EJEM
Econ.J.Emerg.Mark.

Economic Journal of Emerging Markets
Available at http://journal.uii.ac.id/index.php/jep

# Regional financial inclusion and poverty: Evidence from Indonesia

Iwan Fathi Fauzan[1*], Muhammad Firdaus[2], Sahara[3]

[1] Statistics Indonesia, Jakarta, Indonesia
[2,3] Department of Economic Science, Faculty of Economics and Management, IPB University, Bogor, Indonesia
Corresponding author: iwan.fathi@bps.go.id

**Article Info**

***Article history:***
Received : 23 December 2019
Accepted : 10 January 2020
Published : 8 April 2020

***Keywords:***
Financial inclusion index, poverty, spatial panel econometrics

***JEL Classification:***
C33, G28

**DOI:** 10.20885/ejem.vol12.iss1.art3

**Abstract**

This paper builds a financial inclusion index of thirty-three provinces in Indonesia from formal financial institutions banks. It aims at analyzing how the financial inclusion index relates to regional poverty using a spatial panel econometric approach. **Findings/Originality:** The results show that the average financial inclusion index of each province in Indonesia is still in a low category, and there is a financial system development inequality between DKI Jakarta Province and other regions. We also find that poverty has a significant negative effect on the financial inclusion index. With the recent migration of residents as a spatial weighting matrix, we decompose the global effect of the poverty variable on the financial inclusion index into a local effect for each province.

## Introduction

Economic development is inseparable from a well functioning financial system. So, in macroeconomic theory, there is a market for goods and money markets. A strong and stable financial system will support economic growth through funding for investment. At the micro-level, the financial system provides savings services to disposable income after deducting consumption from households – known as surplus economic units – and can be used for future consumption, or providing loan services to households and companies both of a short–term and long–term loans (mortgage), and providing various forms of payment for economic transactions with the touch of digital technology. The more inclusive the financial system is, by providing broad access to formal financial services such as community outreach to bank branch offices, ATMs, credit cards, and digital financial services, the more the benefits to the poor and small and medium scale enterprises are (Demirgüç-Kunt & Klapper, 2013; Nayak, 2016; Zins & Weill, 2016).

However, the fact is that the poor face higher barriers to entering the financial system. The inability to access financial services such as not having money to save, not being able to pay for account opening fees at the bank, as well as the distance of residence to formal financial services that is far and expensive, is a factor that explains the obstacles of the poor to the financial system (Demirgüç-Kunt & Klapper, 2013; Zins & Weill, 2016). In pure economic terms, poverty is when family incomes fail to meet different thresholds across countries. Thus, an early indication of a financial system that is exclusive in an area can be seen from the low access and use of the financial system due to the high level of poverty.

The regional financial inclusion index in Indonesia has been compiled both by official government institutions and some previous studies such as Sanjaya and Nursechafia (2016) and Ummah (2015). There are some formal financial institutions in Indonesia, such as banks, insurance

P ISSN 2086-3128 | E ISSN 2502-180X

companies, pension funds, venture capital, and stock exchange. In this paper, the financial inclusion index is built by banking indicators. A bank is a business entity that collects funds from the public in the form of deposits and lends them out to the public in the form of credit and or other forms in order to improve the lives of many people (Republic of Indonesia, 1998).

Indonesia's financial development seems to have increased over the past 17 years. The number of accounts in commercial banks has increased by 473% from 66 million in 2000 to 315 million in 2017 (Bank of Indonesia, 2018). However, inequality between regions, as indicated in almost all indicators of the financial system of the bank, is still quite high, both in demand and the provision of access to formal financial services. For example, each adult population in the provinces of DKI Jakarta and East Nusa Tenggara has more than four accounts in banking institutions (ratio of the number of deposits to the number of adults). Meanwhile, in other regions, on average, each adult only has one to two accounts in formal financial banking institutions. These results are different when compared to the number of total third party fund accounts (*dana pihak ketiga*/DPK) per province. As the province of West Java, with a large number of DPK accounts, the ratio of the number of DPK per adult population is lower than half the other provinces. The little use of formal financial services by the community is also a problem in almost all provinces (Sanjaya & Nursechafia, 2016; Ummah, 2015).

There have been several previous studies on measuring financial inclusion and analyzing its relationship with poverty. Sarma's research is one of the earliest studies that formulates financial inclusion in an index (Sarma, 2008). Subsequently, Sanjaya and Nursechafia (2016) and Sarma and Pais (2011) revealed how financial inclusion can affect economic growth, while Ummah (2015) attempted to identify the determinants of regional financial inclusion in Indonesia using Tobit regression analysis. Further Wang and Guan (2017) analyzed the relationship between spatial interactions and financial inclusion based on the World Bank's global *findex* database in 2011. Using the formula of Bozkurt, Karakus, and Yildiz (2018) and Wang and Guan (2017) calculated the financial inclusion index and implemented a spatial determinant analysis of financial inclusion in 120 countries from 2011 and 2014 by employing the spatial panel model. A study by Agustina, Wasono, and Darsyah 2015) suggests that poverty also has spatial interactions where poverty across regions is closely related to one another.

This study aims at building a financial inclusion index of commercial banks and assessing the effect of poverty levels on financial inclusion, assuming that there is a relationship between regions (spatial interaction). The spatial information weighted both the dependent variable (financial inclusion index) and known as the spillover effect, on poverty and on other control variables, as well as spatial relationships that occur on variables outside of research in general (disturbance of model). LeSage and Pace (2009) formulates summary statistics from spatial equations called direct effects and indirect effects, where these statistics will also be calculated in this study. Finally, this research will decompose global spatial effects into local spatial effects per province as an observation unit.

The contribution of this paper is to provide a picture financial inclusion index of banks, providing a spatial approach as a means of spatial analysis of financial inclusion and poverty relationship, and regional analysis calculating the local effects of the inter-regional financial system spillover. The hypothesis is formulated as, H0: Poverty does not affect regional financial inclusion. The framework of thought is described as follows:

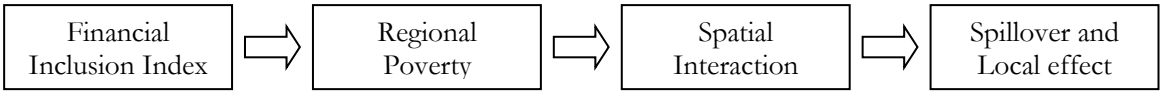


**Figure 1.** Theoretical framework

## Methods

This study aims at constructing an index of financial inclusion and regressing the index on several regressors based on panel data that include 33 provinces in Indonesia from 2010 to 2018. The

construction of the index follows the equation of Bozkurt et al. (2018) and Wang and Guan (2017) where the index indicators and the independent variables used were sourced from Bank Indonesia (BI), the Financial Services Authority (OJK), and the Central Statistics Agency (BPS).

**Table 1.** Definition of research variables

| Variable | Definition | Value | Source | Literature |
|---|---|---|---|---|
| | Dependent Variable | | | |
| IFI | *Index of Financial Inclusion* | Interval 0-1 | BI, OJK, BPS | |
| | Access Dimension | | | |
| ACCOUNT | Share account to adult 15+ | % | BI, OJK | Bozkurt et al. (2018); Wang and Guan (2017) |
| BRANCH | Branch per 1000 adult 15+ | % | BI, OJK | |
| ATM | ATM per 1000 adult 15+ | % | BI, OJK | |
| | Usage Dimension | | | |
| DPK | DPK to PDRB ADHK ratio | % | BI, OJK | |
| CREDIT | Credit to PDRB ADHK ratio | % | BI, OJK | |
| | Independent Variables | | | |
| | Treatment Variable | | | |
| POVERTY | Poverty rate | % | BPS | |
| | Control Variables | | | |
| AGE | Age (median) | Interval | BPS | |
| PRIMARY | Gross enrollment ratio in primary education | % | BPS | Ang and Kumar (2014); Bozkurt et al. (2018); Chithra and Selvam (2013); Demirgüç-Kunt and Klapper (2013); Fungáčová and Weill (2015); Honohan (2008); Sahoo, Pradhan, and Sahu (2017); Wang and Guan (2017) |
| SECONDARY | Gross enrollment ratio in secondary education | % | BPS | |
| TERTIARY | Gross enrollment ratio in tertiary education | % | BPS | |
| D_MOSLEM | Regional dummy with a Moslem majority | 0: No, 1: Yes | BPS | |
| INTERNET | Internet access (% of population) | % | BPS | |
| CELLPHN | Cellular phone (% of population) | % | BPS | |
| GDRPCAP | Log gross domestic regional product per capita | % | BPS | |
| | | | BPS | |
| UNEMP | Unemployment | % | BPS | |
| GINI | Gini ratio | % | BPS | |
| GFCF | Gross fix capital formation ratio | % | BPS | |
| TAXBURDEN | Log tax burden | % | BPS | |
| GOVSPEND | Log total government spending | % | BPS | |

## Measuring Index of Financial Inclusion

The financial inclusion index is calculated in two stages with formulas adopted in Bozkurt et al. (2018) and Wang and Guan (2017). In the first stage the dimension index (access and usage dimension) for each province and year period is calculated. The minimum and maximum values of each indicator are used to transform values from different previous sizes into one value on a scale from 0 to 1.

Transformation value of indicator j for province k:

$$x_j = \frac{Aktual\ j - Minimum\ j}{Maximum\ j - Minimum\ j} \quad (1)$$

Each dimension is then calculated using equation (2) following Bozkurt et al. (2018) and Wang and Guan (2017).

$$\text{I dimension k} = 1 - \frac{\sqrt{w_{I1}^2(1-x_{k,I1})^2 + w_{I2}^2(1-x_{k,I2})^2 + \cdots + w_{Ij}^2(1-x_{k,Ij})^2}}{\sqrt{w_{I1}^2 + w_{I2}^2 + \cdots + w_{Ij}^2}} \quad (2)$$

where:
*I* = dimension index ($I_{access}$ and $I_{usage}$)
*x_(k,Ij)* = transformed k indicator value
*w_Ij* = weight from *k* indicator in *I* dimension
*j* = unit observation

Dimension weight is calculated using the ratio of coefficient of variation of each indicator to the sum of the coefficient of variation indicators in each dimension (Bozkurt et al., 2018; Wang & Guan, 2017).

$$w_{Ij} = \frac{coefficient\ of\ variation_{ij}}{\sum_j coefficient\ of\ varioation_{ij}} \quad (3)$$

In the second stage the Index of Financial Inclusion (IFI) is calculated. Following Bozkurt et al. (2018) and Wang and Guan (2017, the access dimensions index and the usage dimensions index are aggregated using equation (4) to produce the IFI for each province and each year.

$$IFI_k = 1 - \frac{\sqrt{w_{I\,access}^2(1-I\,access_k)^2 + w_{I\,usage}^2(1-I\,usage_k)^2}}{\sqrt{w_{I\,access}^2 + w_{I\,usage}^2}} \quad (4)$$

**Spatial Panel Model Specification**

This study uses five spatial panel regression models, following the equations of Bozkurt et al. (2018) with some additional model specifications, to generate the best model that can describe the relationship between the IFI with poverty and other control variables. The five models are the following:

1. Spatial autoregressive model (SAR) in equation (5) to see spatial dependence of the dependent variable;
$$\log(IFI)_{it} = \rho \sum_{j=1}^{n} W_{ijt} \log(IFI)_{it} + \sum_{k=1}^{s} \beta_k X_{itk} + \varepsilon \quad (5)$$
2. Spatial error model (SEM) in equation (6) to see spatially autocorrelated error term;
$$\log(IFI)_{it} = \sum_{k=1}^{s} \beta_k X_{itk} + \lambda \sum_{j=1}^{n} W_{ijt} v_{it} + \varepsilon \quad (6)$$
3. Spatial autoregressive with spatially autocorrelated error model (SAC) in equation (7) to see spatial dependence of both dependent variable and error;
$$\log(IFI)_{it} = \rho \sum_{j=1}^{n} W_{ijt} \log(IFI)_{it} + \sum_{k=1}^{s} \beta_k X_{itk} + \lambda \sum_{j=1}^{n} W_{ijt} v_{it} + \varepsilon \quad (7)$$
4. Spatial Durbin model (SDM) in equation (8) to see spatial dependence of the independent variable;
$$\log(IFI)_{it} = \rho \sum_{j=1}^{n} W_{ijt} \log(IFI)_{it} + \sum_{k=1}^{s} \beta_k X_{itk} + \theta \sum_{j=1}^{n} W_{ijt} X_{itk} + \varepsilon \quad (8)$$
5. General Nested Spatial model (GNS) in equation (9) to see spatial dependence of the dependent variable, independent variable, and error term.
$$\log(IFI)_{it} = \rho \sum_{j=1}^{n} W_{ijt} \log(IFI)_{it} + \sum_{k=1}^{s} \beta_k X_{itk} + \theta \sum_{j=1}^{n} W_{ijt} X_{itk} + \lambda \sum_{j=1}^{n} W_{ijt} v_{it} + \varepsilon \quad (9)$$
Note:
*IFI* = index of financial inclusion

$i, j$ = unit observation of province; where i,j=1,2,…,33 and $i \neq j$
$k$ = sum of independent variable; $k$ =1, 2 ,…,14
$\beta$ = parameter coefficient
$\varrho$ = spatial lag dependent variable coefficient
$\lambda$ = spatial lag error coefficient
$\theta$ = spatial lag independent variables coefficient
$W_{it}$ = recent migration weight matrix
$X_{itk}$ = independent variables, such as:
$X_{it1}$ : median of age population (AGE)
$X_{it2}$ : poverty rate (POVERTY)
$X_{it3}$ : gross enrollment ratio in primary education (PRIMARY)
$X_{it4}$ : gross enrollment ratio in secondary education (SECONDARY)
$X_{it5}$ : gross enrollment ratio in tertiary education (TERTIARY)
$X_{it6}$ : regional dummy with a Moslem majority (D_MOSLEM)
$X_{it7}$ : percentage of household using the internet (INTERNET)
$X_{it8}$ : percentage of the population having the cellular phone (CELLPHN)
$X_{it9}$ : gross domestic regional product per capita (GDRPCAP)
$X_{it10}$ : unemployment rate (UNEMP)
$X_{it11}$ : gini ratio (GINI)
$X_{it12}$ : gross fixed capital formation rate (GFCF)
$X_{it13}$ : tax burden (TAXBURDEN)
$X_{it14}$ : total government spending (GOVSPEND)
ε = Error

The spatial panel model estimation method follows the strategy provided by Elhorst (2010) and LeSage and Pace (2009). The first step is to choose the best model by testing the Lagrange Multiplier (LM) between SAR, SEM, and SDM. When SDM is selected as the best model, then a re-selection is made between SDM and GNS, or when the SAR or SEM model is chosen as the best model, then the best model is chosen between SAR, SEM, and SAC. The choice of the best model is made by picking the model with the smallest values of Bayesian Information Criterion (BIC) and Akaike Information Criterion (AIC). In addition, the Hausman test is also carried out to determine the best model between the fixed effect model and the random effect model. This estimation is implemented using the maximum likelihood estimation technique.

**Direct and Indirect Effect Formula**

The essence of the spatial model is to develop the information set of a spatial observation unit that is produced in a global equation where there is information from a neighboring observation unit. To see this effect, LeSage and Pace (2009) uses the SDM model to derive models that can be written generally as follows:

$$\begin{aligned} y &= \rho W y + \iota_n \alpha + X\beta + WX\theta + \varepsilon \\ (I_n - \rho W)y &= \iota_n \alpha + X\beta + WX\theta + \varepsilon \\ y &= V(W)\iota_n \alpha + \textstyle\sum_{r=1}^{k} S_r(W)x_r + V(W)\varepsilon \\ S_r(W) &= V(W)(I_n \beta_r + W\theta_r) \\ V(W) &= (I_n - \rho W)^{-1} \end{aligned} \tag{10}$$

From the $S_r(W)$ matrix above, the average value of the direct and indirect effects can be formulated as follows:

$$\bar{M}(r)_{direct} = n^{-1} tr\big(S_r(W)\big) \tag{11}$$

$$\bar{M}(r)_{total} = n^{-1}\iota_n' S_r(W)\iota_n \quad (12)$$

$$\bar{M}(r)_{indirect} = \bar{M}(r)_{total} - \bar{M}(r)_{direct} \quad (13)$$

The average value of these effects is a summary value of the local effect values per unit of observation so that from the $S_r(W)$ matrix, we can also decompose the direct and indirect effects into local effects for each observation unit.

### Spatial Weight Matrix (W)

The spatial weighting matrix is a non-negative matrix that presents the set of relationships between spatial observation units. A spatial weighting matrix is a formal form of spatial dependencies between observations (Anselin, 1988). In this study, the spatial weighting matrix used is the general spatial weight matrix. This spatial weighting takes consider of initial information (a priori), the purpose of the case under study, and the theory underlying the research (Anselin, 1988). Following Wibowo (2019), the data of recent migration of residents from the Population Census 2010 are used to construct the general spatial weight matrix. The following is a fragment of the recent migration matrix used in the study:

| Destination \ Origin | 11 | 12 | 13 | .... | 82 | 91 | 94 |
|---|---|---|---|---|---|---|---|
| 11 | 0 | 23043 | 1364 | .... | 0 | 0 | 143 |
| 12 | 17909 | 0 | 9148 | .... | 0 | 0 | 354 |
| 13 | 1237 | 14201 | 0 | .... | 0 | 0 | 352 |
| .... | .... | .... | .... | .... | .... | .... | .... |
| 82 | 0 | 785 | 181 | .... | 0 | 802 | 497 |
| 91 | 268 | 896 | 0 | .... | 1402 | 0 | 8003 |
| 94 | 137 | 2326 | 36 | .... | 294 | 57199 | 0 |

The spatial weighting matrix requires a symmetrical matrix and with the principle that the main diagonal is always zero for areas that show migrant movement within the province. Furthermore, it is necessary to standardize each element by dividing it in each row by the total sum of values in the same row (the number of incoming migration from each province divided by the total incoming migration), so that the total sum of values in each row is 1. Examples of standardized spatial weighting matrices are formed as follows:

$$w = \begin{bmatrix} 0.000 & 0.640 & 0.038 & \dots & 0.000 & 0.000 & 0.004 \\ 0.133 & 0.000 & 0.068 & \dots & 0.000 & 0.000 & 0.003 \\ 0.009 & 0.106 & 0.000 & \dots & 0.000 & 0.000 & 0.003 \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ 0.000 & 0.039 & 0.009 & \vdots & 0.000 & 0.040 & 0.025 \\ 0.005 & 0.015 & 0.000 & \vdots & 0.024 & 0.000 & 0.134 \\ 0.001 & 0.021 & 0.000 & \cdots & 0.003 & 0.510 & 0.000 \end{bmatrix}$$

## Results and Discussion

### Index of Financial Inclusion

There are several types of financial inclusion index formulas from various studies. While Sarma and Pais (2011) uses three dimensions such as availability, penetration, and usage dimensions, Cámara

and Tuesta (2017) uses three dimensions such as access, usage, and barriers dimensions, and Wang and Guan (2017) use two dimensions such as access and usage index. We chose the formula in Wang and Guan (2017) based on the consideration that all studies have similarities in maximizing access and usage of the financial system. The financial inclusion index values are divided into three categories, namely low level (with IFI value <0.3), medium level ( 0.3 ≤ IFI value <0.6), and high level (with IFI value ≥ 0.6) (Bozkurt et al., 2018). The results show that at the national level, the financial inclusion index falls into the low level category.

**Table 2.** Regional index of financial inclusion in Indonesia, 2010 and 2018

| Province | 2010 | | | | 2018 | | | |
|---|---|---|---|---|---|---|---|---|
| | Access | Usage | IFI | Rank | Access | Usage | IFI | Rank |
| Nanggroe Aceh Darussalam | 0.176 | 0.180 | 0.178 | 19 | 0.225 | 0.190 | 0.204 | 21 |
| Sumatera Utara | 0.183 | 0.310 | 0.237 | 6 | 0.232 | 0.272 | 0.256 | 9 |
| Sumatera Barat | 0.201 | 0.211 | 0.205 | 10 | 0.241 | 0.178 | 0.203 | 22 |
| Riau | 0.190 | 0.091 | 0.144 | 26 | 0.231 | 0.095 | 0.147 | 31 |
| Jambi | 0.140 | 0.146 | 0.143 | 27 | 0.216 | 0.151 | 0.176 | 27 |
| Sumatera Selatan | 0.143 | 0.191 | 0.164 | 20 | 0.194 | 0.182 | 0.187 | 26 |
| Bengkulu | 0.137 | 0.191 | 0.161 | 22 | 0.202 | 0.222 | 0.214 | 16 |
| Lampung | 0.096 | 0.142 | 0.116 | 33 | 0.147 | 0.144 | 0.146 | 32 |
| Bangka Belitung | 0.169 | 0.194 | 0.180 | 16 | 0.231 | 0.203 | 0.214 | 17 |
| Kepulauan Riau | 0.423 | 0.163 | 0.294 | 4 | 0.430 | 0.158 | 0.254 | 10 |
| DKI Jakarta | 1.000 | 1.000 | 1.000 | 1 | 1.000 | 1.000 | 1.000 | 1 |
| Jawa Barat | 0.181 | 0.194 | 0.187 | 14 | 0.227 | 0.205 | 0.214 | 18 |
| Jawa Tengah | 0.175 | 0.184 | 0.179 | 18 | 0.221 | 0.205 | 0.212 | 19 |
| DI Yogyakarta | 0.294 | 0.308 | 0.300 | 3 | 0.341 | 0.345 | 0.343 | 3 |
| Jawa Timur | 0.172 | 0.199 | 0.184 | 15 | 0.221 | 0.211 | 0.215 | 15 |
| Banten | 0.230 | 0.190 | 0.212 | 8 | 0.273 | 0.246 | 0.256 | 8 |
| Bali | 0.359 | 0.373 | 0.365 | 2 | 0.406 | 0.394 | 0.398 | 2 |
| Nusa Tenggara Barat | 0.123 | 0.140 | 0.130 | 29 | 0.213 | 0.237 | 0.228 | 13 |
| Nusa Tenggara Timur | 0.096 | 0.218 | 0.149 | 23 | 0.275 | 0.260 | 0.266 | 4 |
| Kalimantan Barat | 0.135 | 0.238 | 0.179 | 17 | 0.212 | 0.258 | 0.240 | 11 |
| Kalimantan Tengah | 0.134 | 0.164 | 0.147 | 25 | 0.233 | 0.177 | 0.199 | 24 |
| Kalimantan Selatan | 0.182 | 0.239 | 0.207 | 9 | 0.259 | 0.254 | 0.256 | 7 |
| Kalimantan Timur | 0.331 | 0.112 | 0.225 | 7 | 0.366 | 0.119 | 0.208 | 20 |
| Sulawesi Utara | 0.269 | 0.252 | 0.262 | 5 | 0.311 | 0.229 | 0.261 | 5 |
| Sulawesi Tengah | 0.130 | 0.170 | 0.148 | 24 | 0.206 | 0.152 | 0.173 | 29 |
| Sulawesi Selatan | 0.167 | 0.242 | 0.200 | 11 | 0.250 | 0.216 | 0.230 | 12 |
| Sulawesi Tenggara | 0.119 | 0.130 | 0.124 | 31 | 0.206 | 0.149 | 0.172 | 30 |
| Gorontalo | 0.128 | 0.131 | 0.129 | 30 | 0.188 | 0.194 | 0.193 | 25 |
| Sulawesi Barat | 0.082 | 0.174 | 0.122 | 32 | 0.145 | 0.117 | 0.128 | 33 |
| Maluku | 0.137 | 0.282 | 0.199 | 12 | 0.224 | 0.280 | 0.257 | 6 |
| Maluku Utara | 0.101 | 0.174 | 0.133 | 28 | 0.208 | 0.196 | 0.201 | 23 |
| Papua Barat | 0.256 | 0.111 | 0.188 | 13 | 0.357 | 0.147 | 0.224 | 14 |
| Papua | 0.188 | 0.132 | 0.163 | 21 | 0.229 | 0.142 | 0.175 | 28 |
| Indonesia | 0.208 | 0.217 | 0.211 | | 0.270 | 0.228 | 0.244 | |

Source: *OJK* and *BPS*

Table 2 reports the financial inclusion index in 2010 and 2018, the starting and ending years under study. The calculated index shows that the financial inclusion across provinces in Indonesia is low and has not improved much. The national average for the period under study grows annually by 0.062, with the index value each year: 0.21, 0.22, 0.22, 0.23, 0.23, 0.24, 0.24, 0.24, and 0.24, respectively. This result is not far from that of Ummah (2015) where for the period 2007-2011 the

each year index is 0.18, 0.20, 0.21, 0.22, and 0.24. Likewise, although Sanjaya and Nursechafia (2016) provided a slightly higher national average index for the period 2008-2014 (0.31, 0.31, 0.31, 0.31, 0.32, 0.32, and 0.32), the annual growth is similarly low.

From the provincial comparison perspective, DKI Jakarta scores the highest financial inclusion index, far ahead of other provinces that have index values averaging into the low level category (index value <0.3). Interestingly, provinces with the highest number of DPK indicators that include West Java, Central Java, and East Java were not able to compete with the provinces of Bali, Riau Islands, Banten, and East Nusa Tenggara in the financial inclusion index for the 2018 period.

**Poverty and Financial Inclusion Index**

Spatial panel regression analysis is employed to assess the relationship between financial inclusion index and poverty. Several stages and tests were carried out in a spatial panel regression analysis. The first stage is Hausman testing to obtain the best panel model between the fixed effect model and the random effect model. The result suggests the random effect model as the better model. The null hypothesis that the panel contains no correlation between the error components and the independent variable cannot be statistically rejected, recommending that the random effect model is selected over the fixed effect model (Baltagi, 2005).

**Table 3.** Specification test of choosing the optimum model

| Statistic's indicator | Result | |
|---|---|---|
| Best model | SAC | |
| Hausman Test | | |
| $\chi^2$ | 25.513[X] | |
| P-value | 0.490 | |
| N | 297 | |
| LM Test | | |
| Chi² | 2.549[X] | |
| P – value | 0.111 | |
| First $H_0$ | Accept (SDM can be simplified to SAR) | |
| Chi2 | 0.105[X] | |
| P – value | 0.746 | |
| Second $H_0$ | Accept (SDM can be simplified to SEM) | |
| BIC and AIC Specification Test | | |
| | BIC | AIC |
| SAR model | -702.171 | -757.577 |
| SEM model | -702.149 | -757.555 |
| SAC model | -702.367 | -757.773 |
| SDM model | - | - |
| GNS model | - | - |

Note: - Null Hypothesis for Hauman Test: $E(u_{it}/ X_{it}) = 0$
- First Null Hypothesis for LM Test (SDM simplified to SAR model): $H_0$: $\theta = 0$
- Second Null Hypothesis for LM Test (SDM simplified to SEM model): $H_0$: $\theta = -\varrho\beta$

In the second stage a spatial dependency testing, following Elhorst (2010) and LeSage and Pace (2009), is implemented where the Spatial Durbin Model (SDM) for the financial inclusion index is estimated. From the estimated SDM, two null hypotheses are then tested using the LM specification test. While the first null hypothesis, $H_0$: $\theta = 0$, is for testing whether the SDM model can be simplified into the SAR model, the second null hypothesis, $H_0$: $\theta = -\varrho\beta$, for testing whether the SDM model can be simplified into an SEM model. From the specification LM test result, the

selection of the best model is then made among the SAR model, SEM model or SAC model as the combination of SAR and SEM models. The selection of the best model is made by picking the model with the smallest values of the Bayesian Information Criterion (BIC) and Akaike Information Criterion (AIC). Table 5 shows that SAC model is the best because it has the smallest BIC and AIC values.

Table 4 reports the determinants of the financial inclusion index in Indonesia using a spatial panel model. LeSage and Pace (2009) explains that the way of interpreting the estimated coefficients in the spatial model differs from that in the traditional regression model. Specifically, a change in an independent variable in a specific unit of observation (space/province) will not only induce a change in the dependent variable in that same space (province), but also produce a spillover effect on the dependent variable in other spaces (provinces). LeSage and Pace (2009)made a summary measure consisting of average total effects, average direct effects, and average indirect effects for the interpretation of spatial regression models. Table 4 reports the estimated results of the poverty effect on the financial inclusion index with a spatial panel analysis approach.

**Table 4.** Determinants of financial inclusion in Indonesia

| Estimation of Parameters | IFI | |
|---|---|---|
| Best Model: SAC Model | | |
| Spatial autoregressive coeff. $\rho$ | 0.091 | |
| Spatial lag error coeff. $\lambda$ | -0.117 | |
| Intercept | -2.639*** | |
| | Direct Effect | Indirect Effect |
| POVERTY | -0.87473*** | -0.08720 |
| AGE | -0.00918*** | -0.00092 |
| PRIMARY | 0.26429** | 0.02635 |
| SECONDARY | 0.05087 | 0.00507 |
| TERTIARY | 0.03334 | 0.00332 |
| D_MOSLEM | -0.23570 | -0.02350 |
| CELLPHN | 0.09324*** | 0.00930 |
| INTERNET | -0.15501*** | -0.01545 |
| LN_GDRPCAP | -0.00057 | -0.00006 |
| UNEMP | 0.00802 | 0.00080 |
| GINI | -0.04730 | -0.00472 |
| GFCF | 0.52884*** | 0.05272 |
| LN_TAX | -0.00143 | -0.00014 |
| LN_GOVSPEND | 0.15008*** | 0.01496 |
| N | 297 | |
| Log-Likelihood | 393.886 | |
| BIC | -702.367 | |
| AIC | -757.773 | |

Note: entries in ***, **, and * are significant in 1%, 5%, and 10% significant level, respectively.

As expected, the poverty rate has both negative direct and indirect effect on the financial inclusion at 1 percent level of significance. This suggests that changes in the poverty rate in a province tend to have a negative direct effect on financial inclusion in that province as well as negative indirect effects in other provinces. In other words, reducing the poverty rate in a province likely increases financial inclusion in both that province and other provinces. The result corroborates the result of Bozkurt et al. (2018) that also suggests the poverty rate negatively affects the financial inclusion index of the countries under their study.

In addition, age and education also influence financial inclusion. Education measured in gross enrollment ratio in primary education has a significant positive effect on financial inclusion

and has a negative indirect effect. This result might serve as an empirical evidence of the effectiveness of the government's financial inclusion program in schools in recent years. Programs that can expand financial system services and educate people to improve their financial literacy need to be routinely carried out. An interesting thing to note is the negative indirect effect of primary education on financial inclusion in the surrounding provinces. This result is in line with Bozkurt et al. (2018) where the effect of education as a proxy of financial literacy has a significant negative indirect effect.

Religion variable proxied by the proportion of Muslims in the population proved not to significantly influence the financial inclusion index. The result is supported by Bozkurt et al. (2018) that found that the proportion of religious groups in the population did not significantly influence financial inclusion. Although not significant, the negative indirect effect of regional factors with the majority of Muslim population on the model is in line with Ang and Kumar (2014) where countries with a majority of Muslim and Catholic populations tend to be associated with low levels of financial system development.

The percentage of the population who own a cell phone also significantly influences the financial inclusion index. Advances in information technology, especially mobile phones and the internet, have influenced the development of the modern financial system. On the demand side, the greater use of technology by household members likely have a positive effect on the financial system inclusiveness due to easier access to the financial system for the community. On the supply side, several large formal financial institutions from both private and state-owned enterprises have seized the opportunity by adopting internet and mobile banking platforms, making it far much easier for consumers to execute banking and even daily buying-selling transactions, just through their own mobile phones. No wonder, the estimated direct impact of the percentage of cell phone users are positive, indicating that an increase in cellular phone users can increase IFI in their respective regions. However, its indirect impact is negative, implying that an increase in the cellular phone usage in a province tends to lower IFI in the neighboring provinces, and vice versa. The likely implication of this result is the importance of government policy in enhancing telecommunications network infrastructure across provinces to improve access and use of formal financial services. The results are in line with Bozkurt et al. (2018) in terms of negative indirect effect, but on the direct effects, the latter produces a negative direct effect on the financial inclusion index, which is against the theory and hypothesis.

Per capita GDRP has a significant positive effect on the financial inclusion index, showing that the higher the level of income, in addition to increasing consumption, the higher the demand for savings. The results are in line with Bozkurt et al. (2018) and Demirgüç-Kunt & Klapper (2013), where people with high incomes have higher opportunity to access formal financial services, twice as much as that of low-income people. The ratio of gross fixed capital formation to GDRP at current prices also has a significantly positive effect on financial inclusion. The development of fixed capital, from both domestic and foreign capital, in the area such as constructions and non-constructions, greatly influences economic development in each province, including the development of the financial system. Spatial panel data analysis results show the importance of the role of gross fixed capital formation for financial inclusiveness in a province. However, the government needs to focus more on developing telecommunication network infrastructure to enhance the inclusiveness of the financial system in the future, given the development of the financial and economic system currently heading towards a new era of digitalization.

**Local Poverty Impact to Index of Financial Inclusion**

The result of a spatial panel model enables us to look into the local effects on financial inclusion in each province by each variable. As an example, here we chose the effect of the poverty variable on financial inclusion in DI Yogyakarta. Decomposition results are represented by figure 2 that shows

the flow of local poverty effects in DI Yogyakarta, both direct and indirect effects from and to neighboring areas.

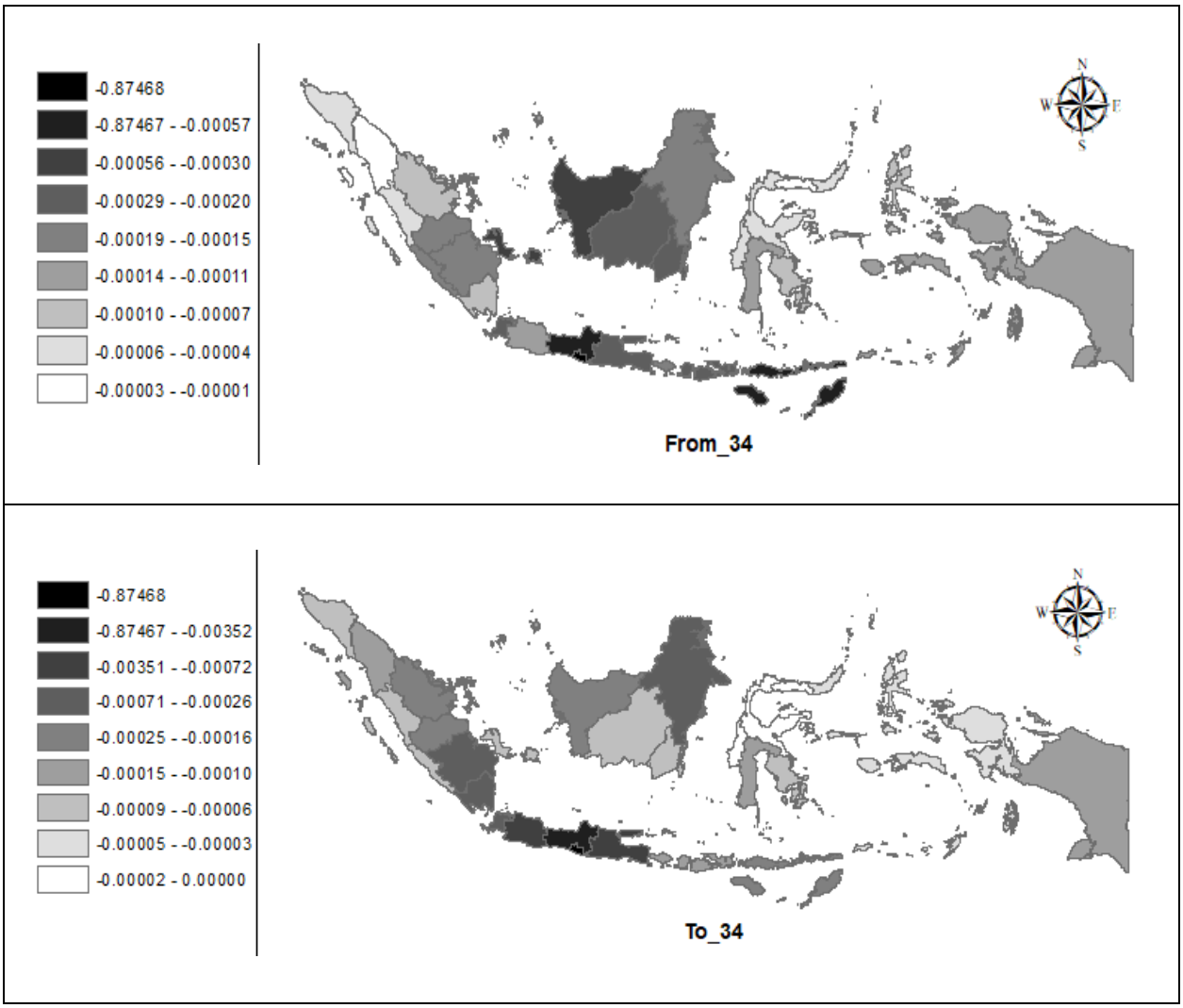


**Figure 2.** Effect of local poverty on its own financial inclusion and on other provinces (the case of DI Yogyakarta province)

Figure 2 shows the direct and indirect effects of the poverty variable on financial inclusion in the Daerah Istimewa Yogyakarta to other neighboring provinces. The interpretation of the direct effect is the effect of poverty in DI Yogyakarta on financial inclusion in DI Yogyakarta itself. This effect can be found in the "to 34" and "from 34" effect on provincial code 34 that has the same value. The "to 34" indirect effect is the effect of poverty in each neighboring province on their financial inclusion, and then the change in their financial inclusion index influences the financial inclusion in DI Yogyakarta. The "from 34" indirect effects is the effect of poverty in DI Yogyakarta on financial inclusion in DI Yogyakarta, and then the change in that financial inclusion influences the financial inclusion in each neighboring province. The results show that poverty in the western and central regions of Indonesia has more influence on financial inclusion in DI Yogyakarta, while poverty in the province of DI Yogyakarta has more influence on financial inclusion in the central and eastern provinces of Indonesia. These results are influenced by the spatial weighting used in the model that utilizes recent migration of population data between provinces.

**Table 5.** The poverty effect on financial inclusion index to and from DI Yogyakarta Province

| Provincial Code | Effect of Poverty | | Provincial Code | Effect of Poverty | |
|---|---|---|---|---|---|
| | To 34 | From 34 | | To 34 | From 34 |
| 11 | -0.00007 | -0.00006 | 52 | -0.00010 | -0.00023 |
| 12 | -0.00012 | -0.00002 | 53 | -0.00023 | -0.00062 |
| 13 | -0.00006 | -0.00005 | 61 | -0.00017 | -0.00037 |
| 14 | -0.00016 | -0.00007 | 62 | -0.00007 | -0.00021 |
| 15 | -0.00018 | -0.00015 | 63 | -0.00007 | -0.00023 |
| 16 | -0.00035 | -0.00018 | 64 | -0.00032 | -0.00016 |
| 17 | -0.00006 | -0.00018 | 71 | -0.00004 | -0.00005 |
| 18 | -0.00026 | -0.00009 | 72 | -0.00002 | -0.00005 |
| 19 | -0.00006 | -0.00030 | 73 | -0.00011 | -0.00012 |
| 21 | -0.00010 | -0.00011 | 74 | -0.00006 | -0.00009 |
| 31 | -0.00072 | -0.00016 | 75 | 0.00000 | -0.00001 |
| 32 | -0.00125 | -0.00014 | 76 | -0.00001 | -0.00004 |
| 33 | -0.00352 | -0.00057 | 81 | -0.00003 | -0.00013 |
| 34 | -0.87468 | -0.87468 | 82 | -0.00003 | -0.00008 |
| 35 | -0.00087 | -0.00020 | 91 | -0.00004 | -0.00014 |
| 36 | -0.00033 | -0.00020 | 94 | -0.00012 | -0.00012 |
| 51 | -0.00011 | -0.00018 | | | |

Note: Provincial Code as follow: 11 NAD, 12 Sumut, 13 Sumbar, 14 Riau, 15 Jambi, 16 Sumsel, 17 Bengkulu, 18 Lampung, 19 Kep Babel, 21 Kepri, 31 DKI Jakarta, 32 Jabar, 33 Jateng, 34 DIY, 35 Jatim, 36 Banten, 51 Bali, 52 NTB, 53 NTT, 61 Kalbar, 62 Kalteng, 63 Kalsel, 64 Kaltim, 71 Sulut, 72 Sulteng, 73 Sulsel, 74 Sultra, 75 Gorontalo, 76 Sulbar, 81 Maluku, 82 Malut, 91 Papbar, 92 Papua.

## Conclusion

We have built a regional financial inclusion index in Indonesia, where the average index value for regional financial inclusion in Indonesia is still low. Inequality in financial system levels of development clearly is significant, in particular between DKI Jakarta Province and almost all other provinces. This research also identifies variables deemed to be responsible for the financial inclusion development and assesses both their direct and indirect effects. Several variables that are commonly used by previous studies on financial inclusion in various countries such as the number of credit card users, the amount of digital money, the number of digital financial institutions, are not used due to lack of data, which are not available at the provincial level. We hope that in the future, these data will be accessible to the public for research and financial inclusion policy formulation.

Poverty is one of the main determinants as to why the financial system inclusion in various provinces is still low, with a negative effect. Changes in poverty rate in a province affect financial inclusion not only in that province but also indirectly in neighboring provinces. Taking the result for DI Yogyakarta province as an example, a decrease in poverty rate by 1 percent tends to increase the financial inclusion index in the same province by 0.8 percent, and in other provinces by much smaller magnitude. In addition, other determinants of financial inclusion with both direct and indirect effects include age, gross enrollment ratio in primary education, percentage of population with cell phone, income proxied by GDRP per capita, the ratio of gross fixed capital formation to GDRP at the current price, and total regional government spending. Future research can include indicators of digital financial services/fintech in the formulation of financial inclusion index, and the use of data from lower level territories (districts) within a province.

## References

Agustina, M. F., Wasono, R., & Darsyah, M. Y. (2015). Pemodelan Geographically Weighted Regression (GWR) pada tingkat kemiskinan di Provinsi Jawa Tengah. *Jurnal Statistika*, *3*(2), 67–74. Retrieved from https://jurnal.unimus.ac.id/index.php/statistik/article/view/1763/1806

Ang, J. B., & Kumar, S. (2014). Financial development and barriers to the cross-border diffusion of financial innovation. *Journal of Banking & Finance*, *39*(C), 43–56. https://doi.org/10.1016/j.jbankfin.2013.10.011

Anselin, L. (1988). *Spatial econometrics: Methods and models* (1st ed.). Berlin: Springer Netherlands. https://doi.org/0.1007/978-94-015-7799-1

Baltagi, B. H. (2005). *Econometric analysis of panel data* (3rd ed.). London, UK.: John Wiley & Son Ltd.

Bank of Indonesia. (2018). *2017 Bank Indonesia financial report*. Retrieved from https://www.bi.go.id/en/publikasi/laporan-tahunan/bi/Default.aspx

Bozkurt, I., Karakus, R., & Yildiz, M. (2018). Spatial determinant of financial inclusion over time. *Journal of International Development*, *30*(8), 1474–1504. https://doi.org/10.1002/jid.3376

Cámara, N., & Tuesta, D. (2017). Measuring financial inclusion: A multidimensional index. In *Bank of Morocco – CEMLA – IFC Satellite Seminar at the ISI World Statistics Congress on "Financial Inclusion."* Marrakech: Bank for International Settlements. Retrieved from https://www.bis.org/ifc/publ/ifcb47p.pdf

Chithra, N., & Selvam, M. (2013). *Determinants of financial inclusion: An empirical study on the interstate variations in India* (SSRN Working Paper Series No. 2296096). https://doi.org/10.2139/ssrn.2296096

Demirgüç-Kunt, A., & Klapper, L. (2013). *Measuring financial inclusion: Explaining variation in use of financial services across and within countries* (Brookings Papers on Economic Activity, Spring 2013). Retrieved from https://www.brookings.edu/wp-content/uploads/2016/07/2013a_klapper.pdf

Elhorst, J. P. (2010). Applied spatial econometrics: Raising the bar. *Spatial Economic Analysis*, *5*(1), 9–28. https://doi.org/10.1080/17421770903541772

Fungáčová, Z., & Weill, L. (2015). Understanding financial inclusion in China. *China Economic Review*, *34*(C), 196–206. https://doi.org/10.1016/j.chieco.2014.12.004

Honohan, P. (2008). Cross-country variation in household access to financial services. *Journal of Banking & Finance*, *32*(11), 2493–2500. https://doi.org/10.1016/j.jbankfin.2008.05.004

LeSage, J., & Pace, R. K. (2009). Introduction to spatial econometrics. In N. Balakrishnan & W. R. Schucany (Eds.), *Statistics: Textbooks and monographs*. Boca Raton, USA: CRC-Taylor & Francis Group, LLC.

Nayak, M. (2016). The impact of commercial bank's characteristics on micro, small, and medium enterprises in India. *Economic Journal of Emerging Markets*, *9*(1), 1–10. https://doi.org/10.20885/ejem.vol9.iss1.art1

Republic of Indonesia. Act of the Republic of Indonesia number 7 of 1992 concerning banking as amended by act number 10 of 1998 (1998). Retrieved from https://www.bi.go.id/en/tentang-bi/uu-bi/Documents/act_1098e.pdf

Sahoo, A. K., Pradhan, B. B., & Sahu, N. C. (2017). Determinants of financial inclusion in tribal

districts of Odisha: An empirical investigation. *Social Change*, *47*(1), 45–64. https://doi.org/10.1177/0049085716683072

Sanjaya, I. M., & Nursechafia, N. (2016). Financial inclusion and inclusive growth: A cross – province analysis in Indonesia. *Bulletin of Monetary Economics and Banking*, *18*(3), 281 – 306. https://doi.org/10.21098/bemp.v18i3.551

Sarma, M. (2008). *Index of financial inclusion* (Working Paper No. 215). Retrieved from https://www.icrier.org/pdf/Working_Paper_215.pdf

Sarma, M., & Pais, J. (2011). Financial inclusion and development. *Journal of International Development*, *23*(5), 613–628. https://doi.org/10.1002/jid.1698

Ummah, B. B. (2015). Analisis inklusi keuangan dan pemerataan pendapatan di Indonesia. *Jurnal Ekonomi Dan Kebijakan Pembangunan*, *4*(1), 1–27. https://doi.org/10.29244/jekp.4.1.1-27

Wang, X., & Guan, J. (2017). Financial inclusion: Measurement, spatial effect and influencing factors. *Applied Economics*, *49*(18), 1751–1762. https://doi.org/10.1080/00036846.2016.1226488

Wibowo, B., Anggraeni, L., & Rindayati, W. (2019). *Dampak spillover dan kebijakan fiskal terhadap pencapaian pertumbuhan inklusif antar provinsi di Indonesia*. IPB University. Retrieved from https://repository.ipb.ac.id/handle/123456789/97495

Zins, A., & Weill, L. (2016). The determinants of financial inclusion in Africa. *Review of Development Finance*, *12*(1), 45–57. https://doi.org/10.1016/j.rdf.2016.05.001