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Analyzing the Consequences of Financial Inclusion on the Effectiveness of the Financial System and its Capacity to be Maintained Through Evidence from Asia

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ABSTRACT: Using yearly data for 40 countries between 2000 and 2021, this article seeks to examine the connection between the financial inclusion index and development factors in the world's poorest regions: Asia. As a means of investigating this connection, we use pooled panel regression and panel data analysis. This empirical evidence suggests that expanding economies is the key to expanding access to financial services. Women are more likely than males to be economically excluded due to a variety of reasons, including unemployment and literacy rates. People in rural regions of less developed nations have less access to financial resources because of the economy's reliance on agriculture. Wage disparity has a chilling effect on people's ability to participate in the financial system and hampers progress. Because of this low degree of financial inclusion, these nations are not as developed as they may be. This research has the potential to improve the lives of marginalized people in the nations under consideration. Policymakers should think about enacting measures to boost literacy, eradicate gender discrimination, and increase wage equity in order to better the environment for development.

KEYWORDS: Asia, Financial Inclusion, Gender, Economic Growth, and Financial Policy.

INTRODUCTION

Since the advent of the endogenous growth hypothesis, researchers have paid a lot of attention to the role that financial development plays in growth. Research findings that linked poverty with financial exclusion sparked a surge of interest in studying and improving financial inclusion or the percentage of the population that has access to and makes use of formal financial services, in the early 2000s (Babajide, Adegboye, & Omankhanlen, 2015). One of the nine pillars of the global development agenda, financial inclusion was acknowledged during the G20 Summit in Seoul, South Korea in November 2010. (GPFI, 2011). Access to appropriate financial services tailored to individuals' requirements and made available to them at reasonable prices is what is meant by the term "financial inclusion." Establishing a deposit or transaction account with a bank or other financial service provider to make and receive payments and holding or saving money is the first step toward formal financial inclusion (Demirguc-Kunt, Klapper, & Singer, 2017). Later on, financial inclusion includes having access to suitable financing from official financial institutions and using insurance products to mitigate financial risks including those caused by natural disasters like fires, floods, and crop failure (Demirguc-Kunt et al., 2017). More farmers were able to save money because of financial inclusion, which in turn enhanced agricultural productivity and family expenditure (Demirguc-Kunt et al., 2017). This is of paramount importance for the poorest rural residents. Consequently, financial inclusion aids in combating poverty and promoting social justice. To better people's lives, provide more possibilities, and fortify economies, "financial inclusion" has been defined as "a process that signals progress in the quantity, quality, and efficiency of financial intermediary services" (Babajide et al., 2015). Financial inclusion encourages local savings, which in turn encourages local firms to make more profitable investments (Babajide et al., 2015). The purpose of this research is to investigate (1) the state of financial inclusion in Asia, and (2) the effect of financial inclusion on economic viability and productivity. Financial efficiency, or "the degree to which the financial system accomplishes its functions," is often considered a key indicator of a developed financial system (Olgu, 2014). Bank runs are thought to be less likely to occur in financially stable countries (Olgu, 2014). Meanwhile, the capacity of the financial system to "absorb shocks without precipitating the collapse of financial institutions, financial markets, and payment systems" is what is meant by "financial stability" (Motelle & Biekpe, 2015; Nelson & Perli, 2007). Efficiency and longevity in the financial sector have been overlooked in financial development comparisons, despite their importance for categorizing a healthy financial system. Due largely to the success of its rising countries, Asia is predicted to maintain its status as the world's fastest-growing economic region for the foreseeable future (Bhardwaj, Hedrick-Wong, & Howard, 2018). If this development is to be fair and inclusive, however, authorities in Asia will need to address the region's widespread lack of access to financial services. It is believed that over a billion individuals in the area do not have access to formal financial services, such as

a bank account, a steady job, or the means to earn money via trade or other means (online or off) (Bhardwaj et al., 2018). It is also projected that just 27% of individuals in developing Asia have a bank account, and only 33% of businesses have a loan or line of credit (Bhardwaj et al., 2018). Many efforts have been made to expand access to financial services throughout Asia, but this is still a major obstacle for the continent as a whole. This is because Asia is one of the world's most varied regions, with enormous disparities in GDP per capita and population size across its member states, and a similarly bewildering range of cultural, ethnic, linguistic, and religious varieties (Bhardwaj et al., 2018). Therefore, it is exceedingly doubtful that a "magic bullet" strategy will be effective in Asia to foster greater financial inclusion (Bhardwaj et al., 2018). The remaining parts of this research are structured as follows.

LITERATURE REVIEW

The literature on financial inclusion may be roughly divided into three categories: (i) the development of indicators, (ii) the assessment of variables, and (iii) studies of the connection between financial inclusion and economic expansion. Research on financial inclusion is still relatively new but rapidly developing (for instance, Honohan, 2008; Sarma, 2012; Demirguc-Kunt & Klapper, 2012, 2013; Sarma, 2015). The number of persons and families with a bank account was one way in which Honohan (2008) measured financial inclusion. In all, 160 countries are analyzed to determine their level of financial inclusion. Indicators such as these may be used to gauge the extent of financial inclusion. This kind of financial inclusion statistic has several shortcomings, such as failing to take into account factors like the accessibility, affordability, and usefulness of financial services (Sarma, 2015). Even though people have bank accounts, this doesn't always mean they are financially included if there are hurdles to using those accounts, such as a lack of transportation, high fees, or a lack of confidence (see, for instance, Kempson, 2006; Diniz, Birochi, & Pozzebon, 2012). Those who are "underbanked" or "marginally banked," as defined by Kempson et al., have but do not actively utilize a bank account (2004). A sizable percentage of the "banked population" in several countries relied on non-bank financial services rather than banking institutions. The term "underbanked" or "marginally banked" is used to describe these households (Sarma, 2012). To compile the Global Findex database, researchers Demirguc-Kunt and Klapper (2012) questioned 150,000 people across 148 countries in 2011. Adults' income, gender, and level of education are disaggregated to provide financial inclusion measures as part of this study. One may gauge financial health based on a variety of factors, such as the share of the population with various types of bank accounts, the rates of formal and informal saving and borrowing, the prevalence of credit and debit cards, home ownership, and medical coverage. Since then, approximately 150,000 people across 140 economies have been surveyed every three years to update the database. According to the 2017 Global Findex database, financial inclusion is on the rise throughout the world. Since 2011, an additional 1.2 billion people have had access to some kind of financial services, including 515 million in 2014. The share of people having access to formal financial institutions or mobile money services increased from 54% in 2014 to 63% in 2017. Women in developing nations have access to 9 percentage points fewer bank accounts than men (Demirguc-Kunt, Klapper, Singer, Ansar, & Hess, 2018). Financial inclusion may be measured on both a macro and local scale (Sarma, 2012). Using only one of these metrics to learn about the diversity of the economy is a poor idea (Sarma, 2012). Sarma demonstrates that a skewed measure of financial inclusion in an economy may be obtained by focusing on a few misleading factors (2012). In another line of inquiry, scholars have looked at what factors influence people to become financially included (Demirgc,-Kunt, Klapper, & Singer, 2013; Kumar, 2013; Fungacova & Weill, 2015; Allen, Demirgu€c,-Kunt, Klapper, & Peria, 2016; Zins & Weill, 2016). According to the 2012 World Bank Global Findex Database including 98 developing countries, Demirguc,-Kunt et al. (2013) conclude that gender matters for financial inclusion. This study indicated that women are more likely to be financially excluded due to a lack of access to bank accounts, formal savings, and formal loans. For 37 African countries, Zins and Weill (2016) use the World Bank's Global Findex database. Men, the well-to-do, the college-educated, and the elderly are disproportionately represented in financial contributions; the impact of education and money is particularly pronounced. Comparing mobile banking to traditional banking reveals several similarities. Different factors influence informal and formal financial situations. To examine international monetary participation, Allenet al. (2016) analyzed data from the World Bank's Worldwide Findex Database in 2012. Lower banking costs, closer proximity to financial intermediaries, and better institutions like stronger legal rights and more stable environments are all associated with higher rates of financial inclusion. People who are higher in socioeconomic status, have completed more education, live in larger cities, are gainfully employed, are married or divorced, or have children are more likely to hold a bank account. Characteristics of someone who saves formally Official borrowing is more common among older, better-educated, wealthier, married men. Using data from the 2011 World Bank Global Findex, Fungacova and Weill (2015) compared China's level of financial inclusion to that of the other BRICS countries. In China, those who are wealthy, educated, and/or above the age of 30 are more likely to use official banking institutions and have access to credit. The inability to open a bank account due to a lack of funds and the presence of a family member who already has one both serve as barriers to financial inclusion for the poor. Concerns about fees and trust in financial institutions are greater among the educated. Women are less likely to participate in the financial system because they may not have access to the necessary documentation or may not have a family member who already has an account. Concerns about finances, moving, and faith are common among the elderly. It has been shown that people's preferences for formal vs informal

credit are affected by their income and level of education but not by their gender. Higher education does not increase access to loans in China. The third body of research examines the connections between financial inclusion and other facets of economic growth and development (for examples, see De la Torre, Ize, & Schmukler (2011), Garcia & Jos e (2016), Mehrotra & Yetman (2015), and Neaime & Gaysset (2018)). (see, for instance, Estrada, Park, & Ramayandi, 2010; Sarma & Pais, 2011; Swamy, 2014; Babajide et al., 2015; Kim, 2016; Sharma, 2016; Kim, Yu, & Hassan, 2018). Due to consumption smoothing, increased financial inclusion provides consumers with better access to saving and borrowing options (Mehrotra & Yetman, 2015). Since production volatility is reduced, the central bank's role of preserving price stability is simplified. The importance of interest rates in the monetary transmission is projected to increase as financial inclusion rises since a larger share of economic activity will depend on them (Mehrotra & Yetman, 2015). The efficiency of monetary policy is likely to increase as a result, which bodes well for long-term fiscal viability. However, as financial inclusion expands, the same set of intermediaries can handle a bigger volume of transactions. The societal costs of individuals' institutional defects may increase as their involvement in the financial markets increases. As a result, there will be a rise in the incidence of social and moral hazards, which will put more pressure on the economy (De la Torre et al., 2011). Having more financial intermediaries is preferable in this context if there is also strong financial regulation and oversight in place (De la Torre et al., 2011). As a result, the growing number of community-based organizations like credit unions and community banks exposes the economy to greater risks in the form of natural catastrophes and economic downturns (Garcia & Jose, 2016). In addition to being a byproduct of a thriving economy, financial inclusion is a key factor in fostering that expansion (Babajide et al., 2015). The effect of financial inclusion on economic development in Nigeria was studied by Babajide et al. (2015) using yearly data sets spanning from 1981 to 2012. The study uses the World Development Indicators (WDI) indicator of commercial bank deposits (CMBD), which reports "the number of deposit account holders in commercial banks and other resident banks functioning as commercial banks that are resident nonfinancial corporations (public and private) and households." The empirical findings show that the amount of economic output is affected by the total component of production as well as the capital per worker. For the years 2004-2013, Sharma (2016) examines the connection between several aspects of financial inclusion and economic development in India, a developing nation. We zero in on banking penetration, banking service availability, and banking service use to get to the heart of financial inclusion (deposits). Many aspects of financial inclusion are shown to increase in tandem with economic development, as discovered by the research. Empirical findings based on Granger causality analysis demonstrate unidirectional causation from the number of deposit/loan accounts to GDP, as well as a bidirectional causality between geographic reach and economic growth. Organization of Islamic Cooperation (OIC) nations have had their financial inclusion and economic development examined by Kim et al. (2018). Key aspects of financial inclusion were measured using the following five variables: (1) the number of ATMs per 100,000 adults; (2) the number of bank branches per 100,000 adults; (3) the number of deposit accounts with commercial banks per 1000 adults; (4) the number of borrowers from commercial banks per 1000 adults; and (5) the ratio of life insurance premium volume to GDP. The research concludes that financial inclusion plays an important role in fostering economic development and that there are reciprocal causalities between the two variables, based on the findings of dynamic panel estimates done on panel data for 55 OIC nations. However, there are several caveats to the research that makes its findings less than ideal. In the first place, the degree to which citizens of OIC nations have access to the financial system varies widely from country to country. Religion, sex discrimination, illiteracy, interest rates, money, and government regulations may all play a role in these differences. Consequently, while modeling the degree of financial inclusion in Islamic nations, it is important to take into account the elements that may affect that level. Second, there is no unified financial inclusion index; rather, distinct financial inclusions are analyzed independently in various models. Several research has shown that financial inclusion may have both good and negative effects on financial security. Few empirical research, however, has examined the nature of this connection (see, Morgan & Pontines, 2014; Neaime & Gasset 2018). Meanwhile, there is a lack of data on how financial inclusion affects economic productivity. This is in part because information on financial inclusion and efficiency is so fresh and rare. By quantifying and detecting trends in financial inclusion, financial efficiency, and financial sustainability, this research adds to the existing body of work on the topic. This research also examines the potential link between financial inclusion and long-term fiscal health. The goal is to check whether there are more positive policy interactions among financial access, financial effectiveness, and financial security. To do this empirically, we use data from 40 different Asian nations.

DATA AND METHODOLOGY

Data And Variables

Taking into consideration several factors as proposed by the current literature, this research endeavors to create a composite Financial Inclusion Index for Asia. The principal component analysis (PCA) is then used to determine which of the chosen indicators has the greatest independent impact on the Index both throughout Asia and within each of the nations included in the research. To do this, we mine information from the World Bank's Global Financial Development Database. 40 nations from varying socioeconomic brackets make up our sample (Refer to Table 1). In this analysis, 40 Asian nations are analyzed to see whether they share a correlation between financial inclusion and fiscal viability. In Table 2 we show the list of variables used in the construction

of our three composite financial indicators, namely financial inclusion, financial efficiency, and financial sustainability. The categorization used by the World Bank's Global Financial Development Database guided our selection of variables for the three composite financial indicators, and we were also constrained by the availability of data from our research sample over a substantial inquiry period. Table 3 provides a summary of the statistical descriptions of the variables.

Methodologies

As can be seen in Table 2, the variables are measured in various ways and use different scales. In addition, Table 3 shows that the variance varies greatly from one variable to the next. Because principal component analysis aims to optimize variance, it places greater emphasis on big variances. Consequently, the chosen indicators will have to be translated into normalized variables. Indicators need to be transformed in this way before they can be combined into a single index. For robustness testing and sensitivity analysis, this research uses a variety of normalization procedures, including the z-score, min-max, and SoftMax approaches.

High-Income Countries [13]
Singapore, Qatar, Hong Kong, Macau, Israel, United Arab Emirates, Japan, South Korea, Brunei, Kuwait, Bahrain, Saudi Arabia, Oman
Upper Middle-Income countries [12]
Kazakhstan, Malaysia, Maldives, Turkmenistan, Thailand, Azerbaijan, Iran, Georgia, Lebanon, Iraq, Armenia, Jordan
Low and Lower Middle-Income Countries [15]
Indonesia, Philippines, Vietnam, Uzbekistan, Bhutan, Laos, India, Bangladesh, Pakistan, Cambodia, Myanmar, Tajikistan, Kyrgyzstan, Nepal, Afghanistan

Table 1. List of Countries used in this research

Variable	Topic	Indicator	Unit
FI 1	Access	Automated Teller Machine (ATMs) per 100,000 adults	
FI 2	Access	Branches of Commercial Banks per 100,000 adults	
FI 3	Access	Institutions of Commercial Banks	
FI 4	Access	Outstanding Deposits with Commercial Banks (% of GDP)	%
FI 5	Access	Outstanding Loans with Commercial Banks (% of GDP)	%
FE 1	Efficiency	Bank Net Interest Rate Margin (in %)	%
FE 2	Efficiency	Bank Return on Assets (in % after tax)	%
FE 3	Efficiency	Bank Return on Equity (in % after tax)	%
FS 1	Sustainability	Bank Z-Score	%
FS 2	Sustainability	Bank Credit-Bank Deposits (in %)	%
FS 3	Sustainability	Liquid Assets to Deposits and Short-Term Funding (in %)	%

Table 2. The Study of Financial Indicators in Asia (2006 – 2021)

[*Data Source: WB's Global Financial Development Database 2021]

If you want to standardize your indicators using a scale that is dependent on how far they are from the mean, the z-transformation is a typical standardization approach to use. As a result of using this technique, international comparisons may be made. However, two things must be watched out for: (1) the sample size should be big enough, and (2) recalibration is necessary when new data points are added. When constructing a standardized model, z-score normalization is used.

$$Zee = \frac{X_i - \bar{X}}{\sigma} \dots\dots\dots\dots\dots\dots\dots (i)$$

here, $\bar{X} = Group\ Average;\ \sigma = Standard\ Deviation.$

Using the min-max method, a scale is created by combining the highest and lowest values. Other values are positioned on this scale based on these values. Performance may be compared to the best and worst examples given. This technique's reasoning. As with z-score normalization, adding additional data points requires recalibration of the model.

Table 3. Summary of Descriptive Statistics of the Selected Variables.

Variable	Obs	Mean	Std. Dev.	Min	Max
FI 1	375	45.758	55.401	0.0014	290.14
FI 2	385	15.124	11.35	0.351	70.678
FI 3	397	44.152	41.157	4	264

FI 4	386	60.147	47.258	3.14	274.31
FI 5	388	47.856	33.12	1.68	155.41
FE 1	391	4.35	2.149	0.742	21.015
FE 2	395	1.48	1.0102	-1.418	5.514
FE 3	397	13.475	8.987	-15.24	118.23
FS 1	391	18.12	10.247	3.201	57.36
FS 2	398	104.479	110.214	8.147	880.367
FS 3	400	31.149	17.59	6.75	97.15

Min-max normalization uses the minimum and maximum observations to adjust scores.

$$mmx = \frac{X_i - X_{min}}{X_{max} - X_{min}} \dots\dots\dots\dots\dots\dots\dots (ii)$$

Where, $X_{min} = Minimum\ Data\ Point;\ X_{max} = maximum\ data\ point$

SoftMax normalization reduces the impact of extreme values or outliers without deleting them. Outliers should be included in a dataset while still preserving the relevance of data within a standard deviation of the mean. Nonlinear data transformation uses sigmoidal functions. SoftMax normalization uses exponential function, mean, and standard deviation to normalize score.

$$softmax = \frac{1}{1 + exp^{-V}} \dots\dots\dots\dots\dots\dots\dots (iii)$$

Where, $V = \frac{X_i - \bar{X}}{\sigma}; \sigma = Standard\ Deviation$

Next, normalized data were processed using PCA, which examines the influence of variable changes on final outcome. PCA simplifies a dataset by eliminating unnecessary data and identifying hidden features and correlations. PCA decreases data analysis dimensions. PCA basis vectors are dataset-dependent, unlike other linear transformation algorithms. PCA's capacity to compare and contrast models is another benefit (Yoshino & Taghizadeh-Hesary, 2015). Explanatory data analysis uses PCA. It displays data structure and discusses variances as a projection approach (Jolliffe, 2011). PCA is seldom utilized in financial inclusion research. PCA has been used to analyze phenomena impacted by financial factors (see Adu, Marbuah, & Mensah, 2013; Ang, 2010; Ang & McKibbin, 2007; Le, Kim, & Lee, 2016; Muhammad Adnan Hye, 2011). Ang and McKibbin (2007) utilized this technique to generate Malaysia's financial depth and repression indices. Ang (2010) created a financial liberalization index to measure the influence of research and finance sector changes on South Korean creativity.

Adu et al. (2013) used PCA to generate financial development indicators for Ghana to analyze long-run growth impacts. PCA applies weights to each of the index's input variables, determining the output variable. The first primary component is the index's value since it best represents the input variables (Radovanovic, Filipovic, & Golusin, 2018). Weights reflect the correlation between an input variable and the output index (Radovanovic et al., 2018). This helps us discover which factors explain the result index. Due to standardization, all main components have zero mean and square root of eigenvalue standard deviation (Radovanovic et al., 2018). Bartlett's test of sphericity and Kaiser-Meyer-Olkin (KMO) test were used to analyze the data's appropriateness for factor analysis. Bartlett's sphericity test determines whether the PCA correlation matrix is an identity matrix. Factor analysis requires significance (p 0.05). (Hair, Black, Babin, Anderson, & Tatham, 2006; Tabachnick, Fidell, & Ullman, 2007). Kaiser-Meyer-Olkin (KMO) test measured sample adequacy. It shows how much common variation may be due to underlying variables (Yoshino & Taghizadeh-Hesary, 2015). KMO index spans from 0 to 1, with >0.5 suggesting acceptable factor analysis (Hair et al., 2006; Tabachnick et al., 2007). Table 4 shows the test findings. KMO levels are usually over 0.5. (with three cases are 0.5). All estimated p values for Bartlett's sphericity test are below alpha = 0.01. This rejects H0, demonstrating that PCA variables are associated. Both tests support PCA in this investigation. Next, we run PCA, which consists of detecting and evaluating components. First, we pick the elements with the lowest pairwise correlation and calculate their total variance. The goal is to discover and extract the most influential variables. The first factor explains the most variance. The second component explains the most of the remaining variation but has no relevance to the first (Radovanovic et al., 2018). This method continues until the detected components equal the original variables. Then, we may extract the components that account for a fraction of variance beyond a specific threshold, represented as the amount of variation each component (or eigenvalue) explains (Radovanovic et al., 2018). This threshold is one (Mundfrom, Shaw, & Ke, 2005).

Table 4. Result of Bartlett test of sphericity and Kaiser-Meyer-Olkin measure of Sampling Adequacy
Bartlett test of sphericity: Ho: Variables are not intercorrelated. ** indicates statistical significance @1%.

	Bartlett test of sphericity			Kaiser-Meyer-Olkin Measure of Sampling Adequacy
	Chi-Square	d.f.	p-Value	
Financial Inclusion				
z-score normalization	386.53**	10	0.000	0.61
Min-max normalization	316.572**	10	0.000	0.59
Soft-max normalization	391.80**	10	0.000	0.61
Financial Efficiency				
z-score normalization	566.03**	3	0.000	0.58
Min-max normalization	457.15**	3	0.000	0.56
Soft-max normalization	551.367**	3	0.000	0.58
Financial Sustainability				
z-score normalization	11.521**	3	0.005	0.51
Min-max normalization	13.475**	3	0.002	0.51
Soft-max normalization	14.248**	3	0.005	0.51

EMPIRICAL RESULTS

Table 5 displays the determined eigenvalues and calculating factors. The first three variables were selected for the principal component analysis (PCA) of Financial Inclusion because they explain over 80% of the overall variance in this indicator. When looking at Financial Efficiency and Financial Sustainability, all three measures have not altered. Three instances of normalized variables are provided in Section 3, and their estimated primary components are shown in Table 6 below.

Table 5. Total Variance Calculation

	Component	Eigenvalues	% of Variance	Cumulative Variance %
Financial Inclusion	**Index**			
Normalized variables	1	2.007	46.01	46.01
Using standardized	2	0.872	21.04	67.07
z-score	3	0.694	15.13	82.20
	4	0.583	12.46	94.66
	5	0.214	5.34	**100.00**
Normalized variables	1	0.201	42.35	42.35
Using min-max	2	0.116	19.86	62.21
normalization	3	0.113	20.01	82.22
	4	0.063	11.64	93.86
	5	0.034	6.14	**100**
Normalized variables	1	0.092	46.24	46.24
Using soft-max	2	0.042	18.94	65.18
normalization	3	0.031	17.24	82.42
	4	0.021	12.23	94.65
	5	0.012	5.35	**100**
Financial Efficiency	**Index**			
Normalized variables	1	1.91	70.67	70.67
Using standardized	2	0.651	26.47	97.14
z-score	3	0.136	2.86	**100**
Normalized variables	1	0.174	67.41	67.41
Using min-max	2	0.071	26.14	93.55
normalization	3	0.0167	6.45	**100**
Normalized variables	1	0.081	69.35	69.35
Using soft-max	2	0.0276	26.14	95.49
normalization	3	0.0061	4.51	**100**
Financial Sustainability	**Index**			
Normalized variables	1	1.091	38.71	38.71
Using standardized	2	0.921	36.14	74.85
z-score	3	0.701	25.15	**100**

Normalized variables	1	0.136	41.69	41.69
Using min-max	2	0.107	33.14	74.83
normalization	3	0.084	25.17	**100**
Normalized variables	1	0.053	40.14	40.14
Using soft-max	2	0.043	33.14	73.28
normalization	3	0.031	26.72	**100**

The first three components of the Financial Inclusion Index explain about 80% of the total variation in the index. In all honesty, that's a very good success rate. The size of the coefficient for each variable in Table 6 indicates the extent to which that variable contributes to a component. Yet the magnitudes of the coefficients also depend on the dispersion of the individual variables. As was previously said, when data is standardized, the average of the major components is set to zero. Moreover, it is emphasized that the basic elements are unrelated to one another. To interpret the PCA, we must identify the variables that exhibit the highest correlations with each component, i.e., the values that deviate most dramatically from zero. For this aim, we propose that a correlation of 0.5 or greater serve as statistically significant. Relationships of significance are shown in Table 6. In the following paragraphs, we will discuss how to interpret the results of the PCA using the specified level of significance. Three criteria, FI1, FI2, and FI3, are shown to be favorably and strongly related with the first major component. The fact that various measures of financial inclusion seem to follow each other's trends shows they may be driven by the same basic underlying variables, such macroeconomic stability and economic growth. Numbers of financial and credit services, such as automated teller machines, commercial bank branches, and loans, tend to increase in line with GDP in nations where growth is expected to be substantial (World Bank, 2010). Longitudinal correlations between variables measuring financial access in Nigeria that are dependent on financial technology innovation and distinct bank-based pathways for financial access were also observed by Ageme, Anisiuba, Alio, Ezeaku, and Onwumere (2018). Our research shows that when FI1 increases, FI4 and FI5 often do too. This metric may be seen as a weighted average of commercial bank deposits, loans, and the number of automated teller machines per 100,000 persons in a certain area. Each of the first three main components correlates similarly with the second major component, and FI5 has the largest association with outstanding loans with commercial banks (i.e., 0.51, 0.53 and 0.54, respectively). The results were somewhat insensitive to the normalization technique used (min-max, SoftMax, etc.). When FI2 increases, PC2 also grows. One method to consider this is by looking at the ratio of commercial bank branches per 100,000 persons. When FI3 is high, the third main factor has a substantial value. That's why this variable might be seen as a barometer of the number of commercial banks around. PCA plots of the Financial Inclusion Index are shown in Figure S1 (available online). In Section 3, we examined the construction of the major components with normalized variables using z-score, min-max, and SoftMax normalization. Each country's data is shown on a single graph that includes

Table 6. An analysis of the impact of specific indicators on the main components of the composite financial indexes in 40 Asian nations.

Normalized variables using standardized Z-Score				***Normalized Variables using min-max normalization***			***Normalized Variables using soft-max normalization***		
Financial Inclusion Index									
Variable	**Principle component (81%)**			**Principle component (83%)**			**Principle component (81%)**		
	1	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**
FI 1	*0.523*	*0.171*	*-0.061*	*0.538*	*0.114*	*0.175*	*0.519*	*0.182*	*0.004*
FI 2	*0.231*	*0.878*	*-0.040*	*0.288*	*0.210*	*0.824*	*0.243*	*0.878*	*0.069*
FI 3	*0.324*	*-0.089*	*0.935*	*0.331*	*0.792*	*-0.412*	*0.332*	*-0.227*	*0.893*
FI 4	*0.519*	*-0.341*	*-0.267*	*0.493*	*-0.341*	*-0.241*	*0.529*	*-0.334*	*-0.341*
FI 5	*0.524*	*-0.124*	*-0.171*	*0.511*	*-0.375*	*-0.132*	*0.537*	*-0.124*	*-0.214*
Financial Efficiency Index									
FE 1	*0.426*	*0.843*	*0.033*	*0.412*	*0.911*	*0.042*	*0.412*	*0.912*	*0.033*
FE 2	*0.624*	*-0.279*	*-0.731*	*0.645*	*-0.246*	*-0.714*	*0.642*	*-0.281*	*-0.710*
FE 3	*0.616*	*-0.313*	*0.710*	*0.634*	*-0.317*	*0.683*	*0.620*	*-0.341*	*0.697*
Financial Sustainability Index									
FS 1	*0.155*	*0.981*	*0.135*	*0.311*	*0.816*	*0.475*	*0.061*	*0.924*	*0.221*
FS 2	*0.671*	*-0.217*	*0.681*	*0.612*	*-0.556*	*0.532*	*0.711*	*-0.171*	*0.632*
FS 3	*-0.707*	*0.015*	*0.721*	*-0.712*	*-0.142*	*0.686*	*-0.674*	*-0.114*	*0.712*

three plots of principal component scores based on three different types of normalized variables. Financial inclusion is rising in many developing and emerging economies, including Bangladesh, Bhutan, Cambodia, India, the Kyrgyz Republic, Mongolia, the

Philippines, Sri Lanka, and Tajikistan. Additional instances of high-income and upper-middle-income countries with widespread access to financial services may be found in Japan, South Korea, Kuwait, Lebanon, Macao, Malaysia, the Maldives, Qatar, Saudi Arabia, Singapore, Thailand, and the United Arab Emirates. Our findings are supported by those of Jahan, De, Jamaludin, Sodsriwiboon, and Sullivan (2019), who found a similar enhancement in financial inclusion in Singapore, Japan, South Korea, Thailand, Malaysia, India, the Philippines, and Cambodia. It was less clear, however, where financial inclusion efforts were headed in most of the world's other countries. Nonetheless, the statistics reveal that Indonesia, Pakistan, Vietnam, Iraq, and Jordan have all made progress during the last several years. The real political will and actions taken in these countries over the last decade to increase access to financial services may be connected to this finding. For instance, the Vietnamese government has released "2011e2020 Socio-Economic Development Strategy" and "Microfinance Development Strategy: 2011e2020" to promote the country's financial inclusion. To "create and grow a safe and sustainable microfinance system to serve the poor, low-income, and micro and small firms," the State Bank of Vietnam (SBV) has led the development and implementation of a national financial inclusion strategy in tandem with the World Bank (Segre, 2018). The Financial Efficiency Index is based on the first three basic components, which account for almost 70% of the overall variation. What you've stated as a ratio is a fair estimate. Table 6 displays the magnitudes of the coefficients for each variable's contribution to the given component. The spread of the relevant variables also affects the relative strengths of the coefficients. After normalization, the mean of all key components is zero, much as the Financial Inclusion Index does. And the main parts have nothing to do with one another. Our next step in extracting significance from the PCs is to identify the most strongly correlated variables with each PC. Again, we consider a correlation of 0.5 or higher to be statistically significant. Relationships of significance are shown in Table 6. High positive correlation between two normalized variables, FE2 and FE3, and the first principal component indicates that the two criteria fluctuate in tandem. For instance, when FE2 (bank ROA, in%) rises, FE3 (bank ROE, in%) often follows suit by increasing by the same amount. Both are potential indicators of a bank's profitability and are thought to interact with measurements of solvency risk and macroeconomic growth (Aisen & Franken, 2010). The annual growth rate of gross domestic product (GDP), which measures the increase of economic activity, is often cited as a major macroeconomic driver of banks' profitability (Bhattarai, 2017). Profits for banks increase as the economy grows, in part because of higher interest rates (Athanasoglou, Brissimis, & Delis, 2008; Demirguc-Kunt & Huzinga, 1999). Rachdi (2013), Ali, Akhtar, and Ahmed (2011), and Zeitun (2012), among others, all indicate that rising GDP has a favorable and sizable effect on ROA and ROE. Combey and Togbenou (2017), Khrawish (2011), and Saeed (2014), on the other hand, find that real GDP growth has a statistically significant and negative influence on the ROA and ROE of banks. Furthermore, whereas FE2 has the largest link with the first principal component, FE3's relationship with the first principal component is not drastically different (i.e., 0.64 and 0.63, respectively). The results are consistent with several normalization strategies, including min-max and SoftMax standards. As FE1 (a measure of banks' net interest margin) increases, so does the second significant contributor. FE2 lowers and FE3 increases, leading to a larger third PC. The graphs of the Financial Performance Index are shown in Figure S2 (available online). The primary ingredients are compiled using three different normalization strategies: z score, min-max, and SoftMax. This time, three plots of principal component scores based on three types of normalized variables are arranged on the same graph for each country in order to ease comparison and robustness checks. During the time period we studied, no country in our sample shown a statistically significant improvement in fiscal efficiency (2004e2016). The trend is often characterized by alternating periods of growth and decline for most countries. But financial efficiency is falling across the board, affecting countries from the poorest to the richest. India, Indonesia, Mongolia, Tajikistan, Vietnam, and Yemen are all examples of such countries. Sri Lanka, the Philippines, Israel, Thailand, and the United Arab Emirates are among the areas where this trend has been more consistent. The Financial Sustainability Index is constructed from the first three basic components, which account for around 40% of the overall variation. Table 6 displays the coefficient sizes for each factor, indicating the relative importance of each variable. Standardization produces PCA with zero mean and no PCA-to-PCA relationship, much as the other two Financial Indices. Then, the variables that are strongly correlated with each principal component are extracted using a correlation threshold of 0.5 as a criterion. Relationships of significance are shown in Table 6. It comes out that although FS1 is positively associated with FS2, FS2 and FS3 are strongly and negatively connected with FS1. This finding indicates the two criteria indeed move together, but in the incorrect direction. For instance, if FS2 (bank credit to bank deposits, in percentage) increases, FE3 (liquid assets to deposits and short-term financing, in percentage) is likely to drop. It seems to reason that a bank's ability to withstand a run on its funds would decrease if its liquid assets were larger in comparison to its deposits and other forms of short-term financing. Liquidity risk is measured by the ratio of bank loans to bank deposits (Shen & Chen, 2014). The findings were unaffected by using various normalization strategies like min-max and SoftMax. As FS1 improves, so does the bank's Z-score, the second most important factor. This third fundamental component, however, expands as FS2 and FS3 rise in size. The graphs of the Financial Sustainability Index are shown in Figure S3, which is available online. To generate the primary components from normalized data, we use z-score, min-max, and SoftMax standardization, much as we did for the other two Financial Indices. Again, we showed three sets of main component scores for each country, this time using three distinct forms of normalized data, to simplify comparisons and robustness checks.

For the group of low and lower-middle income nations, we find the trend of improving financial sustainability in Bhutan, Cambodia, Indonesia, the Kyrgyz Republic, and Vietnam; and for the group of upper-middle and high-income countries, we find it in Lebanon, Qatar, and Singapore. On the other side, Afghanistan, Brunei, Japan, and the Maldives are all seeing a decline in their capacity to maintain their financial stability. The trend throughout the research period has been more volatile in the remaining nations. In this research, we looked at three different financial indicators to see whether there is a correlation between financial inclusion and financial efficiency. The reason for this is because we find no statistically significant trend of higher financial efficiency for any of the nations in our sample, while finding evidence of growing financial inclusion in a few of these same countries. However, advances in both indices suggest a possible correlation between financial inclusion and financial sustainability in a number of nations. It's also possible that the association is considerable but difficult to see because of the erratic behavior of the indices across the time period under study. In short, our proposal is founded only on first, perhaps deceptive, plot observations. To back up our claimed connections, we first used Dumitrescu and Hurlin's Granger non-causality test (2012). At the 5% level of significance, we discovered evidence of a causal relationship connecting financial inclusion to both financial efficiency and financial sustainability. Since the Granger non-causality test is only relevant for firmly balanced panels and without gaps (no missing values), which is not the case here, we had to use a method to fill in the blanks for the normalized variables. That's why it's possible our findings aren't solid. In addition, the sign of the causal link between the variables could not be determined by the causality analysis. In order to determine whether there is a meaningful connection between the three variables used to measure the aforementioned three financial indicators, we apply Feasible Generalized Least Squares (FGLS). The FGLS method, first introduced by Parks (1967), employs tractable generalized least squares to fit linear models of panel data, producing unbiased and consistent parameter estimates even in the presence of correlated and heteroskedastic error components across the panels (Rosenfeld & Fornango, 2007). As a result, we may estimate using cross-sectional correlation and group-wise heteroskedasticity across panels, in addition to AR (1) autocorrelation within panels. Under the random effect estimation null hypothesis of the Hausman test, the FGLS estimator in this work is reliable and effective. 1 Our study's baseline model is comprised of the three financial indices shown in Equations (4) and (5). In addition, we use the natural logarithm of GDP per capita as a control variable in our baseline model since this variable may affect the correlation between various economic metrics (Kim et al., 2018; Sharma, 2016).

$$Financial\ Efficiency_{it} = \alpha_{10} + \delta_{11} Financial\ Inclusion_{it} + \delta_{12} Financial\ Sustainability_{it} + \delta_{13} GDP\ Per\ Capita_{it} + \varepsilon_{1it} \ldots\ldots (iv)$$

$$Financial\ Sustainability_{it} = \alpha_{20} + \delta_{21} Financial\ Inclusion_{it} + \delta_{22} Financial\ Sustainability_{it} + \delta_{23} GDP\ Per\ Capita_{it} + \varepsilon_{2it} \ldots\ldots\ldots (v)$$

Where i, t denotes the year t and the nation i. The error terms are denoted by **Ɛ** and the constant terms by **α**. The estimated coefficients are denoted by **δ**. The estimate is performed for both the whole panel and the two subsamples of countries with varying levels of wealth. Table 7 presents the findings briefly and clearly. However, the estimate findings show that financial inclusion has a large and negative effect on the degree of financial efficiency throughout the whole sample and the two subsamples of nations at various income levels, contradicting the first observations. However, it was shown that financial inclusion had a substantial and favorable effect on the whole sample's financial sustainability. The same result holds true for the two income-category subsamples of nations. Increasing financial inclusion due to intense engagement in the financial system by low-income customers may lead to significant transaction and information costs, as we discover, which is consistent with the views of Garca and Jose (2016). This exacerbates the inherent informational inefficiencies of financial systems, which are notoriously difficult to fix (for instance, due to lack of collateral or credit history). The positive effects of financial inclusion on financial sustainability that we observe can be attributed to the following: the diversification of bank assets, and thus the reduction of their riskiness; the increase in the stability of their deposit base, and thus the reduction of liquidity risks; and the improvement in the transmission of monetary policy (Morgan & Pontines, 2014). Neaime and Gaysset (2018) find that financial inclusion contributes positively to financial stability for eight MENA (Middle East and North Africa) countries over the period from 2002 to 2015, and these findings are similar to those of Morgan and Pontines (2014), who showed that financial inclusion and financial sustainability are complementary rather than a trade-off. Our results are consistent with those of Mehrotra and Yetman (2015), who argued that a rise in financial inclusion will raise the share of household and corporate economic activity that is sensitive to interest rates, hence strengthening the importance of interest rate in monetary transmission. As a result, monetary policy becomes more efficient, which helps ensure the economy's long-term health. However, Cihak, Mare, and Melecky (2016) found that, on average, there are trade-offs between financial inclusion and financial stability for their research population, which runs counter to our results. It was shown that higher rates of financial inclusion are linked to higher rates of personal

Table 7. Results from a Feasible Generalized Least Squares (FGLS) Estimation Framework.

Dep. Var: Financial Efficiency	(i) Whole Sample	(ii) Low & Lower-Middle Income Countries	(iii) Upper-Middle- & High-Income Countries	Dep. Var: Financial Sustainability	(iv) Whole Sample	(v) Low & Lower-Middle Income Countries	(vi) Upper-Middle- & High-Income Countries
Explanatory var:				Explanatory var:			
Financial Inclusion	-0.312***	-0.351***	-0.361***	Financial Inclusion	0.268***	0.155***	0.351***
	[0.0532]	[0.065]	[0.079]		[0.036]	[0.052]	[0.050]
Financial Sustainability	0.075	-0.152*	0.0378***	Financial Efficiency	0.044	-0.095*	0.0183***
	[0.071]	[0.089]	[0.0117]		[0.037]	[0.051]	[0.051]
GDP per Capita	-0.011	0.022	-0.069	GDP per Capita	-0.013	-0.021	0.162
	[0.043]	[0.091]	[0.173]		[0.033]	[0.069]	[0.0121]
Constant	0.102	-0.252	0.501	Constant	0.193	0.270	-0.991
	[0.380]	[0.0909]	[1.511]		[0.264]	[0.720]	[0.893]
N	345	200	145	N	345	200	145
Wald χ^2	41.17***	36.45***	23.40***	Wald χ^2	51.74***	20.40***	54.56***
Countries	40	15	25	Countries	40	15	25

*[To generate the three Financial Indices, principal component analysis is applied to data that have been normalized using a standardized Z-score. Our standard deviations are within []. Statistical significance is shown at the 10%, 5%, and 1% levels using the symbols *,**, and ***.]*

borrowing, which in turn may raise the likelihood of financial system shocks and banking crises (Cihak et al., 2016). While trade-offs between financial inclusion and financial sustainability are more common, Cihak et al. (2016) argued that synergies between the two are possible with almost the same likelihood, especially during non-crisis times. They reasoned that if more people were involved in the financial system, it would be more secure and that would help reduce the sector's anticipated losses (Cihak et al., 2016). By better screening creditworthy consumers, including new users of credit, and aiding stability by, for example, increasing the accuracy of estimates of probable losses, comprehensive credit information systems may promote both financial inclusion and financial sustainability (Cihak et al., 2016). In line with previous research by Capraru and Ihnatov (2014), Smaoui and Ben Salah (2012), and Thiagarajan (2018), we found that GDP growth had no significant effects on either financial efficiency or financial sustainability.

CONCLUSION

This study looks at 31 Asian countries to see what the trends are in terms of financial inclusion, financial efficiency, and financial sustainability. The study also looks at whether financial inclusion is linked to financial efficiency and sustainability, which could lead to policy conflicts or synergies, and it asks questions for future research. In order to make the three financial indicators, PCA is used on different sets of normalized variables. In our study sample as a whole, we find that the trends are changing. The results of FGLS's estimations show that financial inclusion has a large and negative effect on financial efficiency and a large and positive effect on financial sustainability in the study sample countries from 2004 to 2016. These results are true for both the whole sample and the subsamples of countries with different levels of income. Our real-world data shows that financial stability and financial inclusion help each other. This means that both goals can be met at the same time. That is, policymakers can reach their goals of getting more people to use financial services while keeping the system stable. In fact, it is thought that the recent policy changes in Asia that encourage financial inclusion have helped make the financial sector more accessible and stable (Hannig & Jansen, 2010). On the other hand, our research suggests that policies meant to increase financial inclusion might reduce the efficiency of the financial system as a whole. This is because more people are getting involved in the financial markets, which makes the social costs of each person's institutional flaws grow. So, social and moral will probably get better (De la Torre et al., 2011). Also, if more and more people with low incomes use the financial system, this could lead to high costs for transactions and information. This makes it harder for people to get loans without collateral or a credit history. This makes information asymmetries worse, which is a major source of inefficiency. To solve this problem, there needs to be a larger number of financial intermediaries, as well as good governance and a good structure for financial regulation and oversight (De la Torre et al., 2011).

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