

**The Impact of Internet Connectivity on Financial Inclusion: A Panel Study  
on Asian and Africans Countries by Using GMM**

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**Abstract**

Financial inclusion collectively develops the economic growth in which persons can start their business by getting loans from banks and from any other source of microfinance schemes. Higher the index of financial inclusion indicates the availability of better and easy access to the bank account, online payment system, saving, lending and borrowing for a person. In this research, we investigate the two models namely; the relationship between Financial Inclusion (FI) and internet user and other is to find the relationship between Economic growth and financial inclusion by making a panel of 39 Asian and African countries. In model 1, we used financial inclusion index as a dependent variable and in model 2, we used economic growth as a dependent variable by taking time from 2004 to 2017. For this purpose, we incorporate the econometric technique of GMM. The findings of this research show that financial inclusion index is positively related to internet users and economic growth also significantly and positively related to financial inclusion. If Internet users increase in an economy, then financial inclusion also increases in the case of Asian and African countries. At last, we provide some policy implications for creating an environment which contributes to an improvement of FI.

**Keywords:** Financial Inclusion Index, Internet User, Economic Growth, and Panel data; GMM

**JEL Codes:** G10; O40; C33

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## **1. Introduction**

In economic development, the main objective is to seek solutions to alleviating poverty in the economy. Banerjee and Newman 1993 investigate that Finance access is observed as a serious factor in transforming their production; activities of employment as well as to eliminate their poverty studied by these researchers namely Banerjee 2001, Bolton and Aghion 1997, Pande and Burgess 2003, Yunus 1999. In current years, FI has gained political importance in several nations including the UK and India (2006) and the UN (2006). For this purpose, World Bank (2008 and 2009) has built up financial committees to realize their FI problems and their financial integration possibility to recover and investigates about the feature of FI. Nevertheless, the aspects of mainstreaming FI haven't yet been thoroughly explored. Financial inclusion means that individuals and businesses have access to useful and affordable financial products and services that meet their needs transactions, payments, savings, credit and insurance that delivered in a responsible and sustainable way.<sup>3</sup>

For Pakistan, which is a highly expanded economy and society as well, it's necessary to pay due consideration to the dimensions of FI. There is some economist who has tried to measure a few features of FI. Honohan (2007) examined the adult population share through formal financial intermediaries (FIs) by incorporating information of the numbers of bank and Member of Institute of Financial Services (MFIs) over 160 nations, then attempt correlation with inequality and poverty. Sarma (2008) has introduced an index of FI in 55 countries by using bank aggregates indicators namely number of accounts in banks, a number of bank branches and total loans and deposits. Mehrotra (2009) accumulated index of FI by using some variables included the number of rural deposits, total deposits, the total rural offices and the placements of banks data for the sixteen major Indian states.

In addition, the World Bank (2008) is a complex indicator of easy access to financial services that represents the adult's percentage who has no account as FIs in around 51 countries.

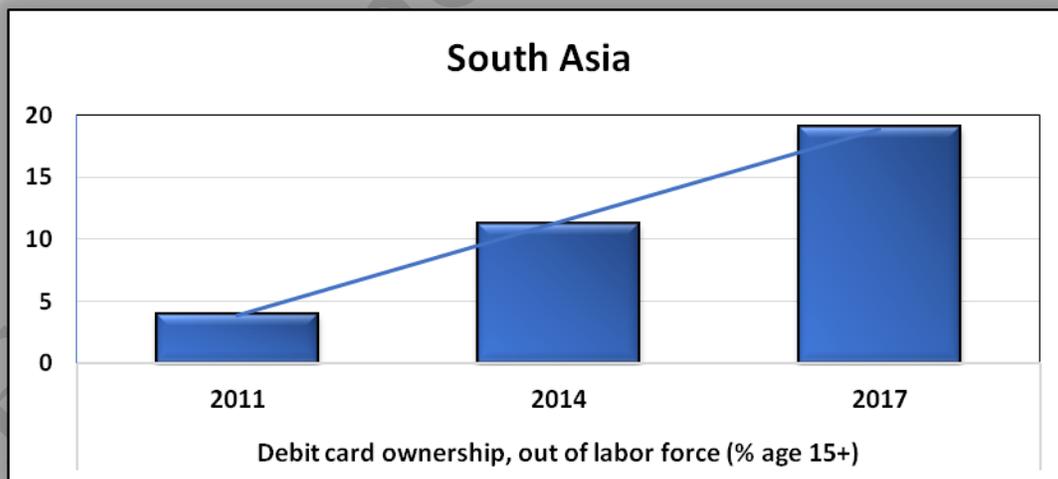
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<sup>3</sup>(<http://www.worldbank.org/en/topic/financialinclusion/overview#1>)

While New World (2009) Depending on the access of the poor to the service of society, it explains the country's Democratic Union of Integration (DUIs) is measured by many thousands of other things that arguments like the bank numbers of things that were offered by the banks of the authors requesting banks can affect access to and from banks of the peoples of 45 countries, did not follow. Beck et al. (2009) discuss the book using a large amount of information about the financial system in many respects, but they are not indicators of the inclusion of the cause of the financial sector.

### **1.1. Factors of Financial Inclusion in South Asian and Sub Saharan Africa**

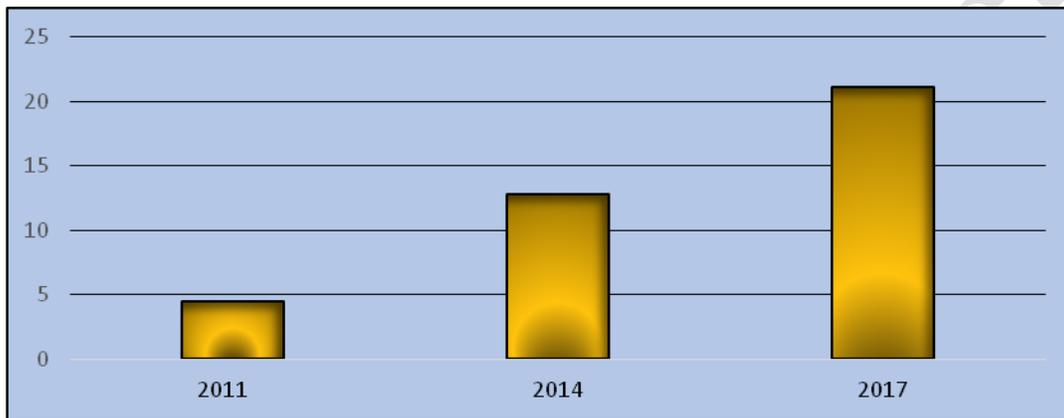
There are some factors which directly relate to financial inclusion including the number of users of debit card and credit card, used of digital payment for online transaction and shopping purpose and mobile money banking. These are the more highlighted factors which are helping for increasing the role of financial inclusion in South Asian and Sub Saharan Africa during the last decade. Some graphical illustrations are shown below by which we can understand the impact of key factors of financial inclusion and these variables data are obtained from World Bank Global Findex (WBGF).



**Figure 1.** Debit Card Ownership, Out of Labor Force (% age 15+)

Source: Authors Illustration

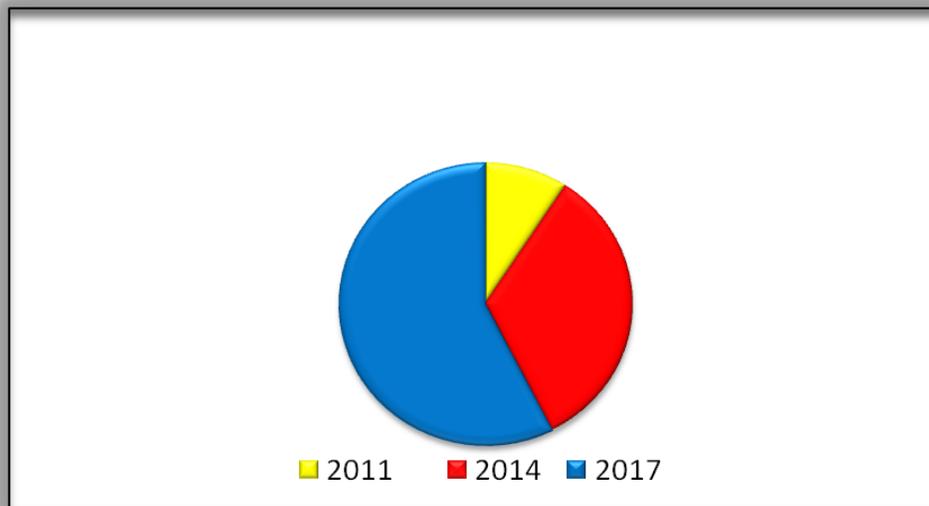
Figure 1 illustrates that the debit card ownership of labor force above the age of 15 years is continuously increasing over time in South Asian Countries. A debit card is factor of financial inclusion as it increases the ease of withdrawing money at any time and facilitates the purpose of purchasing. If the money of the debit card holders is not withdrawn, it also helps to increase the investment in the economy. Above figure clearly shows the increasing trend of debit card users in South Asian countries which boost the financial inclusion.



**Figure 2.** Made or received digital payments in the past year, young adults (% age 15-24) South Asia

Source: Authors Illustration

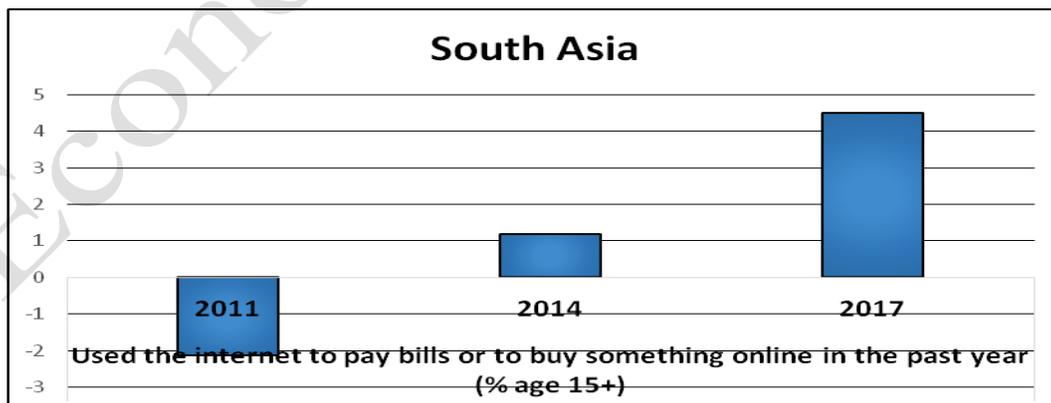
Figure 2 shows the digital payment received or made in the last decade is gradually increasing in South Asian countries. Digital payment is an example of internet-based shopping and banking. This factor reflects the use of internet in the economy by incorporating banks which directly lead to financial inclusion. With the passage of time, uses of digital payment increasing which is a positive sign towards E-Banking?



**Figure 3.** Mobile money account, young adults (% age 15-24) South Asia

Source: Authors Illustration

Figure 3 explains the mobile money account in South Asian countries and it shows a very sharp increase from 2011 to 2017. Users of mobile money accounts holders are increasing very fast in the past decades as shown in the above figure. Mobile money is like bank account where we can store and manage money. With the help of this persons can send and receive money easily. These factors also play a vital role in boosting financial inclusion in the economy.

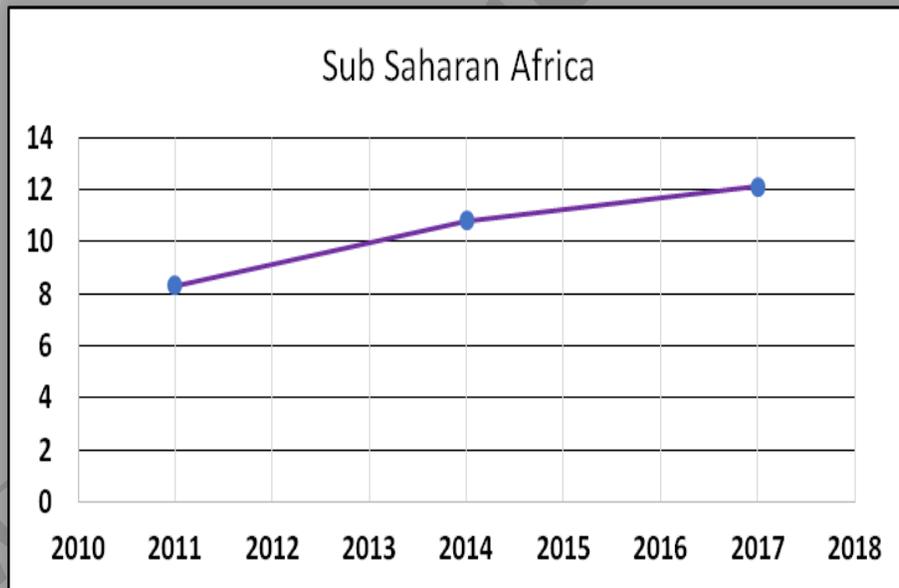


**Figure 4.** Used the Internet to pay bills or to buy something online in the past year (% age 15+)

Source: Authors Illustration

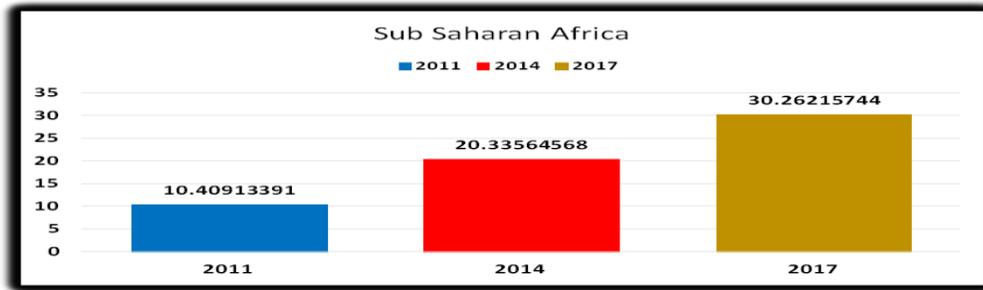
Figure 4 shows the users of the internet for paying bills and to purchase something online in the past decade are continuously increasing in South Asian countries. In 2011, internet user is very few about less 1%, but in 2017 trend shows highly increased in the mode of payment and buy something online by using the internet. It explains that now internet users are also a key factor which directly boosts financial inclusion very reckless.

Figure 5 explains the users of a credit card in Sub Saharan Africa are increasing day by day. As lending of money and borrowing of money is an indicator of financial inclusion. A credit card is different from a debit card, as you need to pay an interest rate on credit card. Ultimately here comes the term borrowing from the bank which directly relates to financial inclusion. If credit card users are increasing then financial inclusion index also increasing, as there is a positive and significant relationship between these two variables.



**Figure 5.** Credit card ownership, older adults (% age 25+)

Source: Authors Illustration

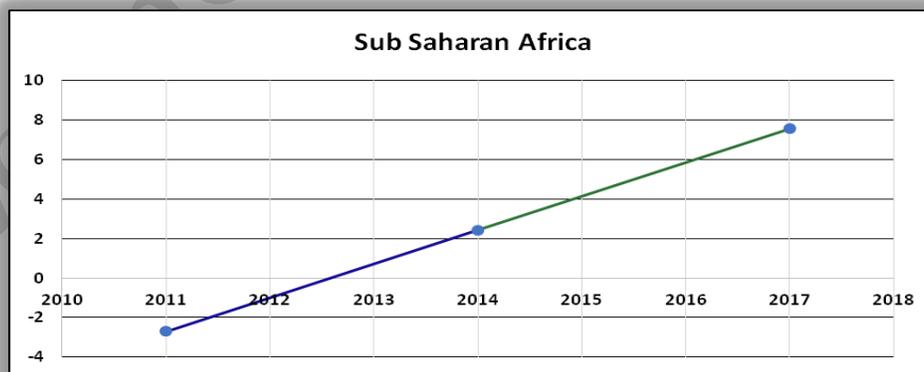


**Figure 6.** Made or received digital payments in the past year, young adults (% age 15-24)

Source: Authors Illustration

Figure 6 shows the digital payment received or made in the last decade that is gradually increasing in Sub Saharan African countries. Digital payment is an example of internet-based shopping and banking. This factor reflects the use of internet in the economy by incorporating banks which directly lead to financial inclusion. With the passage of time, uses of digital payment increasing which is a positive sign towards E-Banking?

Figure 7 shows the users of the internet for paying bills and to purchase something online in the past decade are continuously increasing in Sub Saharan African countries. In 2011, internet user is very few about less 1%, but in 2017 trend shows highly increased in the mode of payment and buy something online by using the internet. It explains that now internet users are also a key factor which directly boosts financial inclusion very reckless.



**Figure 7.** Used the internet to pay bills or to buy something online in the past year (% age 15+)

Source: Authors Illustration

The main objective of this research is to examine the relationship between financial inclusion and individual internet user by incorporating a panel data of 39 Asian and African countries. On the other hand, this research also finds the relationship between financial inclusion and economic growth in Asian and African countries. Financial inclusion nowadays becomes a very important factor for boosting growth in the economy. This research tried to find the main factors which influence financial inclusion in which internet users is a key factor that we have found. This study used own calculated index of financial inclusion as described in section III.

In the context of Asian and African Countries, while reviewing the previous research studies in the relevant field, to the best of my knowledge, found no study which investigates the impact of internet connectivity on financial inclusion in African and Asian countries. In this study we developed own calculated index of financial inclusion incorporating some dimensions (No of ATMs per 100000 adults, Borrowers from commercial banks per 1,000 adults, depositors with commercial bank per 1000 adults, commercial banks branches per 100,000 adults and domestic credit to GDP ratio) by taking latest data from 2004 to 2017.

Rest of the paper is proceeds as follows: In section 2 we reviewed some literature related to Economic Growth and internet users. In section 3 we give a theoretical framework of financial inclusion index. In section 4 we give Econometric model, methodology and data sources. In section 5 we give empirical analysis and their interpretation and in the last section 6, we give a conclusion and some effective policy implications.

## **2. Literature Review**

Levine (1997) investigated the vies of neoclassical theory and suggest that those countries who have many banks and many equities market that country grow faster as compared to other countries in recent decades. Similarly, Burgess and Pande 2003 highlight the significant factor that is easily accessed to all finance in all sectors of society. Finance Economics is playing a positive and significant role in declining poverty. Beck 2009 investigate and suggest that an accessible and more advanced financial system help to decreases transaction costs, influences savings rates, increase investment decisions, increase technological innovation and long-term

growth rates. Khandker and Binswanger 1995, their evidence recommends that the IRDP has significantly decline rural poverty and boost employment in nonagricultural sectors.

Sadhan Kumar Chattopadhyay (2002) studied the need for FI in India; RBI Case of West Bengal (2011) studied levels of FI in West Bengal. According to their study, it was not better in the field of the banking business, but it was not significant. The FII was developed for India. By using data of three indicators of FI namely Byzantine Banking Penetration, access to Banking System and the use of the banking system. This study compares the images of different countries based on the FII ranking. While Honuhan (2008) examined that economic growth is the main factor which affects the bank stability and FI in Kenya.

Vivek Anandan, N.R (2013) studied financial inclusion in India, in which the author explains that India had a rapid economic growth was not much inclusive. The reason was poverty in India and low income. Which mean that all the financial services were enjoyed by few peoples in India. The Government adopted many measures, such as bank nationalization, credit for the private sector, RRB, cooperative associations, direct benefits transfers, etc. Over the last thirty years, most rural houses have no source credits. This section announces the latest initiatives that have included financial inclusion, product initiatives, policy initiatives, the RBI and future initiatives. It emphasizes that financial inclusion contributes to the country's comprehensive economic growth.

On the other hand, Allen et al. (2013) concluded that commercial bank can enhance easy access of financial services to under privileged household in Kenya. Brune et.al. (2011) found that an increase in financial services through mobilization of rural savings, it proves that the life of Malswain rural population because poor family have access to save for agriculture inputs.

Migap et.al. (2015) analyzed FI as a policy for economic growth in Nigeria. This study relates the Nigeria's FI index with other upper middle income of emerging economies in Africa. This study concluded that educational institution and media should need to be stimulated to boost the financial literacy in Nigeria. While Kulanda and Aduba (2015) analyzed the relationship between FI and financial sector services in Kenya and concluded that FI is significantly relate to the economic growth and development because of many FI programs have positive impact on financial stability in Kenya.

Okoye (2017) estimated the impact of FI on development and economic growth in Nigeria by taking time period from 1986 to 2015. This research applied simple OLS technique and concluded that credit to private sector has insignificant impact on economic growth while FI helps to promote poverty alleviation by rural credit delivery in Nigeria.

Uddin et al. (2017) investigate the determinants of FI in India by taken time period 2005-2014. This research incorporates the GMM technique and QRA. This research differentiates both side factors of FI (supply side and demand side). The author incorporates the size of the bank, interest rate, and efficiency as a supply-side factor of FI. Whereas: age dependency ratio and literacy rate were the demand side factors. Africans countries were taken for this research and data obtained from WBGF data based on 37 panels of African countries. The research found that financial inclusion was determinants of age, gender, income, and education.

Musau et al. (2018) examined the relationship between FI and credit risk management of banking system in Kenya by incorporating the time period from 2007 to 2015. This study analyzed the data by using panel of multiple regression analysis and descriptive statistics. This paper concluded that there is a positive and significant relationship between FI and credit risk of the commercial bank in Kenya. Therefore, this research suggested that all commercial banks should need to negotiate with their central bank in favor to boost the macroeconomic factors like GDP.

Barik and Lenka (2018) examined the relationship of mobile phones growth and use of internet on FI in SAARC countries by taking data from 2004-2014. This study applied random effect, fixed effect and standard error model techniques to analyze the result. This study reveals that there is a positive relationship of FI on education and income, whereas FI is negatively related with unemployment and rural population. Alam et al. found that mobile banking is more secure, easy sand convinced. Customer banking habit increased due electronic financial services. On the other hand, Brich (2013) also found positive relationship between financial services and internet users.

### 3. Theoretical Framework

As we have described above that we used five major indicators to make FII in which (No of ATMs per 100000 adults, Borrowers from commercial banks per 1,000 adults, depositors with commercial bank per 1000 adults, commercial banks branches per 100,000 adults and domestic credit to GDP ratio) includes.

In this research, we have incorporated the technique of Sarma (2008) for constructing FII. For that purpose, we used five indicators namely (No of ATMs per 100000 adults, Borrowers from commercial banks per 1,000 adults, depositors with commercial bank per 1000 adults, commercial banks branches per 100,000 adults and domestic credit to GDP ratio). Whereas the first two variables explain the accessibility of banks as FI and other last three variables indicates the usage of FII. All the indicators of FI we obtained from WDI from 2004 to 2017 and 39 countries in which 20 are Africans countries and 19 are Asian countries.

Given below are the specifications of Sarma (2008), the first step to calculate financial inclusion is to find its dimension by the following procedure;

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

Where  $A_i$  dimension represents the actual value,  $m_i$  dimension represents the minimum value and  $M_i$  dimension represent the maximum value. The FII for country  $i$  is calculated by NIE distance is pointed  $d_i$  and all these put in equation 1, from the ideal point  $I$  which is equivalent to 1. More generally, the formula is given by in equation 2.

$$FII_i = 1 - \sqrt{\frac{(1-d_1)^2 + (1-d_2)^2 + (1-d_3)^2 + \dots + (1-d_n)^2}{\sqrt{n}}} \quad (2)$$

Whereas the term  $D_i$  used in equation (2) is the dimension which we calculate in equation (1). By using this formula, we can find the FII and its value lies from 0 to 1. A higher value indicates the high FI in the country and low index show very low role of FI in an economy.

#### 4. Econometric Model, Methodology and Data

##### 4.1 Econometric Model and Methodology of GMM

Based on the above theoretical framework research models are build that is shown as under:

$$FII_{it} = (\alpha - 1)FII_{it-1} + \beta_0 IIU_{it} + \beta_1 EMP_{it} + \beta_2 FDI_{it} + \beta_3 CPI_{it} + \mu_i + \epsilon_{i,t} \quad (3)$$

Where;

$FII_{it}$	=	Lag of Financial Inclusion Index of Asian and African Countries at time t.
$IIU_{it}$	=	Individual Internet User of Asian and African Countries at time t.
$EMP_{it}$	=	Employment to Population of Asian and African Countries at time t.
$FDI_{it}$	=	Foreign Direct Investment of Asian and African Countries at time t.
$CPI_{it}$	=	Corruption Perception Index of Asian and African Countries at time t.
$\mu_{it}$	=	unobserved country specific effect
$\epsilon_{i,t}$	=	Disturbance at time t.

To eliminate the country specific effect, we take 1<sup>st</sup> difference of equation (3):

$$FII_{it} - FII_{it-1} = \alpha (FII_{it-1} - FII_{it-2}) + \beta_0 IIU_{it} - IIU_{it-1} + \beta_1 EMP_{it} - EMP_{it-1} + \beta_2 FDI_{it} - FDI_{it-1} + \beta_3 CPI_{it} - CPI_{it-1} + \mu_{it} - \mu_{it-1} + \epsilon_{i,t} - \epsilon_{i,t-1} \quad (4)$$

$$GDP_{it} = (\alpha - 1) GDP_{it} + \beta_0 FII_{it} + \beta_1 GDPPC_{it} + \beta_2 RQLT_{it} + \beta_3 CPI_{it} + \beta_4 LEXP_{it} + \mu_{it} + \epsilon_{i,t} \quad (5)$$

Where;

$GDP_{it}$	=	Gross Domestic Product of Asian and African Countries at time t.
$FII_{it}$	=	Financial Inclusion Index of Asian and African Countries at time t.
$GDPPC_{it}$	=	GDP per Capita of Asian and African Countries at time t.
$RQLT_{it}$	=	Regulatory Quality of Asian and African Countries at time t.
$CPI_{it}$	=	Corruption Perception Index of Asian and African Countries at time t.

$LExp_{it}$  = Log of Export of Goods and Services of Asian and African Countries at time t.

$\mu_{it}$  = Unobserved country specific effect

$\epsilon_{i,t}$  = Disturbance at time t.

To eliminate the country specific effect, we take 1<sup>st</sup> difference of equation (5):

$$GDP_{it} - GDP_{it-1} = \alpha (GDP_{it-1} - GDP_{it-2}) + \beta_0 FII_{it} - FII_{it-1} + \beta_1 GDPPC_{it} - GDPPC_{it-1} + \beta_2 RQLT_{it} - RQLT_{it-1} + \beta_3 CPI_{it} - CPI_{it-1} + \beta_4 LEXP_{it} - LEXP_{it-1} + \mu_{it} - \mu_{it-1} + \epsilon_{it} - \epsilon_{it-1} \quad (6)$$

Levine et al. (2000) gave two reasons that why we used instruments namely: to deal with the likely endogeneity of the financial inclusion and economic growth and another reason is the creation of new error term  $\epsilon_{i,t} - \epsilon_{it-1}$  as shown in equation 4 and 5 are correlated with their lagged dependent variable that are  $FII_{it-1} - FII_{it-2}$  and  $GDP_{it-1} - GDP_{it-2}$ . The GMM panel estimator uses the following moment conditions for equation 03:

$$E[FII_{it-s} (\epsilon_{i,t} - \epsilon_{it-1})] = 0 \text{ for } s \geq 2; t=3, \dots, T$$

$$E[III_{it-s} (\epsilon_{i,t} - \epsilon_{it-1})] = 0 \text{ for } s \geq 2; t=3, \dots, T$$

$$E[EMP_{it-s} (\epsilon_{i,t} - \epsilon_{it-1})] = 0 \text{ for } s \geq 2; t=3, \dots, T$$

$$E[FDI_{it-s} (\epsilon_{i,t} - \epsilon_{it-1})] = 0 \text{ for } s \geq 2; t=3, \dots, T$$

$$E[CPI_{it-s} (\epsilon_{i,t} - \epsilon_{it-1})] = 0 \text{ for } s \geq 2; t=3, \dots, T$$

The GMM panel estimator uses the following moment conditions for equation 05

$$E[GDP_{it-s} (\epsilon_{i,t} - \epsilon_{it-1})] = 0 \text{ for } s \geq 2; t=3, \dots, T$$

$$E[FII_{it-s} (\epsilon_{i,t} - \epsilon_{it-1})] = 0 \text{ for } s \geq 2; t=3, \dots, T$$

$$E[GDPPC_{it-s} (\epsilon_{i,t} - \epsilon_{it-1})] = 0 \text{ for } s \geq 2; t=3, \dots, T$$

$$E[RQLT_{it-s} (\epsilon_{i,t} - \epsilon_{i,t-1})] = 0 \text{ for } s \geq 2; t=3, \dots, T$$

$$E[CPI_{it-s} (\epsilon_{i,t} - \epsilon_{i,t-1})] = 0 \text{ for } s \geq 2; t=3, \dots, T$$

$$E[LEXP_{it-s} (\epsilon_{i,t} - \epsilon_{i,t-1})] = 0 \text{ for } s \geq 2; t=3, \dots, T$$

Under the assumption of error term, it is not serially correlated and the independent variables are weakly exogenous. This is the reason; author refers this as the first difference estimators.

There is statistical shortcoming with this estimator. Alonso and Arellano (1996) and Blundell and Bond (1998) explains that when the independent variables are consistently over the time, lagged levels of these variables are become weak instruments for the regression equation in differences. Therefore to reduce the possible biases related with the difference estimator, the author used a new estimator that combines in a system the regression in differences with the regression in levels. The mentioned instruments are suitable under the following assumption that there might be exists correlation between the levels of the right hand side variables and the country specific effect in the level equations. Therefore, no correlation can be found between the differences of these variables and the country specific effect. The moment conditions for the second part of the system which is regression in the levels are,

$$E[(FII_{it-s} FII_{it-s-1}) (\mu_i + \epsilon_{i,t})] = 0 \text{ for } s=1$$

$$E[(IIU_{it-s} IIU_{it-s-1}) (\mu_i + \epsilon_{i,t})] = 0 \text{ for } s=1$$

$$E[(EMP_{it-s} EMP_{it-s-1}) (\mu_i + \epsilon_{i,t})] = 0 \text{ for } s=1$$

$$E[(FDI_{it-s} FDI_{it-s-1}) (\mu_i + \epsilon_{i,t})] = 0 \text{ for } s=1$$

$$E[(CPI_{it-s} CPI_{it-s-1}) (\mu_i + \epsilon_{i,t})] = 0 \text{ for } s=1$$

According to the Arellano and Bover (1995), lagged levels are used as instruments in the differences specification, most recent difference is used as instrument in the level specification and by using other lagged differences it will result in redundant moment conditions. The panel data model involves the usage of a dynamic outcome, in this case adding a lagged dependent

variable to the explanatory variables. In addition, the model is estimated using GMM, which works in a similar way to Two Stage least squares, overcoming problems of endogeneity. This approach requires that no of observation is greater than Time period, i.e. the cross-section observations exceed the time series. This technique is basically a method that chooses parameter estimates, such that the theoretical model is satisfied as ‘closely’ as possible. The estimates are chosen to minimize the weighted distance between the theoretical and actual values.

This method requires that the theoretical relations between the parameters satisfy so-called ‘orthogonality conditions’, which mean that the sample correlations between the explanatory variables and instruments are as close to zero as possible. OLS is a special case of GMM, where we assume no correlation between the explanatory variables and the error term. GMM is like 2SLS, in that we need to specify the instrument list. It is often argued that the GMM approach is a second-best identification strategy compared to the IV approach in case of endogeneity of the explanatory variables. Sometimes, it is also hard to believe that the dependent variable lagged one period can be included as an additional explanatory variable. GMM is more of an econometric trick than a proper solution for endogeneity.

#### **4.2. Data Sources**

In this research, we make a panel of 39 counties in which we incorporate 19 Asian countries and 20 African countries. Time periods are taken from 2004 to 2017. The dependent variable is the Financial Inclusion Index in model 1 and in model 2, economic growth used as a dependent variable. For making Financial inclusion index we incorporate five variables including (No of ATMs per 100000 adults, Borrowers from commercial banks per 1,000 adults, depositors with commercial bank per 1000 adults, commercial banks branches per 100,000 adults and domestic credit to GDP ratio). Explanatory variables namely Employment to Population, Foreign Direct Investment, net inflows (% of GDP), GDP current US dollar (Apply log), Individual internet user (% of the population), Export of goods and services current US \$ (Apply log), we obtained these variables data from World Bank Indicator. On the other hand, Regulatory quality and Corruption perception index data, we obtained from WGI. We have applied lag dependent for both the models as, lag of financial inclusion and lag of GDP.

## **5. Empirical Analysis**

In this research, we have applied Generalized method of moments of two-stage least square. Main motive to apply GMM is that we have a problem of endogeneity because we used lag dependent variables in both the models for this purpose we use 2SLS to remove the problem of endogeneity. Results of GMM for both the models are shown in table 1. Column 2 represents the relationship between financial inclusion and internet user relation. Whereas, column 3 shows the relationship between Economic growth and Financial inclusion relations Descriptive statistics and correlation matrix are shown in table 3, 4, 5 and 6 respectively (See Appendix).

Table 1 shows the result of GMM for both the models, in which column 2 shows the relationship between financial inclusion and individual internet users. Whereas: column 3 shows the relationship between financial inclusion and economic growth by incorporating a panel of 39 countries in which 20 African countries and 19 Asian countries. According to the column 2, results show that individual internet users, employment to population and foreign direct investment are highly significant at level 1% of significance, whereas Corruption is insignificant above 10% level of significance. Financial inclusion and internet users have a positive relationship with each other. Results show that if there is a 1% increase in internet user, 0.053% will increase in financial inclusion index in Asian and African countries. Nowadays, financial inclusion becomes an important factor to boost the economic growth in the country and State bank of Pakistan focusing on the factors which influence the financial inclusion in the economy. We should consider internet user to create an environment of financial inclusion. Employment is also an important factor which is positively related with financial inclusion, if employment ratio increased then many numbers of people will involve in the banking system for lending and borrowing, ATM purpose uses of debit card and credit card which are the indicator of financial inclusion. If a 1% increase in employment, then there will be a 0.07% increase in financial inclusion index.

**Table 1.** Financial Inclusion of Asian and African

<b>Variables</b>	<b>GMM Result (Model: 01)</b> Financial Inclusion and Internet User	<b>GMM Result (Model 02)</b> Economic Growth and Financial Inclusion
<b>FII<sub>it</sub></b>	----	0.09* (2.52)
<b>IU<sub>it</sub></b>	0.0053* (2.31)	----
<b>Emp<sub>it</sub></b>	0.007* (2.18)	---
<b>CPI<sub>it</sub></b>	0.002** (0.69)	0.008* (2.90)
<b>FDI<sub>it</sub></b>	-0.25* (-2.60)	-----
<b>Exp<sub>it</sub></b>		0.48* (21.39)
<b>RQlty<sub>it</sub></b>		-9.81* (-4.47)
<b>GDPPC<sub>it</sub></b>	---	0.15* (8.44)
Note: Figures in parenthesis indicates the value of T-statistics. *Shows significant at 1% level of significance and ** show insignificant above 10% level of significance.		

Column 3 shows the relationship between financial inclusion and economic growth of a panel of 39 Asian and African countries. All the variables including financial inclusion, Corruption perception index, exports, regulatory quality and GDP per capita are significant at level 1% of significance. According to the result, there is a positive relationship between financial inclusion and economic growth, if there is a 1% increase in financial inclusion then there will be a 9% increase in economic growth. We can say that, by the help of financial inclusion in which lending and borrowing playing an important role, growth will boost. Lending and borrowing help for the investment in which production will increase and if production increases then it will be led to the higher economic growth in the country. Export is another factor which is positively and significantly affects economic growth. If a 1% increase in exports, then there will be a 48% increase in economic growth. GDP per capita and economic growth also

positively related to each other. If a 1% increases in GDP per capita than a 15% increase in economic growth.

The main reason for applying GMM is the existence of the endogeneity problem in both models. We have a lag dependent variable in both the models that are lag of financial inclusion and lag of GDP. To remove this endogeneity, we used GMM, 2SLS model. Two stages least square where the number of endogenous variables equals the number of instruments. Two stages least square used when the dependent variable's error terms are correlated with the independent variables. Over identified problem is now solved after applying 2SLS. While the coefficients are the same, the standard errors from doing 2SLS by hand are incorrect.

## **6. Conclusion and Policy Implication**

State bank of Pakistan has been committed to improving financial inclusion, but they have not set a valid strategy. Growth is the key factor of financial inclusion, but it doesn't mean that financial inclusion completely depends on growth. There are also some other factors which can boost our financial market. Internet networking nowadays plays a vital role in our country, a number of internet users are increasing day by day. This research investigates the relationship between financial inclusion and internet user in African and Asian countries by using the data from 2004-2017 in which we applied GMM technique and it is found that they are positively related with each other. As the financial inclusion index value is very low for Asian and African countries explaining that their borrowing and lending are not very good. There is a small number of commercial branches existing in Asian and African countries. If the Central Banks wants to boost the financial market, then they must focus on the contribution of internet services. On the other hand, Financial Inclusion increases economic growth. If there is number of commercial banks increases, then it will be easier for any person to take loan as an investment which will automatically increase the production and employment in the country like Asian and African countries. Along with this corruption are also the barriers in economic growth. Government should maintain the best regulation quality in the country as by doing this we will be able to control the rate of corruption to some extent and this will lead to high financial inclusion in African and Asian countries.

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### **List of Acronyms**

2SLS	Two-Stage Least Square
BBI	Backup Bank of India
BP	Banking Penetration
BS	Banking Service
DUIs	Democratic Union of Integration
FI	Financial Inclusion
FII	Financial Inclusion Index
FIs	Financial Intermediaries
GDP	Gross Domestic Product
GDPPC	Gross Domestic Product per Capita
GMM	Generalized Method of Moment
IRDP	Indian rural Development Programme
IV	Instrumental Variable
MFIs	Member of Institute of Financial Services
NIE	Normalized Inverse of Euclidean
NW	New World
OLS	Ordinary Least Square
QRA	Quantile Regression Approach
RRB	Regional Rural Bank
UK	United Kingdom
UN	United Nation
WB	World Bank
WBGF	World Bank Global Findex
WDI	World Bank Indicators

**APPENDIX:**

**Table 2.** Countries List

<b>Asian Countries</b>	<b>African Countries</b>
Afghanistan	Angola
Azerbaijan	Benin
Bangladesh	Burkina Faso
Brunei Darussalam	Burundi
China	Comoros
Georgia	Congo, Rep.
Israel	Ghana
Kuwait	Guinea
Lesotho	Kenya
Lebanon	Madagascar
Maldives	Mali
Pakistan	Namibia
Philippines	Niger
Qatar	Nigeria
Saudi Arabia	Rwanda
Singapore	Senegal
Thailand	Togo
Turkey	Uganda
Yemen, Rep.	Zambia
	Zimbabwe

**Table 3.** Descriptive Statistics of Model 01  
(Financial Inclusion and Internet Users)

	<b>FII</b>	<b>CPI</b>	<b>EMP</b>	<b>FDI</b>
<b>Mean</b>	0.735505	11.62737	43.04825	4.405921
<b>Median</b>	0.464686	3.1	41.165	2.693041
<b>Maximum</b>	10.06661	87	75.658	54.36463
<b>Minimum</b>	-1.55115	-1.59221	11.417	- 6.057209
<b>Std. Dev.</b>	1.239764	16.95531	15.70752	5.757864
<b>Skewness</b>	4.654388	1.843777	0.294615	3.05535
<b>Kurtosis</b>	27.95409	5.944198	2.41406	18.34228
<b>Jarque-Bera</b>	16137.94	506.5597	15.68048	6204.523
<b>Probability</b>	0	0	0.000394	0
<b>Sum</b>	401.5856	6348.544	23461.3	2405.633
<b>Sum Sq. Dev.</b>	837.6736	156678	134219.1	18068.39
<b>Observations</b>	546	546	545	546

**Table 4.** Correlation Matrix of Model 01 (Financial Inclusion and Internet Users)

	<b>FII</b>	<b>CPI</b>	<b>EMP</b>	<b>FDI</b>
<b>FII</b>	1			
<b>CPI</b>	0.11694	1		
<b>EMP</b>	0.11013	-0.0072	1	
<b>FDI</b>	-0.0723	0.03996	-0.103989	1

**Table 5.** Descriptive Statistics of Model 02 (Economic Growth and Financial Inclusion)

	LN_GDP_	LN_GDPPC_	Reg Qlty	CPI	FII	LNEXP
<b>Mean</b>	10.2387	5.506591	0.184926	11.62737	0.73551	8.87844
<b>Median</b>	9.8326	6.596131	0.177821	3.1	0.46469	8.63943
<b>Maximum</b>	16.32	11.1937	0.319032	87	10.0666	14.7168
<b>Minimum</b>	5.90847	-0.295714	0.148312	-1.592206	-1.5511	0
<b>Std. Dev.</b>	1.9511	3.592269	0.025665	16.95531	1.23976	2.60392
<b>Skewness</b>	0.48808	-0.015105	2.356869	1.843777	4.65439	-0.7017
<b>Kurtosis</b>	3.04637	1.458335	9.968655	5.944198	27.9541	4.91661
<b>Jarque-Bera</b>	21.727	54.09141	1610.279	506.5597	16137.9	127.9
<b>Probability</b>	1.9E-05	0	0	0	0	0
<b>Sum</b>	5590.33	3006.599	100.9695	6348.544	401.586	4829.87
<b>Sum Sq. Dev.</b>	2074.69	7032.896	0.358988	156678	837.674	3681.75
<b>Observations</b>	546	546	546	546	546	544

**Table 6.** Correlation Matrix of Model 02 (Economic Growth and Financial Inclusion)

	LN_GDP_	LN_GDPPC_	Reg Qlty	CPI	FII	LNEXP
<b>LN_GDP_</b>	1					
<b>LN_GDPPC_</b>	0.538959	1				
<b>Reg Qlty</b>	0.006602	0.419143	1			
<b>CPI</b>	0.199106	0.051757	0.0681314	1		
<b>FII</b>	0.140267	0.050533	0.0831581	0.116335	1	
<b>LNEXP</b>	0.795308	0.480142	0.0344079	0.199795	0.0913	1