial weight in the form of inter-regional tourist moving, namely the movement of tourists between provinces in Indonesia.

Keywords: tourism, economic growth, spillovers, tourism competitiveness index, spatial weight matrix, Spatial Durbin Model

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ИССЛЕДОВАТЕЛЬСКАЯ СТАТЬЯ

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Пространственный спилловер-эффект в сфере туризма и экономический рост в Индонезии

Аннотация. Экономический рост и процветание чаще всего связывают с развитием таких ключевых секторов экономики, как сельское хозяйство, строительство и производство, в то время как важность сферы туризма зачастую недооценивается. В статье анализируется влияние экономического развития различных провинций Индонезии в зависимости от их туристических ресурсов на экономику страны в целом. В частности, исследуется влияние видового разнообразия туризма на региональный экономический рост. Исследование основано на данных Статистического управления Индонезии (BPS), Министерства туризма и Министерства общественных работ и жилищного строительства за период 2010-2017 гг. по таким показателям, как экономический рост, инвестиции в материальные активы, население, человеческий капитал и индекс конкурентоспособности туризма. Для анализа пространственных эффектов использована пространственная модель Дарбина (SDM), демонстрирующая взаимоотношения между различными регионами Индонезии. Результаты исследования показали, что на развитие туризма в одной провинции влияют не только ее собственные ресурсы, но и развитие туризма в соседних регионах. Пространственный регрессионный анализ свидетельствует о положительном влиянии соседних территорий друг на друга, подтверждая тенденцию географической кластеризации. Таким образом, при формировании региональной политики развития туризма необходимо учитывать выявленные пространственные зависимости и разрабатывать комплексные программы, действующие не только в пределах одной провинции, но и на соседних территориях. Для дальнейших исследований можно использовать показатель перемещения туристов между провинциями Индонезии для построения матрицы пространственных весов.

Ключевые слова: туризм, экономический рост, вторичные эффекты, индекс конкурентоспособности туризма, матрица пространственных весов, пространственная модель Дарбина

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Introduction

Conceptually, economic growth and prosperity are often associated with the growth of key sectors such as agriculture, construction, and manufacturing. It is also associated with the growth of foreign investment inflows (Sinclair, 1998). However, this situation does not emphasise the important role that tourism plays in economic growth. Empirical data shows that tourism is one of the largest and most rapidly developing service sectors in the world and is recognised as an alternative for encouraging economic growth (Belloumi, 2010; Chou, 2013; Clancy, 1999). This encourages economists to comprehensively examine the role of tourism in economic growth.

Geographically, Indonesia is located in the Southeast Asian region whose abundant natural resources serve as capital for tourism development. In Indonesia, tourism is an important economic sector. In 2015, tourism was ranked fourth in terms of foreign exchange earnings, after the commodities of oil and gas, coal, and palm oil, with a foreign exchange earnings value of USD 12,225.89 million. In 2016, the number of foreign tourists visiting Indonesia was more than 11.9 million, a 15.03 % increase compared to the previous year, according to the State Ministry of Culture and Tourism in Indonesia[1].

Tourism, as a driver of economic growth, has a strategic role in terms of factor endowments, such as natural tourism, cultural tourism, and historical tourism, as well as the availability of tourism-supporting industries such as transportation, accommodation, entertainment, services, etc. Thus, the availability of tourism-supporting factors has a significant effect on tourism development, making travel easy for tourists to attract them to tourist destinations, ultimately encouraging economic growth.

According to Sinclair and Stabler (1997), the factor endowments of an area are related to the concept of comparative advantage. In economics, the comparative advantage concept provides a theoretical foundation for countries in terms of

[1] See https://kemenparekraf.go.id/.

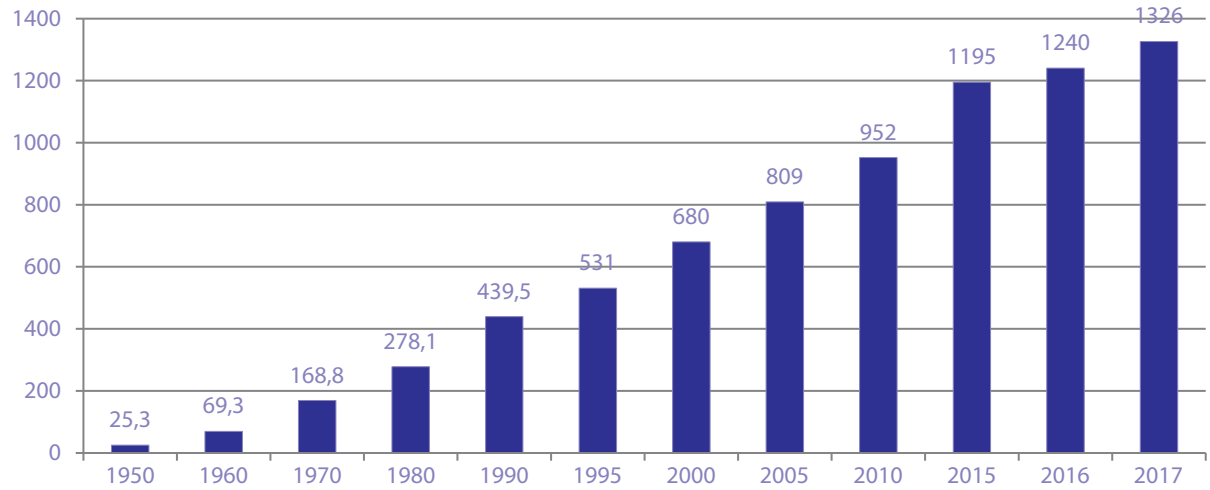

Fig. 1. *Number of international tourist arrivals worldwide for the period 1950–2017(in millions) (source: World Tourism Organization, UNWTO (2018))*

production specialisation and participation in international trade to maximise economic prosperity (Kim & Lee, 2010).

Another important aspect is investment in tourism infrastructure, which capitalises on existing tourism potential to increase tourist visits. Investment in tourism infrastructure is a competitive advantage for an area. With an increasing number of tourists, certain tourist destinations become more competitive and eventually encourage investment in tourism infrastructure. This reciprocal relationship shows that tourist destinations continue to develop and directly or indirectly influence the development of an area through various tourism infrastructure facilities, superstructures, and tourist arrivals, thereby improving the regional economy (Jovanović & Ilic, 2016).

In addition to being a driver of economic growth and convergence between regions, the development of the tourism sector has sectoral and spatial spillover effects. These effects include positive and negative externalities both directly and indirectly present in the sectoral and regional dimensions. Conceptually, the tourism spillover effect is an indirect or accidental effect, where tourism in one region has an impact on tourism flows to other regions. Consequently, regions can benefit from local tourism development arising from the positive spillover effects of tourism growth in other regions (Antonakakis et al., 2014; Gooroochurn & Hanley, 2005; Ma et al., 2015; Yang & Wong, 2012).

From a geographical perspective, tourism spillovers involve certain spatial interactions between tourist destination areas. Spatial interaction models typically only focus on the interactions between origin and destination areas (Gil-Pareja et al., 2007; Khadaroo & Seetanah, 2008; Yang & Wong, 2012). To date, few studies have analysed the spatial interactions between tourist destinations. To this end, this study examines the spillover effect of tourism flows between destinations in Indonesia. This research provides a framework for interpreting spillover effects and outlines the potential factors that contribute to tourism flows. This study is expected to contribute to the understanding of regional tourism growth and spatial interactions in tourism flows.

Thus, based on the above background, this study aims to analyse how tourism spillovers influence economic growth in Indonesia.

Theory and Literature Review

Economic Growth Models with Tourism: Augmented Solow Model

This study utilises the Solow growth model, which views physical and human capital as the main drivers of economic growth (Solow, 1956). Mankiw, Romer, and Weil (1992) developed a standard Solow model incorporating the human capital factor as a determinant of economic growth, hereinafter known as the Augmented Solow Model, wherein the production function becomes:

$$Y(t) = K(t)^{\propto} H(t)^{\beta} \left(A(t)L(t)\right)^{1-\alpha-\beta}, \quad (2.1)$$

where $Y(t)$ is the output, $K(t)$ is the capital input, $H(t)$ is the human capital input, and $L(t)$ is the labour input. $A(t)$ measures the cumulative effect of general technical progress over time. $\propto$ and β are given exogenous parameters, where $0 < \propto < 1$, $0 < \beta < 1$ and $0 < \propto + \beta < 1$. $A(t)L(t)$ represents effective labour. $L(t)$ and $A(t)$ are assumed to grow exogenously at levels n and g, and the number of effective labour units, $A(t)L(t)$, grows at the level $n + g$.

This study examines the core determinants of economic growth based on the Solow growth model, followed by tourism as another variable affecting economic growth. This study considers the effects of tourism development on technological progress. Therefore, the equation for technological progress is given as follows:

$$A = A(0)e^{gt}P^{\theta}, \quad (2.2)$$

where g is the level of technical progress, P is tourism development, and θ is the elasticity of the effect of tourism development on technical progress.

This model assumes that a constant portion of output, s, is invested. $y = Y/AL$, $k = K/AL$, and $h = H/AL$ are, respectively, the respective outputs, physical capital, and human capital from effective labour units. Thus, we obtain dynamic expressions $k(t)$ and $h(t)$ as given in Equations (2.3) and (2.4):

$$\widetilde{k(t)} = s_k y(t) - (n + g + \delta)k(t), \quad (2.3)$$

$$\widetilde{h(t)} = s_h y(t) - (n + g + \delta)h(t), \quad (2.4)$$

where δ is the rate of depreciation.

When the economy reaches a steady state, $\widetilde{k(t)} = 0$ and $\widetilde{h(t)} = 0$. Based on Equations (2.3), (2.4), and (2.1), we obtain $k^*(t)$, and $h^*(t)$, which represent k and h in the steady state.

$$k^* = \left(\frac{s_k^{1-\beta} s_h^{\beta}}{n + g + \delta}\right)^{1/(1-\alpha-\beta)}, \quad (2.5)$$

$$h^* = \left(\frac{s_k^{\alpha} s_h^{1-\alpha}}{n + g + \delta}\right)^{1/(1-\alpha-\beta)}, \quad (2.6)$$

Substituting Equations (2.2), (2.5), and (2.6) into the production function (2.1), the following equation is obtained:

$$\frac{Y(t)}{L(t)} = A(0) + gt - \frac{\propto + \beta}{1 - \alpha - \beta}(n + g + \delta) + \frac{\alpha}{1 - \alpha - \beta}(S_k) + \frac{\beta}{1 - \alpha - \beta}(s_h) + \theta P, \quad (2.7)$$

where $-\frac{\propto + \beta}{1 - \alpha - \beta}$ is the output elasticity of $(n + g + \delta)$, $\frac{\alpha}{1 - \alpha - \beta}$ is the elasticity of s_k, $\frac{\beta}{1 - \alpha - \beta}$ is the elasticity with respect to s_h, and θ is the elasticity with respect to P.

According to Equation (2.7), we obtain a regression model of output per capita based on physical capital, population growth rates, human capital, and tourism as follows:

$$\frac{Y(t)}{L(t)} = A(0) + gt + \frac{\propto}{1 - \propto - \beta}(S_k) - \frac{\propto + \beta}{1 - \propto - \beta}(n + g + \delta) + \frac{\beta}{1 - \alpha - \beta}(s_h) + \theta(P), \quad (2.8)$$

Equation (2.8) states that output depends on population growth, physical capital accumulation, and tourism. Thus, the model specifications in this study include the core determinants of economic growth based on the Solow growth model and tourism as another variable of economic growth.

Based on Solow (1956), the models developed by Mankiw, Romer, and Weil (1992) and Proenca and Soukiazis (2008) assume that g and δ are constant and vice versa. A(0) represents not only technology, but also a support for resources, climate, institutions, etc., which may differ across countries, so we assume that:

$$A(0) = \propto + u, \quad (2.9)$$

where $\propto$ is a constant and u is unit-specific shock. Therefore, Equation (2.8) can be further stated as follows:

$$\frac{Y(t)}{L(t)} = \propto + gt + \frac{\propto}{1 - \propto - \beta}(S_k) - \frac{\propto + \beta}{1 - \propto - \beta}(n + g + \delta) + \frac{\beta}{1 - \alpha - \beta}(s_h) + \theta(P) + u, \quad (2.10)$$

where S_k is the physical capital, $(n + g + \delta)$ is the population growth rate, S_h is the human capital, $-\frac{\propto + \beta}{1 - \alpha - \beta}$ is the output elasticity to $(n + g + \delta)$, $\frac{\alpha}{1 - \alpha - \beta}$ is the elasticity to s_k, $\frac{\beta}{1 - \alpha - \beta}$ is the elasticity to s_h, θ is the elasticity to P, α is constant, and u is the error term.

Effects of Tourism Spillovers

The relationship between tourism and economic growth, in particular, the hypothesis of tourism as a driver of economic growth (Brida et al., 2016), has been analysed and tested using various methods, as explained in the previous section. These analyses were conducted at the national and regional levels. Although the analyses were performed at the regional level, spatial problems were very often ignored. Therefore, since the analysis unit of this study was inter-provincial, spatial issues were analysed via the effects of spatial spillovers between provinces. The tourism sector is very dependent on not only resources, but also spatial and local factors (Capone & Boix, 2008).

In the tourism context, the spillover effect is an indirect effect wherein the tourism activities of a region increase tourism flows in surrounding areas (Yang & Fik, 2014). Consequently, an area can benefit from the growth of neighbouring tourism, i. e., the existence of spatial autocorrelation. This spillover effect can be explained by the existence of spatial externalities between regions (Fingleton & Lopez-Bazo, 2006).

There are two types of spatial effects, namely spatial spillovers and spatial heterogeneity. An area can receive useful spatial spillovers through tourism development in neighbouring areas. In contrast, spatial heterogeneity illustrates the different patterns of regional tourism growth arising due to different resources, infrastructure, and market access (Yang & Fik, 2014). This can be explained through the core-periphery theory in geographic economics. The core-periphery theory describes how economic, political, and/or cultural forces are distributed spatially between dominant core regions and peripheral regions. In relation to tourism, the core-periphery theory states that the development of a region's tourism will have a positive influence on nearby regions and spatial spillovers can explain regional convergence, which is strongly associated with spatial factors in certain regions (Vayá et al., 2004).

The spillover effect includes positive and negative externalities resulting from economic activities or processes that affect every element that is not directly related to the activities (Yang & Wong, 2012). Regarding tourism flows, the term "spillover effect" refers to the indirect or accidental effect that the tourism industry in one region has on the flow of tourism to other regions. Therefore, an area can benefit from local tourism development arising from the growth of tourism in other regions.

The tourism spillover effect can also be generated on the demand side. Tourists can choose more than one destination on one trip and take a multi-destination trip covering a wide geographical area that offers a variety of tourist attractions. Additionally, the distance from the tourists' origin to the destination encourages tourists to visit several destinations in one trip to make the trip worthwhile, interesting, and to maximise utility. Thus, tourists' multi-destination trips can create a tourism spillover effect.

To capture the spatial spillover effect, we added another variable to the analysis, namely spatial weight, which describes the relationship between regions. Thus, the theoretical model for spatial effects is as follows:

$$\frac{Y(t)}{L(t)} = \propto + \frac{\propto}{1-\propto-\beta}(S_k) - \frac{\propto+\beta}{1-\propto-\beta}(n+g+\delta) + \\ + \frac{\beta}{1-\alpha-\beta}(s_h) + \theta(P) + \rho W\left[\frac{Y(t)}{L(t)}\right] + u, \qquad (2.11)$$

where ρ is the spatial coefficient and W is the spatial weight matrix.

Literature Review

The development of tourism is one of the key strategies for economic growth introduced in developing countries as a source for business activity, investment, employment and entrepreneurship. Significant historical, cultural and natural heritage tourist attractions are among other activities that have contributed to greater tourism investment. According to Lanza and Pigliaru (2000), the increase in the number of tourists has led to positive economic consequences at the global level. Thus, countries with relatively abundant natural energy sources tend to specialise in tourism and accelerate economic development. It has provided a substantial analysis of the relationship between tourism and economic development based on the Lucas type 2 zone model. A large literature exists on the static Granger causality between tourism and economic growth such as Durbarry (2004), Croes and Vanegas (2008), Tang (2011), Seetanah et al. (2011), Apergis and Payne (2012), Ridderstaat et al. (2013). When reviewing the tourism-led growth hypothesis (TLGH), Brida et al. (2016) note that most of the empirical research since 2000 has addressed the economic theoretical framework behind tourism-led growth hypothesis and the increasing diversification in econometric models applied to that research.

The tourism-led growth is highly dependent on the endowment of natural energy resources as these countries tend to specialise in tourism to achieve greater economic development. The abundant natural energy sources of this zone carry great benefits needed to achieve faster economic development, therefore adopting a tourism diversification strategy has been tried in many island countries that depend on tourism. It is assumed that EDTG exports can increase economic development; however, imports of capital goods bring efficiency and boost economic development (Nowak et al., 2007); tourism development depends on governance structures and investments in human and physical capital and well-designed economic policies (Payne & Mervar, 2010). While research on tourism-economic growth ties has been debated, the stability of tourism-growth ties has been challenged to show that it changes

over time, as observed by Arslanturk et al. (2011), Antonakakis et al. (2015), and Nunkoo et al. (2020). Many countries that depend on tourism have been deeply carried away by the political-economic crisis and the weather disaster. Tang and Tan (2018) found that while tourism contributes positively to economic development, its effects vary across countries at different levels of income and institutional quality in a research panel from 167 countries.

Various studies support the tourism-led growth hypothesis, such as Balaguer and Cantavella-Jordá (2002), Durbarry (2004), Lean and Tang (2010). Some works found evidence of a positive relationship between tourism and economic growth in various countries using the techniques of time series analysis, cointegration analysis and Granger causality tests, for example, Proenca and Soukiazis (2008) for Portugal, Balaguer and Cantavella-Jordá (2002) for Spain, Durbarry (2004) for Mauritius, Louca (2006) for Cyprus, Katircioglu (2009) and Zortuk (2009) for Turkey, Kim et al. (2006) for Taiwan, Dritsakis (2004) for Greece, and Brida et al. (2011) for Brazil. In Indonesia, Sugiyarto et al. (2003) using a computable general equilibrium model found that tourism has a positive effect on economic growth. Nizar (2011) revealed that tourism and economic growth have a two-way causality relationship. According to Yang and Fik (2014), tourism spillover effects are indirect effects, where tourism in one area will have an impact on tourism in other areas. These spillover effects can be explained by the presence of spatial externalities between regions (Fingleton & Lopez-Bazo, 2006). Several studies on the spatially analysed tourism spillover effects, such as Li et al. (2011), Ma et al. (2015), Romão et al. (2017), Yang and Fik (2014), Yang and Wong (2012), found a positive impact of tourism in one area on other spatially adjacent areas.

Based on the theoretical study, the research hypothesis developed is that tourism spatial spillovers affect economic growth positively.

Methodology

Variables and Operational Definitions of Variables

The research variables used in this study are economic growth, physical investment, population, human capital, and tourism. Tourism is an activity related to the human movement, involving travel or temporary stops between a person's place of residence to one or several destinations outside their neighbourhood, driven by several needs or motives, without the intention to make a living. This activity depends on the factor endowments of an area, which comprise comparative advantages (resources) and competitive advantages (capacity to use resources). As a tourism indicator, we utilised the tourism competitiveness index, formed from the determinants of tourism competitiveness proposed by the World Travel and Tourism Council. These indicators include human tourism indicators, price competitiveness indicators, infrastructure development indicators, environment indicators, technology advancement indicators, human resources indicators, and social development indicators.

The tourism competitiveness index is calculated based on Gooroochurn and Hanley (2005) method. The tourism competitiveness index is calculated as follows:

1. Normalise indicator data using the maximum-minimum method by calculating the standard value (y_{ij}) for each region:

$$y_{ij} = \frac{x_{ij} - \min\left(x_{ij}\right)}{\max\left(x_{ij}\right) - \min\left(x_{ij}\right)}, \quad (3.1)$$

where the standard value of the indicator varies from 0 to 1, where 1 is the maximum value and 0 is the minimum value.

2. Calculate the composite index of indicators that determine tourism competitiveness using the following formula:

$$S_i^{(k)} = \sum_{j=1}^{k} y_{ij}, \quad (3.2)$$

where $S_i^{(k)}$ is the value in region i with the indicator k and y_{ij} is the standard value of the indicator.

3. Calculate the tourism competitiveness index, wherein each indicator is considered equally important and therefore weights are assigned using the equal weighting method, using the following formula:

$$IDSP = \sum_{j=1}^{k} \omega_k S_i^{(k)}, \quad (3.3)$$

where *IDSP* is the tourism competitiveness index, ω_k is the weighting of each indicator, and $S_i^{(k)}$ is a composite index indicator.

Spatial Weight Matrix

To capture the spatial effect in the analysis, we added another variable, spatial weight, which describes the relationship between regions. According to Coughlin et al. (2006), there are several types of spatial weighting (W) namely binary W, uniform W, inverse distance W, and W originat-

ing from real cases such as economic conditions or the presence or absence of a means of transportation from the location being studied. The binary weighting matrix has a value of 0 if there is no spatial proximity relationship and 1 if there is a spatial proximity relationship between locations. Uniform weighting is defined by the number of locations that are neighbours to the location in the first lag and non-uniform weighting assigns unequal weighting to different locations.

In this study, since Indonesia is shaped in the form of an archipelago, it was difficult to determine the type of weight to be used for spatial linkage analysis. However, we were still able to perform spatial linkage analysis because, according to Coughlin et al. (2006), in addition to the type of spatial weighting, which is an arbiter, we can derive spatial weights from real economic conditions. Coughlin et al. (2006) used three types of weights, namely income, race, and population aged 65 years and over. In terms of tourism, the ideal type of weighting to describe inter-provincial linkages is inter-regional tourist movements. However, due to data limitations, the interconnection between provinces was established based on migration movements between provinces in Indonesia.

The spatial weight matrix is a matrix of size $n \times n$ with a diagonal value of 0. The unit of analysis in this study was 33 provinces, so the spatial weight matrix size 33 × 33 was obtained as follows:

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

For spatial weights in the form of migration movements between Indonesian provinces, the weight of the matrix was calculated using the formula applied by Coughlin et al. (2006) as follows:

$$w_{ij} = \frac{1/\left|mig_i - mig_j\right|}{\sum_j 1/\left|mig_i - mig_j\right|}, \qquad (3.4)$$

where *mig* is the migration flow between provinces, and the subscripts *i* and *j* represent provinces *i* and *j*.

Data

The data used are panel data comprising 33 provinces for the period 2010–2017. Data sources included the Central Agency of Statistics (BPS), Ministry of Tourism, and Ministry of Public Works and Housing[1]. This study uses the migration data between provinces to create a spatial weight matrix to analyse spatial spillovers between provinces in Indonesia.

Empirical Model: Spatial Spillovers in Tourism and Economic Growth

To calculate the effects of tourism spillovers and economic growth, this study uses spatial Durbin models (SDMs) to capture the effects of spatial interdependence on both dependent and independent variables (Yang & Fik, 2014). Based on Lesage and Pace (2009), SDM can be written in vector form as follows:

$$Y = \rho WY + X\beta + WX\theta + \varepsilon, \qquad (3.5)$$

where ρ is the spatial autocorrelation coefficient, *W* is the spatial weight matrix, *X* is the control variable matrix (including labour, physical capital, human capital, and tourism). α, θ, and β are vectors of the estimated regression coefficients and ε is the error term. According to Lesage and Pace (2009), SDMs cover the spatial lag of the dependent variable (*WY*) as well as the explanatory variable (*WX*). This implies that changes in the dependent variable for one region can affect dependent variables in all other regions due to spatial spillovers while changes in the explanatory variables for a single observation can potentially influence the dependent variable in all other observations. Therefore, the empirical model for estimating the effects of spatial spillovers is as follows:

$$\begin{aligned} y_{i,t} = {} & \alpha + a_1 s_{i,t} + a_2 n_{i,t} + a_3 h_{i,t} + a_4 P_{i,t} + \\ & + \rho \sum_{j-1}^{N} W_{ij} y_{j,t} + \theta_1 \sum_{j-1}^{N} W_{ij} s_{j,t} + \theta_2 \sum_{j-1}^{N} W_{ij} n_{j,t} + \\ & + \theta_3 \sum_{j-1}^{N} W_{ij} h_{j,t} + \theta_4 \sum_{j-1}^{N} W_{ij} P_{j,t} + \varepsilon_{i,t}, \end{aligned} \qquad (3.6)$$

where $y_{i,t}$ is economic growth, $s_{i,t}$ is investment, $n_{i,t}$ is population, $h_{i,t}$ is human capital, $P_{i,t}$ is tourism, ρ is the spatial autocorrelation coefficient, α is a constant, α and θ are the regression coefficient to be estimated, *W* is the spatial weight matrix. W_{ij} is an element in the spatial weight matrix *W*, where *j* represents the nearest province ($j \neq i$). The expected parameter values are ρ, *b*, a_1, a_2, a_3, $a_4 > 0$ and ρ represents the spatial coefficient. In the SDM context, variations in the regional economic growth depend on the economic growth of neighbouring provinces, captured by the spatial lag vector W_y, as well as other input factors from the neighbouring province of *WX*.

[1] Links to statistical data in this research are https://www.bps.go.id/ and https://kemenparekraf.go.id/.

Results and Discussion

Tourism Competitiveness Index

The indicators of tourism competitiveness, namely human tourism, price competitiveness, infrastructure development, environment, technology advancement, human resources, and social development, form the tourism competitiveness index for each province in Indonesia. The tourism competitiveness index is calculated using the formulas in Equations (3.1) to (3.3). The tourism competitiveness index is presented in Table 1.

During the observation period, the provinces with high tourism competitiveness indexes were Jakarta and Bali. Outside Java, East Kalimantan showed a high tourism competitiveness index value. In contrast, the provinces that occupied the lowest position were West Sulawesi from 2000 to 2015 and East Nusa Tenggara from 2016 to 2017.

Figure 2 shows the average tourism competitiveness index in Indonesia for the period 2010–2017. In general, the tourism competitiveness of the provinces is still significantly below the national average value. Jakarta has the highest tourism competitiveness index while West Sulawesi has the lowest. Provinces whose tourism competitiveness indexes are above the national average are Jakarta, Bali, East Kalimantan, Yogyakarta, Papua, Riau Islands, North Sulawesi, Riau, and Maluku.

Table 1

Tourism Competitiveness Index by province in Indonesia for 2010–2017

No	Province	2010	2011	2012	2013	2014	2015	2016	2017	Average
1	Nanggroe Aceh Darussalam	0.24	0.26	0.24	0.21	0.25	0.23	0.23	0.26	0.24
2	North Sumatera	0.21	0.22	0.22	0.21	0.21	0.24	0.22	0.20	0.22
3	West Sumatera	0.20	0.20	0.22	0.24	0.26	0.21	0.21	0.23	0.22
4	Riau	0.27	0.26	0.29	0.27	0.28	0.34	0.28	0.25	0.28
5	Jambi	0.21	0.21	0.19	0.26	0.31	0.20	0.23	0.26	0.23
6	South Sumatera	0.17	0.26	0.27	0.27	0.28	0.21	0.22	0.22	0.24
7	Bengkulu	0.19	0.24	0.28	0.26	0.28	0.20	0.18	0.29	0.24
8	Lampung	0.16	0.19	0.25	0.17	0.24	0.24	0.25	0.24	0.22
9	Bangka Belitung	0.16	0.21	0.25	0.15	0.18	0.19	0.19	0.20	0.19
10	Riau	0.30	0.30	0.34	0.31	0.33	0.29	0.29	0.30	0.31
11	DKI Jakarta	0.74	0.75	0.75	0.78	0.71	0.74	0.77	0.68	0.74
12	West Java	0.20	0.24	0.23	0.24	0.26	0.22	0.26	0.29	0.24
13	Central Java	0.14	0.17	0.18	0.18	0.19	0.17	0.19	0.18	0.18
14	D I Yogyakarta	0.36	0.38	0.37	0.36	0.37	0.33	0.33	0.33	0.35
15	East Java	0.17	0.20	0.20	0.20	0.23	0.19	0.23	0.21	0.20
16	Banten	0.17	0.18	0.20	0.21	0.19	0.20	0.19	0.17	0.19
17	Bali	0.44	0.47	0.47	0.45	0.46	0.47	0.50	0.50	0.47
18	West Nusa Tenggara	0.20	0.22	0.21	0.22	0.28	0.22	0.23	0.23	0.23
19	East Nusa Tenggara	0.16	0.18	0.15	0.13	0.14	0.16	0.15	0.16	0.15
20	West Kalimantan	0.19	0.22	0.26	0.22	0.20	0.15	0.20	0.16	0.20
21	Central Kalimantan	0.18	0.21	0.23	0.20	0.24	0.20	0.19	0.18	0.21
22	South Kalimantan	0.17	0.22	0.28	0.22	0.22	0.18	0.19	0.23	0.21
23	East Kalimantan	0.42	0.43	0.42	0.42	0.43	0.38	0.37	0.34	0.40
24	North Sulawesi	0.28	0.29	0.29	0.32	0.25	0.29	0.30	0.27	0.28
25	Central Sulawesi	0.11	0.14	0.15	0.16	0.16	0.21	0.16	0.17	0.16
26	South Sulawesi	0.19	0.24	0.23	0.24	0.23	0.23	0.29	0.23	0.23
27	Southeast Sulawesi	0.15	0.21	0.19	0.22	0.19	0.19	0.21	0.20	0.19
28	Gorontalo	0.12	0.16	0.14	0.16	0.20	0.20	0.26	0.20	0.18
29	West Sulawesi	0.08	0.13	0.12	0.11	0.11	0.10	0.18	0.20	0.13
30	Maluku	0.24	0.22	0.28	0.28	0.30	0.24	0.25	0.32	0.26
31	North Maluku	0.20	0.24	0.26	0.24	0.29	0.27	0.21	0.24	0.24
32	West Papua	0.34	0.37	0.33	0.28	0.35	0.26	0.34	0.31	0.32
33	Papua	0.21	0.20	0.16	0.18	0.20	0.23	0.29	0.29	0.22
	Minimum	0.08	0.13	0.12	0.11	0.11	0.10	0.15	0.16	0.13
	Maximum	0.74	0.75	0.75	0.78	0.71	0.74	0.77	0.68	0.74
	Average	0.23	0.26	0.26	0.25	0.27	0.25	0.26	0.26	0.25
	Median	0.20	0.22	0.24	0.22	0.25	0.22	0.23	0.23	0.23

Source: Data processed based on Equations (3.1), (3.2), and (3.3).

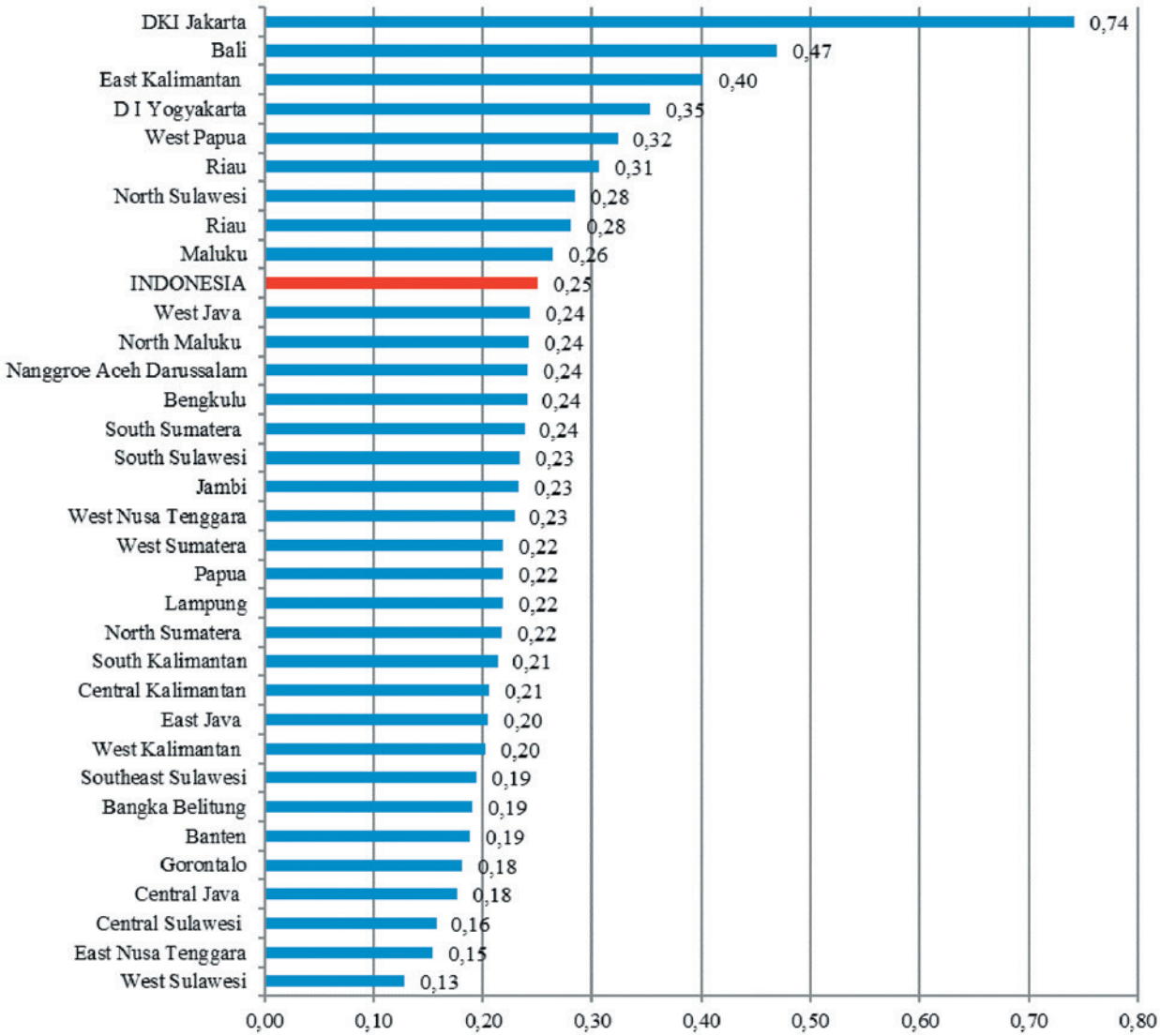

Fig. 2. *Average Tourism Competitiveness Index by province in Indonesia for 2010–2017*

Spatial Pattern of Tourism Competitiveness in Indonesia

The difference in tourism competitiveness between provinces in Indonesia needs further spatial viewing. The focus of this discussion will be directed toward analysing whether there is a grouping of provinces based on their tourism competitiveness index values; therefore, a spatial linkage model among the provinces in Indonesia must be built using a spatial weight matrix (*W* matrix). Regarding tourism and economic growth, proximity relationships (neighbouring) between locations or observations are expressed by the spatial weighting matrix. This spatial weighting matrix is symmetrical with the main diagonal zero.

In this study, the proximity between provinces is observed based on migration movements between provinces in Indonesia. Next, a row standardisation of the matrix is performed to obtain the spatial weight matrix of migration between provinces in Indonesia. While the spatial weighting matrix *W* illustrates the spatial relationship between provinces in Indonesia, it is also used as one of the variable instruments for estimating the tourism spillover model.

Testing of Spatial Autocorrelation in Tourism Competitiveness Index

Spatial autocorrelation testing was performed using Moran's I statistical calculations. The occurrence of spatial autocorrelation is determined by the *p*-value. If the *p*-value is less than 0.05, statistically, spatial autocorrelation exists (Anselin & Rey, 2014).

Table 2 shows the results of the Moran's I calculations of the tourism competitiveness indexes for all provinces in Indonesia. Based on this table, Moran's I is positive, which indicates the occurrence of positive autocorrelation. Based on the observation period 20102017, there is a ten-

Table 2

Moran's I of Tourism Competitiveness Index

Year	Moran's I	*z*-value	*p*-value
2010	0.708	4.165	0.000
2011	0.704	4.218	0.000
2012	0.711	4.195	0.000
2013	0.711	4.379	0.000
2014	0.718	4.117	0.000
2015	0.708	4.394	0.000
2016	0.821	4.092	0.000
2017	0.730	4.352	0.000

Source: Data processed.

dency for grouping provinces with high tourism competitiveness indexes, and vice versa, there is a tendency for grouping provinces with low tourism competitiveness indexes. Moran's I is a global measure of spatial autocorrelation. To determine whether spatial autocorrelation occurs between the observation units, the test was continued using the Moran scatterplot. The Moran scatterplot is a local measure to assess the presence or absence of spatial autocorrelation between observation units.

Table 3

Estimation results of tourism spillovers and economic growth using the Spatial Durbin Model (SDM)

	SDM fixed effects	SDM random effects
Constant ($\propto$)		–59.843 (–7.22)***
Investment ($s_{i,t}$)	0.407 (3.37)***	0.493 (3.71)***
Population ($n_{i,t}$)	–0.289 (–1.40)	0.399 (3.03)***
Human capital ($h_{i,t}$)	0.672 (1.26)	0.973 (1.69)*
Tourism competitiveness index ($P_{i,t}$)	0.005 (0.29)	0.0008 (0.05)
$W \times y_{i,t}(\rho)$	–2.014 (–4.82)***	–2.362 (–5.58)***
$W \times s_{j,t}(\theta_1)$	–0.138 (–0.60)	–0.229 (–0.93)
$W \times n_{j,t}(\theta_2)$	1.799 (3.38)***	1.737 (2.43)**
$W \times h_{j,t}(\theta_3)$	13.459 (6.45)***	14.186 (6.27)***
$W \times P_{j,t}(\theta_4)$	0.073 (1.91)*	0.071 (2.03)**
Observations	264	264
R-square	0.9428	0.9331
Akaike information criterion (AIC)	–1063.55	–778.69
Hausman test	Chi-square(9) = 27.77 Prob [0.0010]	

Source: Data processed.

1. * significant at $\alpha = 10$ %, ** significant at $\alpha = 5$ %, *** significant at $\alpha = 1$ %.

2. Numbers in parentheses () are *z*-statistics.

3. The Spatial Durbin Model is processed using the "XSMLE" command on Stata developed by Belotti et al. (2017).

The Moran scatterplot has four quadrants. Quadrant I (high-high) explains that areas with high observation values are surrounded by areas with high observation values. Quadrant II (low-high) explains areas with low observation values that are surrounded by areas with high observation values. Quadrant III (low-low) explains that areas with low observation values are surrounded by areas with low observation values. Quadrant IV (high-low) describes areas with high observation values surrounded by areas with low observation values.

Figure 3 illustrates the development of the Moran scatterplots, which show the patterns of relationships between the tourism competitiveness index of a province with those of other provinces. Quadrant I shows that provinces that have high tourism competitiveness index values are surrounded by provinces that have high tourism competitiveness index values. The provinces in Quadrant I are North Sumatra, Bangka Belitung, Jakarta, Central Java, Yogyakarta, Banten, Bali, East Nusa Tenggara, West Kalimantan, Central Kalimantan, East Kalimantan, Central Sulawesi, Southeast Sulawesi, Gorontalo, West Sulawesi, Maluku, and West Papua.

Quadrant III shows that provinces that have low tourism competitiveness index values are surrounded by provinces that have low tourism competitiveness index values. The provinces in Quadrant III are Aceh, West Sumatra, Riau, Jambi, South Sumatra, Bengkulu, Lampung, Riau Islands, West Java, East Java, West Nusa Tenggara, South Kalimantan, North Sulawesi, South Sulawesi, North Maluku, and Papua.

Furthermore, an analysis of tourism spillovers will be carried out on economic growth in Indonesia using a spatial matrix based on the flow of migration between provinces in Indonesia.

Effects of Tourism Spillovers on Economic Growth at the National Level

This section discusses the estimation results of the effect of tourism spillovers on economic growth in Indonesia at the national level based on the spatial model discussed earlier using the SDM method. The estimation results are presented in Table 3 below.

The criteria for selecting the best model in this research is to use information on the coefficient of determination (*R*-square) and Akaike Information Criterion (AIC). Based on the coefficient of determination (*R*-square) is 0.9428 for fixed effects and 0.9331 for random effects. The *R*-square value for fixed effects is greater than for random effects, so it can be concluded that the fixed effects model

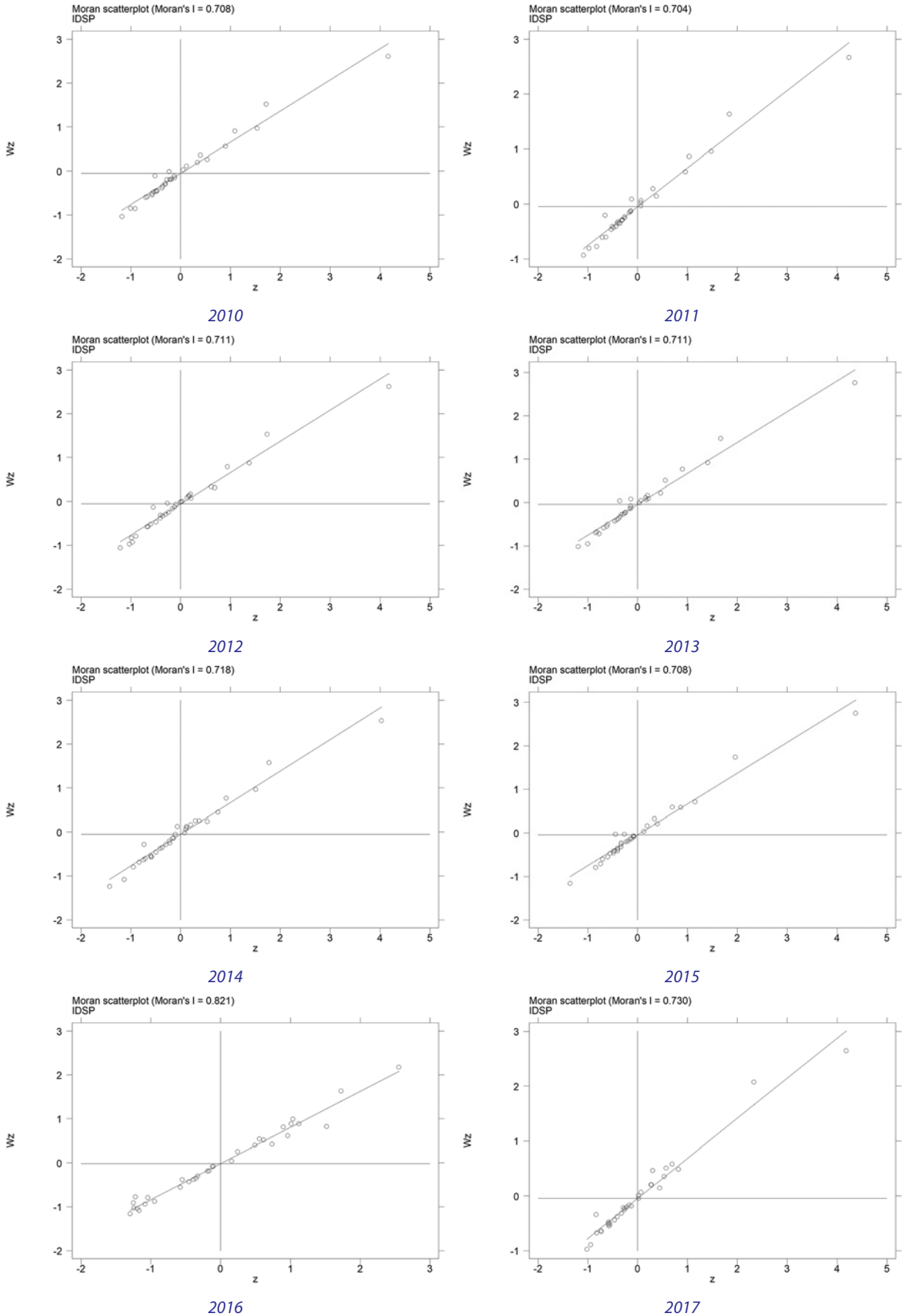

Fig. 3. *Moran scatterplots of the Tourism Competitiveness Index in Indonesia*

meets the criteria for the accuracy of a model (goodness of fit). Based on Akaike Information Criterion (AIC) it is –1063.55 for fixed effects and –778.69 for random effects. Akaike Information Criterion (AIC) value for fixed effects is smaller than for random effects, so it can be concluded that the best model based on the AIC criteria is the fixed effects model. In addition, the selection of the best model can also be done with the Hausman test. Based on the results of the Hausman test, the value of prob > chi2 = 0.0010. This value is less than 0.05 so the model used is the fixed effects model.

The parameter coefficients θ_1 amounted to –0.138, θ_2 amounted to 1.799, θ_3 amounted to 13.459, and θ_4 amounted to 0.073 indicate the coefficient of spatial dependence between each province on investment ($s_{j,t}$), population ($n_{j,t}$), human capital ($h_{j,t}$), and tourism ($P_{j,t}$).

According to Yang and Fik (2014), the effect of tourism spillovers is an indirect effect. Spillover effects can be explained by the existence of spatial externalities between regions (Fingleton & Lopez-Bazo, 2006). In this study, tourism is an endowment factor that consists of comparative advantages and competitive advantages, so as to analyse the effects of spillovers as a result of the development of tourism caused by pull factors. Pull factors are the forces that can be produced by an area in attracting tourists to come to tourist destinations.

The tourism interrelations at the provinces are shown by the parameter coefficient θ_4 or the coefficient of tourism spillovers. The parameter shows the lag spatial dependency coefficient or the magnitude of the influence of the proximity of the province on the tourism variable ($p_{i,t}$). In other words, it shows the magnitude of the effect of spatial proximity of a province on tourism variables that indicate tourism spillovers that occur between provinces.

Based on the estimation results in Table 3, the spatial coefficient of tourism spillovers is 0.073. It means that the inter-provincial tourism linkages play a role in the formation of the tourism competitiveness index of 0.073. In other words, if on average there is an increase in tourism competitiveness in a province by 1 percent then it will encourage an increase in tourism competitiveness in other provinces by 0.073 percent in accordance with the spatial weight of the province against other provinces. These empirical results are in line with the studies conducted by Li et al. (2011), Ma et al. (2015), Romão et al. (2017), Yang and Fik (2014), Yang and Wong (2012) which found a positive impact of tourism in one region on other regions that are spatially adjacent. The spatial coefficient ρ is negative and significant at –1.92 for fixed effects and –2.34 for random effects. The coefficient of tourism spillovers is 0.072 for fixed effects and 0.083 for random effects. This means that there are no tourism spillovers between provinces in Indonesia. This result could be attributed to the geographical conditions of Indonesia, which is in the form of an archipelago.

The tourism spillover coefficient is positive and significant at = 5 %, indicating that a province with a high tourism competitiveness index that is adjacent to other provinces spatially tends to have a high tourism competitiveness index as well. On the other hand, a province with a low tourism competitiveness index that is spatially adjacent to other provinces tends to have a low tourism competitiveness index as well. This means that there are tourism spillovers between provinces in Indonesia.

The results of the spatial analysis of tourism and economic growth in Indonesia show that the neighbourhood aspect is proven to be one of the determinants of economic growth as indicated by the coefficient value in the autoregressive spatial model. This condition indicates that increasing tourism development in neighbouring areas will increase economic growth in other areas. Based on these results, the government needs to formulate policies that are interrelated between regions in Indonesia because of the spatial concentration and overflow between regions. The government must be able to determine certain central areas so that later the development of these areas will encourage the development of other areas.

Indonesia as an island country with diverse regional characteristics cannot be seen as a single economic entity and sufficiently served by one national policy. This is a specific challenge in realising economic integration. Therefore, Indonesia's economic growth strategy needs to take into account regional characteristics due to the diversity of conditions in each region. To realise economic integration, it is necessary to find new sources of regional economic growth which are then integrated at the national level. In particular, the search for these sources needs to consider variations in the types and availability of resources in each region in Indonesia.

New economic sources originating from certain regions have a comparative advantage due to the innate resource factor (endowment factor) and the competitive advantage it has. Economic development in certain areas is carried out based on regional potentials that have comparative advantages and competitive advantages so that they can

create new centres of economic growth through the process of spillovers to the surrounding areas.

Conclusion

In terms of regional development, an area cannot be treated as a stand-alone unit since social and economic interactions occur indefinitely between each economic unit such that economic activity is influenced by factors not only within the region itself, but also from neighbouring regions. In this study, inter-provincial linkages were identified by studying migration movements between provinces in Indonesia. This study utilised the SDM to analyse the effect of tourism spillovers on economic growth. The tourism spillover coefficient was 0.072 for fixed effects and 0.083 for random effects. This means that tourism spillovers occur between provinces in Indonesia. This estimation provides an overview of the tourism interactions between provinces, i. e., tourism in an area is influenced not only by its factor endowments but also by spatially adjacent neighbouring provinces.

In order to develop Indonesian tourism, it is necessary to pay attention to regional characteristics. One of the government's policies in reducing inequality is the development of new economic sources. One of the programmes for developing new economic resources is the development of the tourism sector. This programme aims to encourage competitiveness and make tourism the main source of foreign exchange. The government continues to improve infrastructure development and accessibility of national tourism spread from western to eastern Indonesia, amenities and attractions in ten tourism development destinations.

Each region in Indonesia has a comparative advantage due to the innate resource factor (endowment factor) and different competitive advantages. Economic development in certain areas is carried out based on regional potentials that have comparative advantages and competitive advantages so that they can create new centres of economic growth through the process of spillovers to the surrounding areas. For this reason, it is necessary to create different tourism development policies for different tourist destinations.

The results of the spatial regression show that the spatial aspect of tourism development is proven. This is indicated by the spatial distribution which tends to cluster and the results of the spatial regression show that neighbouring areas have a positive effect on other areas. Based on these results, it appears that the spatial grouping of tourism will be followed by spatial dependence which has an impact on regional tourism development policies. The spatial influence of tourism implies that the government carries out an integrated tourism development programme to produce policies that not only have a local impact in one area but must have a spatial impact, meaning that it has an impact between regions.

Tourism has been proven to boost economic growth. This is in line with the main objective of Indonesia's tourism policy, namely to make Indonesia a tourism destination with competitive long-term tourism and contribute to sustainable growth. This means that tourism expansion should be from the demand and supply side. In practice this can be achieved by increasing the length of visits and the number of visits which will encourage tourist spending. This can be achieved by increasing tourism facilities, namely by improving transportation infrastructure and connectivity by land, air, and water, so as to increase the competitiveness of Indonesian tourism.

The key in optimising the development of a tourist destination is attractions, accessibility and amenities. Attractions mean that the area has something that attracts both the comparative and competitive advantages of the area. Accessibility is a means of transportation infrastructure that supports the movement of tourists to tourism destinations. Amenity is another facility that supports tourism activities. This is in accordance with the direction of the tourism development policy as stipulated in the Regulation of the Minister of Tourism of the Republic of Indonesia Number 29 of 2015 which is to build integrated accessibility, amenity, and attraction facilities and infrastructure (3A) in tourism areas that are national priorities. However, 3A alone is not enough, tourism development requires other policies, namely available packages, activities, and ancillary services. Available packages (tour packages) are packages that combine several attractions in one period of time. Activities are activities that can be carried out by tourists during visits to tourist destinations. Ancillary services (additional services) are support services that can be used by tourists.

This study has several limitations and further research is expected to overcome these limitations. First, further studies are expected to expand the observation period so that broad information is obtained and changes in the dynamics of tourism in Indonesia. The second relates to Indonesia's characteristics as an island nation that is spread and separated by the ocean makes it difficult to find reference types of spatial weights for an island nation; this is because the determination of the type of weights in spatial analy-

sis is often conducted for areas that intersect and are located in one mainland area. Further studies are expected to use the type of spatial weight in the form of inter-regional tourist moving, namely the movement of tourists between provinces in Indonesia.

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