



## INDEX OF FINANCIAL INCLUSION AND THE DETERMINANTS: AN INVESTIGATION IN ASIA



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### ABSTRACT

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This study examines the factors that have impacts on financial inclusion level of Asian economies in the period 2008-2016. This study first measures the index of financial inclusion, which represents the inclusiveness level of financial system of each country. Using the dataset provided by World Bank regarding income, gender ratio, rural population, unemployment and infrastructure, this study explores the link between these variables and the index of financial inclusion. The estimation results reveal that financial inclusion is directly influenced by infrastructure, particularly cell phone subscriptions, while rural and unemployment ratio are the significant factors that decrease the inclusiveness level. These findings are expected to support the policy makers, the banks and other financial institutions in the progress of involving the whole communities in the formal financial systems. Improving infrastructure, reducing joblessness, and developing rural regions should be the effective acts to build up the future of financial inclusion for Asiatic economies.

**Contribution/ Originality:** This paper's primary contribution is finding that financial inclusion in Asian countries is significantly influenced by different social-related factors. The research results recommend that the enhancement in infrastructure, employment, and rural development should be effective to improve the inclusiveness of the financial system of an economy.

## 1. INTRODUCTION

The link between financial inclusion and development has been analysed and affirmed by a majority of researchers and worldwide organisations. The significant need of financial inclusion is recognised in every time period to meet the millennium development goals, especially during the time of global crisis 2007-2008, when financial inclusion is more important than at any other time in the history to recover the economy (Chibba, 2009). The Group of Twenty (G20) leaders evaluate it as one of the main pillars of the global development agenda (Park and Mercado, 2018). According to the *Consultative Group to Assist the Poor (CGAP)*, several of Sustainable Development Goals, which are set to achieve in 2030 by the United Nation, are demonstrated to be enabled by financial inclusion, including no poverty; no hunger; good health and well-being; gender equality; clean water; clean energy; and reduced inequalities (CGAP, 2016). Annually, global economic organisations such as Organisation for Economic Co-operation and Development (OECD), International Monetary Fund (IMF), World Bank, and Asian Development Bank (ADB) host various international conferences regarding financial inclusion to evaluate the financial system of different regions and countries around the world. These organisations along with national

bodies are running innovation projects to enhance financial inclusion, especially targeting at low-income and developing economies, for example, Africa, Pacific regions, Latin America, and Asia. In each country, being the most important financial institution, the bank sector should take the lead role in improving financial inclusion (Sarma and Pais, 2011). Dev (2006) suggests the banks to view financial inclusion as not only a business opportunity, but a social responsibility, therefore, to a certain extent and in some circumstances, the banks have to think about sacrificing part of their profit for the involvement of people in the financial system.

The determinants of financial inclusion have questioned the researchers and organisations for years. Identifying the factors that directly or inversely affect financial inclusion is momentous to the experts and the governments, who use the outcomes of this research area as reference to strengthen or diminish the relevant agents in the progress of promoting financial inclusion. Previous studies have demonstrated the positive impacts of different factors on financial inclusion, such as income (Sarma and Pais, 2011; Chinthra and Selvam, 2013) population density (Allen *et al.*, 2014; Chikalipah, 2017) education (Arora, 2012; Chinthra and Selvam, 2013; Chikalipah, 2017) infrastructure (Sarma and Pais, 2011; Evans and Adeoye, 2016; Chikalipah, 2017) customer awareness (Laha *et al.*, 2011) trust (Wambua and Datche, 2013). On the other side, financial inclusion is held back by regulatory constraint (Rojas-Suarez, 2010) poverty rate (Park and Mercado, 2015) rural population (Chikalipah, 2017) and unemployment (Atkinson and Messy, 2013).

Extensive research have been conducted to exploit the area of financial inclusion, most of which emphasise the condition in a specific developing economy, for example, China (Demirgüç-Kunt and Klapper, 2013; Fungáčová and Weill, 2015; Fan and Zhang, 2017) India (Gupte *et al.*, 2012; Chakravarty and Pal, 2013; Kumar, 2013; Sarma, 2016) Ghana (Akudugu, 2013; Dzokoto and Appiah, 2014) Indonesia (Wibowo, 2013; Tambunan, 2015) Nigeria (Mbutor and Uba, 2013; Adeola and Evans, 2017) Peru (Reyes *et al.*, 2010; Izquierdo and Tuesta, 2015). Fewer research are implemented in a region, such as Asia (Arora, 2012; Park and Mercado, 2015) Sub-Saharan Africa (Demirgüç-Kunt and Klapper, 2013; Chikalipah, 2017) Latin America and the Caribbean (Rojas-Suarez and Amado, 2014; Mehrotra and Yetman, 2015). Park and Mercado (2018) confirm the influence of income, rule of law, and demographic factors such as age dependency and education, on financial inclusion in Asia. They also find the significant correlation between financial inclusion and poverty rates in this region. In the earlier study in the same continent, Arora (2012) argues that financial development is related negatively to student-to-teacher ratio, and directly to the years of schooling. Questionnaire is the most preferable method to collect data, for the responds can be extensive, detailed, and comparable. Other research apply the Global Findex database to examine the research questions in a larger extent regarding time and space. In this spirit, this study aims to contribute to the relevant literature of financial inclusion, concentrate on Asian countries with an updated dataset to strengthen the understanding of this social subject in the region of emerging economies.

This paper employs panel data of 36 Asian countries over the period 2008-2016, which is collected from World Bank database. Asia is the region with significant differentiation in development among the economies, while there also remain the clear gaps among walks of life and the geographic areas within each country. Therefore, this study expects to deepen knowledge of the financial inclusion divergence in this continent. This study applies the method recommended by Sarma (2012) to compute the index of financial inclusion of each country, then examines whether this index is affected by a number of social factors.

This study begins with the overview of the roles of financial inclusion in global development. The next section reviews the diverse of financial inclusion definition and its components, various typical approaches to measure the degree of financial inclusion, and the representative factors that have impact on this index, based on which, the hypotheses are introduced. Section 3 describes the methodology, sample and data to test the hypotheses, followed by section 4 which interprets the findings. Finally, the conclusion and recommendations are given in section 5.

## 2. LITERATURE REVIEW

### 2.1. Financial Inclusion – Definition and Dimensions

The definition of financial inclusion has been contributed by various global organisations and researchers, and built up over time. The initial conceptions mainly focus on the access to (or availability of) financial system. [Leyshon and Thrift \(1995\)](#) – one of the early studies of financial inclusion – do not clearly define this phenomenon. Instead, they exploit the opposite term, “financial exclusion”, which is the “processes that serve to prevent certain social groups and individuals from gaining access to the financial system.” This is akin to the view of [Sinclair \(2001\)](#) that financial exclusion is “the inability to access necessary financial services in an appropriate form.” This term first emerged in 1993, when British geographers raised their concern about bank branch closures that caused limited access to banking services ([Nair and Tankha, 2015](#)). Thus, *access* to financial system is the very first dimension to evaluate the degree of financial inclusion (or exclusion) of an economy. [Pollin and Riva \(2002\)](#) describe financial exclusion as a “gradual process of having one's financial ties cut off” and argue that financial exclusion assessment can base on a number of indicators, such as access to a current account, access to basic banking services, and access to other financial products. [Midgley \(2005\)](#) suggests that financial inclusion would be increased by targeting at “the continued development and wider availability of basic bank accounts offered by mainstream financial institutions.” In later viewpoints, other dimensions are added up to form a more comprehensive perspective, but access is always emphasised as the prerequisite to an inclusive financial system.

To a certain extent, financial inclusion is mistaken with financial access ([Pham and Bui, 2019](#)). Nevertheless, several users are able to access financial products and services but they are not interested in or find no benefit from them. In recent studies, the concept of financial inclusion has expanded. Access to finance is no longer the only concern while other dimensions have been taken into account with considerable magnitude. The research of [Sarma \(2008\)](#) involves *usage* in the perception, which implies how and to what extent people take advantage of financial services and products. [Sarma \(2008\)](#) specifies this dimension using the volume of credit and deposit as proportion GDP. Borrowings and loans are also considered to represent the degree of usage in the research of [Park and Mercado \(2018\)](#), [Alliance for Financial Inclusion \(2016\)](#), [Camara and Tuesta \(2014\)](#), [Amidžić et al. \(2014\)](#), [Nair and Tankha \(2015\)](#), [Chakravarty and Pal \(2010\)](#). Usage consists of the participation of both individuals and enterprises in financial system, which is affirmed in the definition of United Nations Capital Development Fund and by G20 through the announcement of G20 Financial Inclusion Indicators (Global Partnership for Financial Inclusion, 2013).

However, access and usage by themselves are not sufficient to ensure an inclusive system without the condition of other factors. [Camara and Tuesta \(2014\)](#) claim that the usage of financial services is affected by several socio-economic determinants such as Gross Domestic Product (GDP), legal framework, cultural habits, and standards of living. Similarly, the access to finance (for example, the number of ATMs and bank branches) in high degree cannot guarantee an inclusive financial system if the location and distribution of these points of services are not mentioned. Hence, as can be observed from most of the definitions of financial inclusion, the third dimension – *quality* of the products and services delivered – always takes the role to boost and enable the access and usage. [GPI \(2013\)](#) lists a wide range of indicators to implicate the quality dimension, such as financial literacy and capability, market conduct and consumer protection, and credit barriers. Barrier is used in the research of [Camara and Tuesta \(2014\)](#) as the obstacle that prevents individuals from using financial system, such as the location and distribution of ATMs and bank branches, lack of document, lack of trust from financial institutes, and affordability. A low level of barrier implies a great inclusiveness of financial system. In the definition of Centre for Financial Inclusion at Accion about financial inclusion, quality links to services at “affordable prices with convenience, respect, and dignity, delivered by a range of providers in a stable, competitive market to financially capable clients”. [World Bank \(2018\)](#) postulates that financial products and services should be affordable, and provided responsibly and sustainably to the users. [Arora \(2010\)](#) takes into account the transaction cost and time to process application. Financial literacy is also a

significant indicator of quality as it reflects the understanding of people about finance and influences on whether an individual is willing and able to take financial decisions that are beneficial to them (Nair and Tankha, 2015). OECD establishes a score system to measure this indicator, which is called “financial literacy score” and obtained as the sum of the three component scores: financial knowledge, financial behaviour, and financial attitudes. These scores are collected and computed through surveys with a number of questions to examine how respondents understand, think, and act in basic financial situations (OECD, 2016). Furthermore, a new perspective regarding quality getting significant concern recently is environmental sustainability in finance. The embracement of green development is believed to avoid harm to environment when performing financial activities, and it takes time for a globally extensive growth (Islam, 2015).

## 2.2. Measurement of Financial Inclusion

There does not exist a consistent method to measure or to evaluate the achievement in financial inclusion of a country or an economy. Numerous studies have been conducted trying to define an appropriate measurement in order to assess comprehensively the extent of how inclusive a financial system is. Such measurement is called Index of Financial Inclusion (IFI), which is first proposed by Sarma (2008). As financial inclusion is contributed from different dimensions, IFI is also a composite index. This vanguard study has been responded extensively with a variety of mathematic approaches to compute IFI recommended by different researchers, including the participation of ADB. Not only the approaches, but the indicators selected to constitute IFI also vary. A common method, however, has not been attained. In this part of section 2, the author is going to briefly introduce a number of typical measurements that have been currently implemented.

The measurement by Sarma (2008) is one of the most popular-used by later research. According to this study, there are three dimensions composing IFI of a country: *access*, *available*, and *usage*. Each dimension is represented by various indicators. The author applies a multidimensional approach to measure IFI, which is analogous to the method of United Nations Development Programme (UNDP) in calculating development indices such as the HDI, the HPI, and the GDI. The approach of Sarma (2008) is separated into two steps. The first is to compute the level of each indicator, which is called “dimensional sub-index”. The second step is to aggregate these indices using normalised inverse of Euclidean distance formula. This is the distance from IFI point to the ideal point (where all indicators are the maximum) in a multidimensional space. In this study, Sarma (2008) does not consider different weights for each indicator. However, in her later research in 2012 and 2016, those indicators are supposed to be unequally important to financial inclusion. Weights are attached to the indicators and therefore make a slight change to the formulas. As stated in the research, the dimension of access is weighted 1; availability is 0.5, and 0.5 for usage. This use of weight is then criticised for bias, as it originates from author’s judgement, not a mathematical method.

The research conducted by Amidžić *et al.* (2014) proposes a five-step process of common Factor Analysis (FA) to determine IFI, which is combined by two dimensions: the *outreach* and the *use* of financial services. First, the authors select the indicators (or “variables”) and normalise them to eliminate the effect of scales. There are four indicators used in this research: the number of ATMs/1,000 km<sup>2</sup>, the number of branches of depository corporations (ODCs)/1,000 km<sup>2</sup>, the number of household depositors with ODCs/1,000 adults, and the number of household borrowers with ODCs/1,000 adults. Second, they use FA to group these indicators into appropriate dimensions, making sure the theoretical classification is statistically confirmed. The third step is to assign proper weights to each indicator as well as each dimension, which emphasises the different importance among the indicators and between two dimensions. Weights are derived from FA model in the previous stage. Then, the authors construct the formula to compute the two dimensions, and the fifth step finalises the form of the aggregator to compute the IFI using weighted geometric mean rather than arithmetic average.

A different technique is introduced by Camara and Tuesta (2014) adopting Principal Component Analysis (PCA) to form IFI. The authors start with the estimation of three unobserved dimensions (they call them “sub-indices”) – *usage*, *access*, and *barriers*. Every of these dimensions consists of a number of indicators, whose roles are explainable variables in the equations to estimate the three dimensions. Then, also through an equation, these dimensions are used as causal variables to estimate overall IFI. In both stages, the authors apply PCA to estimate dependent variables (dimensions and IFI in the first and second stage, respectively). Weight (or parameter) assigned to each indicator and dimension is inferred from available data using PCA, thus, excludes subjectivity arising from the authors’ judgement.

Table-1. Indicators constituting IFI in previous research.

Studies	Indicators
Sarma (2008)	<ul style="list-style-type: none"> <li>- Bank accounts (% of the total population);</li> <li>- Number of bank branches/1,000 people;</li> <li>- The volume of credit and deposit (% of GDP).</li> </ul>
Chakravarty and Pal (2010)	<ul style="list-style-type: none"> <li>- Number of bank branches/1,000 km<sup>2</sup>;</li> <li>- Number of bank branches/100,000 people;</li> <li>- Number of bank ATMs/1,000 km<sup>2</sup>;</li> <li>- Number of bank ATMs/100,000 people;</li> <li>- Number of loans/1,000 people;</li> <li>- Average size of loans to GDP per capita;</li> <li>- Number of deposits/1,000 people;</li> <li>- Average size of deposits to GDP per capita.</li> </ul>
Sarma (2012)	<ul style="list-style-type: none"> <li>- Deposit accounts/1,000 adults;</li> <li>- Number of (deposit) bank branches and ATMs/100,000 adults;</li> <li>- The total deposit and credit from deposit banks (% of GDP).</li> </ul>
Amidžic <i>et al.</i> (2014)	<ul style="list-style-type: none"> <li>- Number of ATMs/1,000 km<sup>2</sup>;</li> <li>- Number of branches of ODCs/1,000 km<sup>2</sup>;</li> <li>- Number of household depositors with ODCs/1,000 adults;</li> <li>- Number of household borrowers with ODCs/1,000 adults.</li> </ul>
Camara and Tuesta (2014)	<ul style="list-style-type: none"> <li>- Number of people using at least one formal financial service;</li> <li>- Distance, lack of the necessary documentation, affordability and lack of trust;</li> <li>- Number of ATMs/100,000 adults;</li> <li>- Number of commercial bank branches/100,000 adults;</li> <li>- Number of ATMs/1,000 km<sup>2</sup>;</li> <li>- Number of commercial bank branches/1,000 km<sup>2</sup>.</li> </ul>
Park and Mercado (2015)	<ul style="list-style-type: none"> <li>- Number of ATMs/100,000 adults;</li> <li>- Number of commercial bank branches/100,000 adults;</li> <li>- Borrowers from commercial banks/1,000 adults;</li> <li>- Depositors with commercial banks/1,000 adults;</li> <li>- Domestic credit-to-GDP ratio.</li> </ul>
Sarma (2016)	<ul style="list-style-type: none"> <li>- Deposit accounts/1,000 adults from commercial banks, credit unions, cooperative banks, microfinance institutions;</li> <li>- Number of registered “mobile money accounts”/1,000 adults;</li> <li>- Number of bank branches, registered mobile money service providers, and ATMs/100,000 adults;</li> <li>- Volume of credit to the private sector;</li> <li>- Deposits mobilized from the private sector (% of GDP).</li> </ul>
Park and Mercado (2018)	<ul style="list-style-type: none"> <li>- % of the adult population with financial accounts to total population;</li> <li>- % of the adult population with credit and debit cards;</li> <li>- Number of commercial bank branches/100,000 adults;</li> <li>- Number of ATMs/100,000 adults;</li> <li>- The share of the adult population who borrowed and saved from a financial institution;</li> <li>- The domestic credit-to-GDP ratio.</li> </ul>

AFI (2016) replicates the methodology which was used by UNDP. Similar to the first step of Sarma (2012), AFI sets the weight for each indicator to calculate the dimension indices, but simply takes the non-weighted average of the indices for final IFI. Two dimensions used in this study is *access* and *usage*, and the level of financial inclusion is determined through the four rankings of IFI ( $0.75 < IFI \leq 1$ : high;  $0.5 \leq IFI < 0.75$ : above average;  $0.25 \leq IFI < 0.5$ : moderate;  $0 \leq IFI < 0.25$ : low). AFI notices that the index should only be used for diagnosis rather than for county ranking, unless there is an agreement among policy makers on a common set of indicators and dimensions.

In their research, Park and Mercado (2018) combine the methods that had been recommended by Sarma (2008) and Camara and Tuesta (2014). In the first stage, the authors replicate the formula of Sarma (2008) to compute the achievement level of each indicator. Like Sarma (2008), they group the indicators into three dimensions: *access*, *available*, and *usage*, and expand to more indicators. However, in the second stage, they follow the two-step PCA approach by Camara and Tuesta (2014) to synthesise the three dimensions from indicators, and estimate IFI from these dimensions. Table 1 briefly summarises the indicators of IFI used in a number of previous research.

### 2.3. Determinants of Financial Inclusion

Although a variety of factors can be mentioned to have impact on financial inclusion, five significant determinants are selected to discuss in this paper, including income, gender, rural population, unemployment, and infrastructure.

#### 2.3.1. Income

A vast majority of studies have asserted the positive relationship between income and financial inclusion or a few dimensions of it. Allen *et al.* (2012) conduct a survey among 123 countries and over 124,000 people to investigate the extent of their financial usage. The results show a significant distance between high-income and developing economies in term of account ownership and account usage frequency. Averagely, 91 percent of adults in high-income countries have account at a formal financial institution and 72 percent use their accounts regularly, while the proportions in developing countries are 41 percent and 22 percent, respectively. A survey by World Bank in 2013 reports that 81 percent of respondents blamed “lack of fund” for stopping them from opening account at a financial institution. Demirgüç-Kunt and Klapper (2013) find in China that an individual with low income tends not to own a bank account if another family member already does. According to the Global Findex data of World Bank, in 2017, about 1.7 billion adults stay unbanked, and almost all these unbanked people are residents of developing countries. Besides, in economies where only 20-30 percent of adults are unbanked, most of them are likely to be poor.

There are numerous reasons to explain this fact, one can be mentioned is the mode of salary payment of the enterprises. Employees with low or infrequent salary usually get paid by cash. Payment through bank account is more popular in medium or large companies rather than the small ones. There is also the fact that employees have propensity to withdraw the whole salaries or wages they are paid via bank accounts if the amount of income is inconsiderable. The investigation of Allen *et al.* (2012) reveals evidence that people who withdraw cash merely once or twice a month use bank accounts only for salary payment or allowance from government and families. In contrast, people who have habit to withdraw at least three times a month tend to use bank accounts for savings or electronic payments.

Owning bank accounts takes considerable amount of service charges, for example, registration fee, withdrawal fee, transaction fee, maintenance fee, overdraft charges. These charges make it costly in most of the transactions with the banks, especially for the poor. The annual service charges in Sub-Sahara African banks make up almost a fifth of the country's Gross National Income (GNI) per capita (Chikalipah, 2017) and some commercial banks in this region have their service charges contribute up to 25 percent of annual revenue (Beck and Munzele, 2012). Also in

these countries, account owners are always required to maintain their minimum balances, and these balances may account for 50 percent of GNI per capita (Fosu, 2013). The high service charges somewhat reveal the limitation in competition among the banks, as a bank with low charges would surely attract more customers (Allen *et al.*, 2012). One other reason pointing out the relationship between income and financial usage is that low-income people do not have plenty of cashless transactions that require bank accounts, such as online shopping or buying flight ticket. Today, the expansion of e-commerce goes along with the growth of cashless mode of payment, However, it is evident that this kind of payment is still far from familiarity to the poor in community.

Income has a huge impact on borrowing decision. Individuals with limited income may lean toward informal financial market, such as money lenders, savings clubs, families and friends, and even “black credit”, as they are not required to submit complex documentation, demonstrate their ability to pay back, have collateral as well as wait for a long period of time that takes several steps until their loan demands are approved.

Empirical research acknowledge that providing financial services to the poor are more costly than to the high-income customers (Moore and Craigwell, 2003; Bag, 2013; Natamba *et al.*, 2013). Thus, in many countries, bank branches usually gather in urban areas or crowded cities. The bank services are also more convenient for high-income customers rather than for the poor (Beck and Munzele, 2012). To maintain bank branches and points of services in rural, mountainous, and remote areas, sometimes the banks have to spend more than how much they earn, for the quantity of customers and transactions is narrow and the operation is more difficult compared to the urban ones (Beck and Munzele, 2012; Brown *et al.*, cited in (Chikalipah, 2017).

In summary, research has contended the positive association between income and financial inclusion in different parts of the world, for example, China (Fungáčová and Weill, 2015) Argentina (Tuesta *et al.*, 2015) India (Chinthra and Selvam, 2013) Peru (Izquierdo and Tuesta, 2015). This study is re-examining that association for the whole Asia. The hypothesis is stated as follows:

*Hypothesis 1: Income is positively associated with financial inclusion.*

### 2.3.2. Gender

56 percent of unbanked adults are women (World Bank, 2017). In the survey of Allen *et al.* (2012) among the developing economies, 46 percent of men are reported to have a formal account, while the percentage of women is 37 percent. This is supported by the study of Fungáčová and Weill (2015) in China, which evidences the fact that women are less likely to have account or to make a loan at a formal financial institution in comparison with the opposite gender. The reasons cited by most of the respondents are “lack of documentation”, or other family members already have a loan. This is understandable in the circumstance of China and strengthens the viewpoint about the prominent role of men in Chinese families.

Demirguc-Kunt *et al.* (2013) in the Research and Development group of World Bank, carry out an investigation over 98 developing countries to explore gender inequality in finance. The research finds significant gaps in account ownership, usage of savings and credit products between male and female. In many of researched countries, women have no owner-occupancy to their house or land, and this is a disadvantage for them to make a loan at a financial institution, as they are unable to submit proof of ownership when being asked for collateral. Numerous procedures and customs prevent women from approaching financial activities such as to sign contracts using their own names, to control properties, to get properties divided fairly at divorce. In Pakistan, a married woman need her husband's agreement to borrow from the banks, and single women are usually refused a loan (Safavian and Haq, 2013). In many countries in Middle East and Southern Asia, women are required to get signature of their husband or a male family member to get personal loan (Chamlou *et al.*, 2008; Safavian and Haq, 2013) or even a bank transaction. The adverse credit history of the husband can have great impact on the wife, and can cause her credit denial (Blanchard *et al.*, 2005). Moreover, the communication constraint on women in these countries is also a barrier for them to access financial services (Ahmad and Muhammad Arif, 2015). Demirguc-Kunt *et al.* (2013) also point out the gender

difference regarding savings behaviour. In most regions except South East Asia Pacific, Central Asia and Europe, men are more likely to save money in their accounts at a bank, credit union, or a microfinance institution, while women lean to informal ways.

For the gender disparity in finance manifested in various regions, a hypothesis is constructed as follows:

*Hypothesis 2: Female ratio of a country is inversely related with financial inclusion.*

### 2.3.3. Rural Population

Unlike Western countries, where there is no big urban-rural gap in term of literacy, public services, or infrastructure, rural residents in developing countries find their living more disadvantageous. Some remote regions do not even have adequate electricity outreach. The low population density in the countryside may hold back the financial institutions from spreading branches, outlets, ATMs in these areas, for the earnings from these points of services may not exceed fixed costs of operation. Thus, providing financial services to sparsely populated areas is less profitable than the urban ones, even results in a loss (Chikalipah, 2017). The requirement of documentation to borrow from the banks is also a barrier for rural residents (Demirgüç-Kunt and Klapper, 2013). It is understandable that the bank branches are densely located in the cities or crowded provinces with the high demand of financial usage. However, Johnson and Nino-Zarazua (2011) investigating in Uganda, argue that rurality has no link with financial inclusion. The hypothesis is following suggested.

*Hypothesis 3: Rural population ratio is negatively related to financial inclusion.*

### 2.3.4. Unemployment

Unemployed people face challenges in various aspects of lives, and finance is not an exception. The survey of Allen *et al.* (2012) in 123 countries reveals the fact that unemployed people are 14 percent less likely to have savings account than individuals who have jobs. This result supports the statement of Atkinson and Messy (2013) that unemployment circumstance makes people unable or unwilling to use financial products or services. It is perceivable because unemployed individuals have no proof of income to submit to the banks when they needs borrowings or open credit accounts. Sarma and Pais (2011) point out the payment of salaries to be a determinant of financial inclusion. Today, bank transfer is the predominant mode of payment for payroll and retirement pension, so a person without a job may not use bank account frequently or does not even have one. The fourth hypothesis is:

*Hypothesis 4: Unemployment is negatively associated to financial inclusion.*

### 2.3.5. Infrastructure

Infrastructure consists of road system, buildings, electricity, telephone and television network, software, multimedia such as newspapers, radio, computer and internet, which are the basic physical facilities to promote, organise and implement financial activities. Infrastructure is a vital factor in supporting both supply side and demand side in financial system. For example, multimedia are the means to convey financial products and services to users, enable easy access to finance regardless the distance, as well as raise awareness of potential customers about participating in financial system. Telephone and internet help reduce the cost of transaction. Expansive road network can encourage people to go to the banks and points of service. Previous studies have attested the direct correlation between infrastructure and economic growth, which certainly relates to the development of finance. For instance, the poor infrastructure of Africa is significantly associated to the gloomy state of finance in this region (Kessides, 2012; Evans and Adeoye, 2016; Chikalipah, 2017). Proper infrastructure is therefore contributes substantially to the process of including more participants to finance activities. The final hypothesis is following.

*Hypothesis 5: Infrastructure development is positively related to financial inclusion.*

### 3. METHODOLOGY

#### 3.1. Modelling

##### 3.1.1. Measurement of Financial Inclusion

This paper applies the method recommended by Sarma (2012) and Sarma (2016) to calculate IFI. However, to avoid the subjectivity when allocate the appropriate weights, the author considers the equal importance for all indicators as well as dimensions involved in the IFI. Equation 1 illustrates the calculation of the sub-index of each indicator.

$$d_i = \frac{A_i - m_i}{M_i - m_i} \quad (1)$$

Where:

$d_i$ : the achievement level of indicator  $i$  of a country among the sample.

$A_i$ : the actual value of indicator  $i$  of a country.

$M_i$ : the maximum value of indicator  $i$  among the countries in the sample (equal to the maximum  $A_i$ ).

$m_i$ : the minimum value of indicator  $i$  among the countries in the sample (equal to the minimum  $A_i$ ).

So which indicators are included in the IFI measurement? In this study, the numbers of ATMs and bank branches are selected to represent access dimension, while credit and deposit amount indicate usage dimension. These indicators are involved in this measurement because of their data's accessibility. Data of the third dimension – quality – is unavailable to be fully collected for the whole sample. The indicators of IFI employed in this paper are summarised in Table 2.

Table-2. Description of indicators constructing IFI.

Indicator	IFI dimension	Measurement
ATM	Access	Number of ATMs per 100,000 adults
Bank	Access	Number of bank branches per 100,000 adults
Credit	Usage	Domestic credit provided by financial sector (% of GDP)
Deposit	Usage	- Number of depositors with commercial banks per 1,000 adults - Deposit in financial sector (% of GDP)

The value of  $d_i$  implicates the achievement level of a country's indicator  $i$ . There are five factors contributing to IFI measurement in this study, so a country's IFI is illustrated by a point  $X = (d_1, d_2, d_3, d_4, d_5)$  in the five-dimension space. The origin of this five dimensional coordinate system is the point  $O = (0,0,0,0,0)$ , which represents the worst position, while the point  $I = (1,1,1,1,1)$  represents the ideal situation if a country performs the best among the sample in all dimensions.

According to Sarma (2012) the value of IFI of a country is estimated by measuring not only the distance between  $X$  and  $O$ , but also the distance between  $X$  and  $I$ . An  $X$  representing high IFI is supposed to be situated a large distance from  $O$  and a small distance from  $I$ . However, in such a space of more than two dimensions, if two points have the same distance from  $O$ , the point with smaller distance from  $I$  has higher IFI. Similarly, if two points have the same distance from  $I$ , the point with larger distance from  $O$  has higher IFI. Therefore, in order to involve both distances to consider the level of IFI, this study follows the previous research of Sarma (2012) to use simple average of the Euclidean distance between  $X$  and  $O$  and the inverse Euclidean distance between  $X$  and  $I$ .

First, we calculate the distance between X and O (denoted  $X_1$ ) using normalised Euclidean distance formula as presented in Equation 2. The normalisation is taken to make the value of  $X_1$  lie between 0 and 1. High value of  $X_1$  means that X is located far from O, which represents a high level of IFI.

$$X_1 = \frac{\sqrt{d_1^2 + d_2^2 + \dots + d_n^2}}{\sqrt{n}} \quad (2)$$

Second, the inverse distance between X and I (denoted  $X_2$ ) is calculated using the inverse normalised Euclidean distance formula. The subtrahend in Equation 3 is the normalised Euclidean distance from X to I. This subtrahend should be small to implicate a high level of IFI. However, it would be complex to consider a large  $X_1$  and a small  $X_2$  to compare the IFI among the countries. Therefore, the normalised Euclidean distance between X and I is subtracted from 1, which is called “inverse distance”. This makes the next step simpler. The larger  $X_2$  is, the higher IFI is inferred.

$$X_2 = 1 - \frac{\sqrt{(1-d_1)^2 + (1-d_2)^2 + \dots + (1-d_n)^2}}{\sqrt{n}} \quad (3)$$

Finally, we compute IFI by taking the simple average of  $X_1$  and  $X_2$ , which is shown in Equation 4. This calculation indicates that both X-O distance and X-I distance are taken into account to consider the extent of financial inclusion of a country.

$$IFI = \frac{1}{2}(X_1 + X_2) \quad (4)$$

### 3.1.2. Research Model

In this study, regression analysis for panel data is developed to investigate the determinants of financial inclusion. The model is constructed as follows:

$$IFI_{it} = \alpha + \beta_1 FE_{it} + \beta_2 GDP_{it} + \beta_3 Rural_{it} + \beta_4 Unemployment_{it} + \beta_5 Mobile_{it} + \varepsilon_{it}$$

According to the hypotheses, independent variables include five indicators of social development, which are female ratio, GDP per capita (represent income), rural population ratio, unemployment ratio, and the use of cell phone (represent infrastructure). These variables are examined whether they have impacts on IFI, which represents the level of financial inclusion in each country. All variables in the model are described in Table 3 as follows.

Table-3. Variable definition.

Variable	Description	Measurement
<i>Dependent variable</i>		
IFI	Index of financial inclusion	Referred to section 3.2.1.
<i>Independent variable</i>		
FE	Female ratio	Female (% of total population)
GDP	Gross Domestic Product per capita	Log of GDP per capita
Rural	Rural population ratio	Rural population (% of total population)
Unemployment	Unemployment ratio	Unemployment (% of total labor force)
Mobile	The use of mobile phone	Mobile cellular subscriptions (per 1,000 people)

### 3.2. Data Description

The study is implemented among Asian countries over the time period from 2008 to 2016. After removing the countries with incomplete data, the final sample is obtained comprising 36 countries in Asia. The data of dependent and independent variables are collected from World Bank Open Database, which provides annual data of indicators related to economic and global development.

#### 4. RESULTS AND DISCUSSION

The results expose a huge disparity among the examined countries in the value of all variables Table 4. Japan shows the greatest IFI, which is remarkably higher than the average value and over sixty five times as high as the lowest country (Afghanistan). Afghanistan also makes up the smallest female ratio and GDP per capita in the sample. The largest figures of these variables belong to Kuwait and Qatar, respectively. Rural population does not exist in Singapore and Kuwait, but predominates in Nepal. Armenia reports an enormous unemployment rate in comparison to the mean value. In this country, nineteen out of one hundred people in labour ages are unoccupied, while the rate in Qatar is almost zero. The number of mobile phone illustrates an even more tremendous distance among the countries. The largest number is found in the United Arab Emirates (UAE), which is more than 214 cell phone subscriptions per 1,000 people. In the opposite circumstance, the corresponding proportion is under 1. These observations imply that the development levels in Asia are apparently uneven among the economies.

Table-4. Descriptive statistics.

Variable	Mean	Standard deviation	Min	Max
IFI	0.19290	0.14070	0.01287 ( <i>Afghanistan</i> )	0.72442 ( <i>Japan</i> )
Female ratio	65.59372	5.49033	49.54597 ( <i>Afghanistan</i> )	74.27992 ( <i>Kuwait</i> )
Log (GDP per capita)	8.56575	1.43880	5.91454 ( <i>Afghanistan</i> )	11.39149 ( <i>Qatar</i> )
Rural rate	0.42671	0.25927	0 ( <i>Singapore, Kuwait</i> )	0.83895 ( <i>Nepal</i> )
Unemployment rate	5.54707	4.25785	0.14 ( <i>Qatar</i> )	19.01 ( <i>Armenia</i> )
Mobile phone /1,000 people	103.6686	41.25866	0.74250 ( <i>Myanmar</i> )	214.7349 ( <i>UAE</i> )

Table 5 summarises the regression output of the selected determinants of IFI in 36 Asian countries through 2008 to 2016. As observed from the results, two variables show significant effect on IFI at the significance level of 0.05, which are rural population ratio and unemployment ratio. Mobile subscription ratio is significantly associated with IFI at 0.1 significance level.

Table-5. Panel data regression.

IFI	Coefficient	Standard error	z	P>  z
FE	-.0009065	.0012301	-0.74	0.461
GDP	-.0029959	.0066359	□0.45	0.652
Rural	-.2700721	.0680495	-3.97	0.000
Unemployment	-.0027999	.0012975	-2.16	0.031
Mobile	.0000969	.0000571	1.70	0.090
_cons	.3923613	.1074778	3.65	0.000

Rural ratio illustrates a negative impact on financial inclusion, 1 percent increase of rural ratio would decrease IFI by 0.27 percent, ceteris paribus. This is in line with the analysis of Chikalipah (2017), Demirgüç-Kunt and Klapper (2013), Johnson and Arnold (2012). Dev (2006) also notices that rural residents, especially poor farmers and vulnerable individuals, find borrowing from formal financial sources very challenging.

Unemployment ratio is also negatively linked to IFI, but the effect is pretty small (-.0027999). This is similar to what were supported by previous researchers that unemployed people have less chance to participate in financial activities, such as making a loan, using bank account or credit card. The small coefficient, however, suggests that the impact of unemployment is rather limited.

The rate of mobile subscription shows a significantly positive relationship with IFI with a modest effect (0.0000969). This finding is consistent with the research of Chinthra and Selvam (2013), and Sarma and Pais (2011). Therefore, it is confirmed that cell phone plays an important role in enhancing financial inclusion. This device

allows customers to access the points of services in the most convenient way, as well as promptly delivers updated information about financial services, which encourages customers' usage.

The proportion of female shows the negative sign, which is expected, but GDP per capita implicates a surprisingly inverse effect on financial inclusion. Both these variables are not significantly related to IFI.

## 5. CONCLUSIONS AND RECOMMENDATIONS

Obtaining the data from World Bank, this study aims to understand the determinants of financial inclusion in Asian economies for the period 2008-2016. The results affirm the significant influence of a few factors to IFI. Particularly, rural population and unemployment have inverse effect on financial inclusion, while the popular use of mobile phone can boost the access and usage of people to financial system. These findings can be considered as reference for the government and finance suppliers in constructing an inclusive financial system. Rural residents should have more opportunities to participate in financial activities by having more developed infrastructure reached them, simpler procedures and reasonable prices to use financial services. Unemployment is a drawback that needs to be improved for the growth of not only financial system but also other aspects of society. Jobless people should be encouraged and supported to find jobs as well as make a loan to start their own business. The current spread of mobile phone is an advantage to financial inclusion and the suppliers should use up the functions of this device to deliver more information and services to their customers and the potential ones. It is required to combine the effort of different agents, such as policy makers, state banks, commercial banks, financial organisations, enterprises and individuals, to contribute to a society of inclusive finance. The matters of time and cost are also taken into account.

The extent of this paper is still limited for the lack of data, especially the quality indicators, which is expected to be improved in future research. The IFI calculation is also debatable and more analysis should be carried out to finalise an appropriate method to properly measure the level of financial inclusion.

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