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The Impact of Internet Connectivity on Financial Inclusion: Comparative Analysis between Developed and Developing Countries

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Abstract: *Financial inclusion collectively develops the economic growth in which persons can start their business or strengthen existing setups by getting loans from banks and any other source of microfinance schemes. Higher value of the index of financial inclusion indicates that there exist availability of better and easy access to the bank account, online payment system, saving, lending, and borrowing for a person. The research is an attempt to provide a comparative study on the impacts of internet connectivity on financial inclusion for developed and developing countries. The objective of the existing research is to analyze the impact of modern technologies like the use of internet connectivity and use of mobile cellular subscriptions on financial inclusion. For this purpose, we make two models separately to study the impact of internet connectivity on financial inclusion in developing and developed countries, and followed by a comparative analysis. In both models, we use the financial inclusion index as a dependent variable for the period 2004 to 2017. Other explanatory variables are Internet users, Employments ratio, Regulatory Quality, Mobile Cellular Subscription, GDP, and Population growth. By employing the econometric technique of random effect and fixed-effect model, the study concluded that for both developed and developing countries financial inclusion index is positively related to internet users. If Internet users increase in an economy, then financial inclusion also increases. At last, we provide some policy implications for creating an environment that contributes to an improvement in financial inclusion.*

Keywords: *Financial Inclusion, Internet connectivity, Fixed Effect, Random Effect.*

Introduction

Financial inclusion (FI) is a method that makes sure the easiness, access, accessibility, and use of the financial system in a formal way by all the members of the economy (Park & Mercado, 2016). Martinez (2011) recognized FI as a significant strategy used by the government to combat and encourage growth by given its capacity to make a possible proficient allocation of productive resources by decreasing the cost of investment. This method can also be identified as an inclusive financing system and it significantly enhances the everyday management of finances and diminish the growth of informal sources of credit (such as lenders), which are often exploited. An inclusive financial system is extensively

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known as a political main concern in many nations with initiatives by financial regulators, the government, and the banking sector (Campiglio et al., 2018).

Izquierdo and Tuesta (2015) define FI as a method of increasing access to formal financial services and decreasing involuntary barriers perceived by those who do not participate in the formal financial system. The International Monetary Fund (IMF) provides another definition, stating that FI is a planned effort to provide financial services to all, particularly the poor. FI focuses on extending financial services to the poor and has received significant attention due to its importance for inclusive growth, which highlights equitable access to opportunities. According to Park and Mercado (2016), "An inclusive financial system is a key element of inclusive growth that broadens families' access to financial services, protects against negative shocks, balances their consumption, and improves their well-being."

The information (IT) revolution has changed every aspect of human life, including the banking sector. IT serves as a medium for growth in the banking sector, supporting banking services, productivity growth, and risk management. IT is a business mechanism that can be used to promote a competitive advantage. In the last decade, financial institutions have made significant investments in building their IT infrastructure, which has enabled them to productively transform their digital banking. It is assumed that business IT investments improve operational efficiency, which leads to an increase in financial performance (Brynjolfsson & Hitt, 2000).

Gareth, Stephen, Hua, and Juan (2016) investigated that banks in Latin America, Europe, Asia Pacific, and North America altogether spent $241 billion on IT in 2016, an overall increase of nearly 4% compared to 2015. To explain the concept of IT investments, we can theoretically divide them into two parts: internal and external objectives. By the term 'internal objectives,' we refer to investments for productivity, risk management, business models, and regulation. IT investments for external purposes relate exclusively to digital financial services (DFS), which are more important from the customer's point of view as they use these services. As a result, the issue of marketing services in general and digital banking, in particular, has grown substantially over the last decade in almost every country in the world.

Graphical Representation of Financial Inclusion Indicators with the Internet in Developed and Developing Countries

First, we illustrate some dimensions of financial inclusion separately with internet users so that we can see the relationship of each dimension with the internet. In the end, we plot to combine the relationship of financial inclusion and internet users in developed and developing countries.

Figure 01 illustrates the relationship between the internet user and ATM cards in developed countries during 2017. This figure shows that in most developed nations there is an inverse relationship between the internet user and ATM cards. The reason is that when a person uses ATM cards to withdraw cash then there is no need for internet and online payments through application or internet do not have any concerns with ATMs. Whereas in some nations including Ireland, Netherlands, and Turkey there exists a positive rela-

tionship between these two variables. On the other hand, Figure 02 illustrates the same relationship in developing countries during 2017 and shows the positive relationship between the internet user and ATM cards. Both variables are moving in the same direction which tells the highly positive relationship.

Figure 1
Relationship of Internet User and ATM in Developed countries during 2017

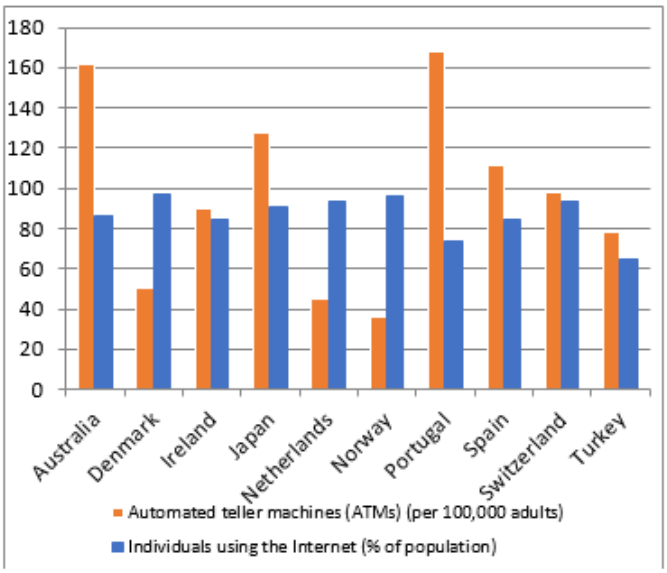


Figure 2
Relationship of Internet User and ATM in Developing countries during 2017

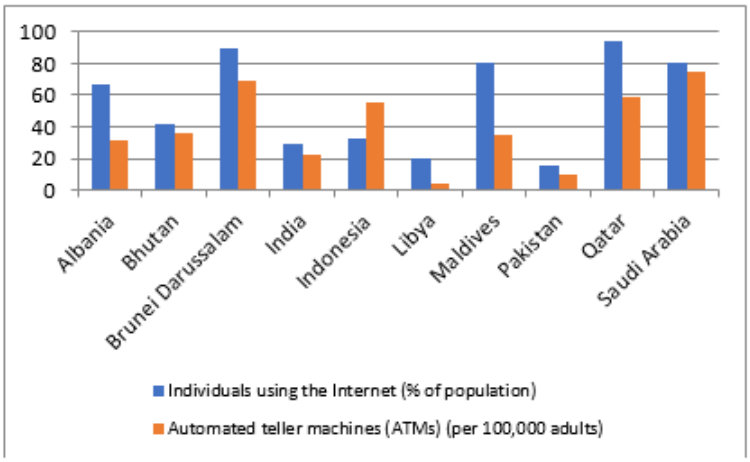


Figure 03 illustrates the relationship between internet users and borrowers from commercial banks in developed countries during 2017. This figure shows a positive trend between the variables. The relationship is positive because banks use their websites for marketing purposes, making information about their services and products easily accessible to clients. This facilitates decision-making for clients when availing services like loans, insurance policies, and other products and accessing terms and conditions.

Figure 3
Relationships of Internet User and Borrowers from commercial banks in Developed countries during 2017

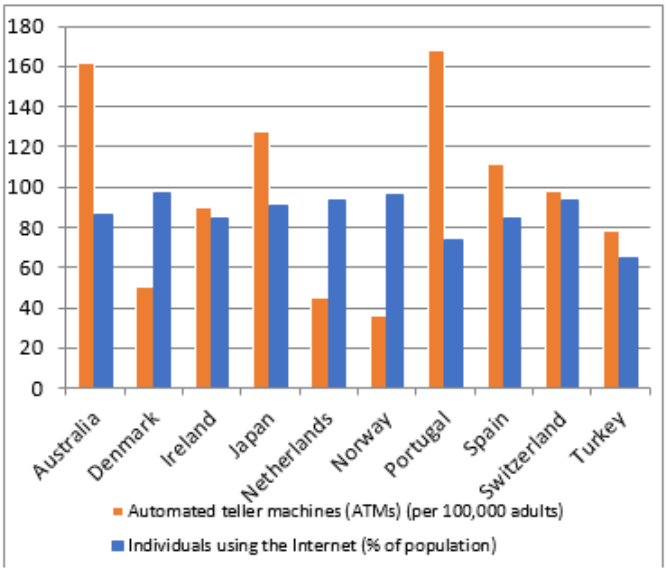


Figure 04 illustrates the relationship between the internet user and domestic credit to the private sector in developed countries during 2017. This figure clearly shows a highly positive relationship between these variables. In the banking sector, credit is usually provided to the private sector, and the main source of communication, such as email, is the internet. Therefore, there is a positive relationship between the number of internet users and the amount of domestic credit provided to the private sector. On the other hand, Figure 05 shows the same relationship in developing countries during 2017, and the same conclusion can be drawn.

Figure 06 and 07 illustrates the relationship between financial inclusion and internet user in developed and developing countries respectively. This trend shows a positive relationship between these two variables. These two variables are concerned with the objectives of the paper that there isa positive relationship between the internet user and financial inclusion. As internet usage increases then the financial inclusion index will also increase in the same direction both in developed and developing countries.

Figure 4
Relationship of Internet User and Domestic credit to the private sector (% of GDP) in developed countries 2017

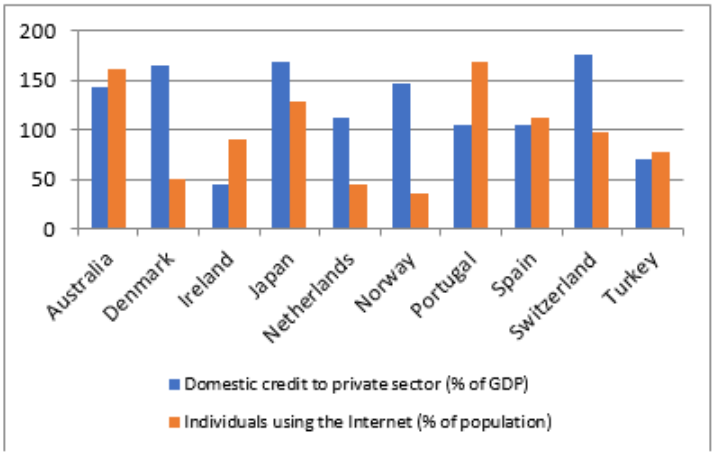


Figure 5
Relationship of Internet User and Domestic credit to the private sector (% of GDP) in developing countries 2017

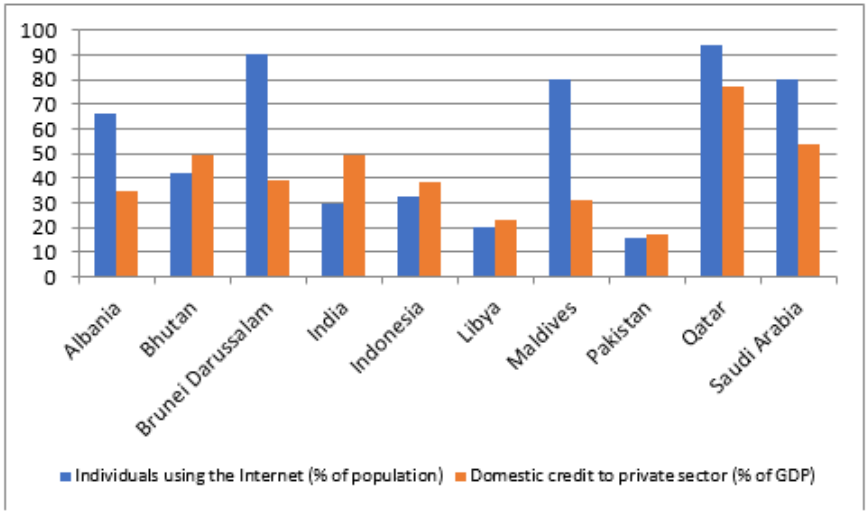


Figure 6
Relationship between Financial Inclusion Index and Internet User in developed countries

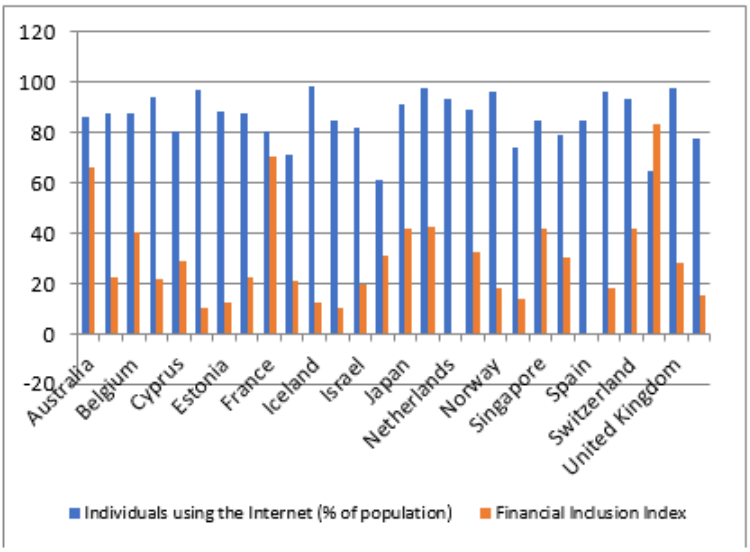
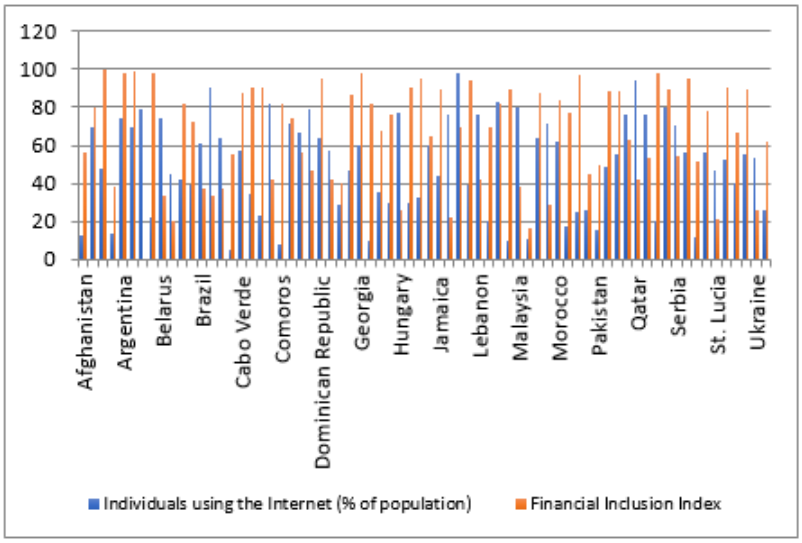


Figure 7
Relationship between Financial Inclusion Index and Internet User in developing countries



The main objective of the paper is to analyze the impact of modern technologies, such as the use of the internet and mobile phones, on financial inclusion. To achieve this, we developed two separate models to study the impact of financial inclusion on developing

and developed economies, and conducted a comparative analysis. Financial inclusion is measured using an index that ranges from 0 to 1. A lower value of the financial inclusion index indicates low financial inclusion or financial exclusion, while a higher value suggests greater financial inclusion in the economy. A value of 1 indicates complete or high financial inclusion. We used financial inclusion as a dependent variable in both models. Nowadays, internet users play a very important role in boosting the environment of financial markets, therefore, they were used as an independent variable. There will be a positive and significant relationship between financial inclusion and internet users. As the number of internet users increases, it will lead to an increase in the financial inclusion index.

In the context of developed and developing countries, while reviewing the previous research studies in the relevant field, to the best of the authors' efforts, no comparative study was found which investigates the impacts of internet connectivity on financial inclusion. The available studies mostly rely on the measurement of financial inclusion index, individual country-based studies, and studies on SAARC, Asian, and African countries. Moreover, there is a lack of current studies covering recent data. This proposed study aims to cover 14 years of data from the period 2004 to 2017. The study will demonstrate that internet usage is a crucial factor that can increase the value of the financial inclusion index.

The structure of the rest of the paper is as follows: Section 2 contains a literature review in which we have incorporated previous pieces of literature that cover the relationship of financial inclusion with different factors such as mobile banking, financial development, education, digital finance, etc. Section 3 contains the theoretical framework in which we have discussed the formulation of financial inclusion. Section 4 contains information about the data sources and methodology used in the study. Section 5 includes the empirical results with their interpretation. Finally, Section 6 contains the conclusion and some effective policy implications.

Literature Review

Ashraf, Karlan, and Yin (2006) confirmed that there are more financial literate people in the economic system; there is a higher level of investment in realistic or productive activities leading to higher production levels, per capita income, and, by extension, economic growth and enhanced economic growth and sustainable development. Besides, Kunt, Beck and Honohan (2008) examined that countries with large financial systems get a faster decrease in the percentage of the population living less than 1$ per day. The change in financial development can explain nearly 30% of the diversity between countries in the evolution of poverty rates.

Financial market imperfections such as transaction costs and information asymmetries are likely to limit the poor to the "poverty trap", decreasing their chances and leading to continued inequality and slowing growth. Education in Vietnamese families is directly linked to financial development. Their results also suggested that household saving is directly related to a fixed asset, education, and family size. On the other hand, some

factors which persuade financial development are social relationships, location, wealth, family size, age of the family, and kinship groups. The FI of an economy is measured by the percentage of the population covered by bank branches and ATMs, as well as the number of deposits and loans granted by families and low-income families.

The empirical literature on financial inclusion is primarily based on national or regional analyses using primary survey data. Sarma (2008) conducted cross-sectional empirical research and identified several factors that contribute significantly to financial inclusion, including development, income levels for human development, inequality, literacy, urbanization, physical infrastructure for connectivity and information, and impaired assets such as the percentage of total assets and the capital ratio of the banking system. Seghers, Manigart, and Vanacker (2012) examined how the human and social capital of entrepreneurs affect their knowledge of financial alternatives, finding that entrepreneurs with commercial and financial training had better knowledge of financial products, while basic education had no influence. The researchers also suggested that supply factors tend to be more important in the financial literature, indicating that funding is due to asymmetric information and not the result of small businesses and small and poor debtors. However, factors that are the result of low or insufficient human capital and which could limit borrowers' demand were not examined.

Klein and Mayer (2011) suggest that the use of mobile phones not only influences financial regulation policies in developing and emerging countries, but also provides an overview of the main reasons for market failures and shows the regulatory measures required for correction. The researchers also believe that the users of mobile phones and the Internet form a good social network for people. Khan et al. (2011) believe that in Nigeria, policymakers have recognized FI as a true instrument for achieving sustainable growth and development. There is considerable evidence in the literature that nations with high FI rates tend to reach a high level of growth and economic development. On the other hand, Dacanay, Nito, and Buensuceso (2011) conducted an empirical analysis on the international perception of FI, microfinance, and financial development for 80 nations. By incorporating the Sarma (2008) FI index, their results concluded that the extent of microfinance has a significant and positive relationship with FI, there is a significant and positive relationship between FI and financial development, and the FI index of the microfinance sector has a somewhat significant relationship with the financial development index and GDP. Concluding their results, they claimed that there is a succession of relationships between microfinance, FI, and financial development, and they suggest the joint consideration of these variables.

Aduda and Kalunda (2012) investigated between FI and financial sector strength in the Kenya country. Exploratory studies have revealed that FI is a requirement for economic growth and development in Kenya, as various FI programs affect Kenya's financial stability. This research shows that the government must improve its FI policy in order to increase access to financial services, particularly for those in the informal sector. Munyange (2012) examined the factors that determine FI: the case of mobile money transfer services in Nairobi. The main objective of this research was to examine the factors that determine the use of mobile financial services in Kenya. Their study includes a sample of the central business district of Nairobi. The econometric technique of a multinomial logit model was

used to analyze the three types of financial services, including mobile money transfers, mobile payments, and mobile banking services based on several independent variables such as age, gender, and educational level Service fee and volume of transactions. Their result suggested that the use of more sophisticated financial services (mobile payments and mobile banking) depends on the gender, education, and wealth of people, as well as service rates and transaction volumes. The study recommended developing financial products and services that are sensitive to gender and low income, as well as increasing knowledge of financial services in both urban and rural areas.

Maity and Sahu (2018) conducted research on commercial banking, FI, and economic growth in India. The main purpose of their study was to identify the state of FI in India. Their research found a relationship between FII and socio-economic variables and suggested that 72.7% of the 89.3 million farmer families were excluded from official sources of funding. Additionally, 85.0% of rural area banks and 59.9% and 74.7% of private sector banks had increased in 2011 compared to the previous year's levels (respectively, 72.9%, 58.3%, and 72.7%). No Indian state was part of a group of high FIIs; both Chandigarh and Delhi belonged to medium-sized FIIs, and the other states had low IFI values. Mbutor and Uba (2013) found that increasing FI promotes and improves the efficiency of monetary policy.

JishaJoseph and Varghese (2014) analyzed the importance of FI in the growth of the Indian economy. This study examined the activities of 5 private banking sector and 5 public owned banks from the period June to November 2013. The dimensions that paper has used for FI are the use of ATMs, the number of commercial bank branches, credit cards, and debit cards of their customers, with a focus in rural and semi-urban regions in India. They found that a few individuals were still barred from financial services even after the introduction of inclusive banking plan in the nation.

Chitokwindo, Mago, and Hofisi (2014) used qualitative data in the Masvingo region in Zimbabwe by taking a survey, and their study suggested that economically disadvantaged people have introduced mobile banking to Zimbabwe because it is easily available, quick, low-cost, and safe. Migap, Okwanya, and Ojeka (2015) argue that Financial Inclusion (FI) is a crucial growth strategy for Nigeria. They evaluate Nigeria's FI index in comparison to other high middle-income countries and find that Nigeria's FI is better than that of developing countries both in Africa and outside of it. The researchers also conclude that the media and educational institutions need to play an active role in promoting financial education in Nigeria.

Nkwede (2015) investigated the relationship between FI and economic growth in Africa by incorporating the case study of Nigeria and took the period from 1981-2013. The study concluded that there is a negative relationship between FI and the growth of the Nigerian economy, which leads to a high level of financial exclusion of adults from financial services.

Park and Mercado (2015) investigated the relationship between FI and income inequality in Asia. The Asian Economic Development Study sought to determine the country-specific factors and macroeconomic variables that influence the level of FI of 37 less developed nations in Asia. They found that both demographic factors and per capita income have a positive and significant impact on FI. Babajide, Adegboye, and Omankhanlen

(2015) analyzed that FI is a crucial factor for capital per worker and the production factor as a whole, which determines the level of the final product in the country.

Allen et al. (2014) used data from 123 countries and a sample of more than 124,000 people. Their results suggest that more FI is linked to a situation that is conducive to accessing financial services, such as weak documentation to open an account and lower bank costs. They also suggested some policies to enhance FI for rural areas. In particular, their findings suggest that politics has to play a role in expanding financial usage. Siddik, Sun, Kabiraj, Shanmugan, and Yanjuan (2016) analyzed their study in Bangladesh from 2003 to 2013 with panel data from 13 banks. Their research found that the electronic banking system has a direct impact on banking performance and that the electronic banking system played a crucial role in boosting economic growth. These results suggested that the extent to which mobile banking services are used can influence the formulation of fiscal policies in less developed nations.

Ghosh (2016) did research by covering 14 main Indian states and their study found that the penetration of the mobile phone had a direct impact on the economic growth of the country and had a positive impact on FI. Ouma, Odongo, and Were (2017) took a survey in some sub-Saharan countries. Their study found that using cell phones has increased household and low-income family savings. This increase in deposits and savings was a sign of greater FI, which ultimately has a positive and significant impact on the country's financial health.

Methodology

Financial inclusion can be assessed using various indicators, such as the number of bank accounts per 1000 adults, number of bank branches per million people, number of ATMs per million people, and bank credit to deposit ratio. However, these indicators may not provide a complete picture of economic inclusion. To address this, we propose a multi-dimensional approach to measuring inclusive financial systems (IFI), similar to the approach taken by United Nation Development Program(UNDP) in constructing indexes such as House price index (HPI), Gender development index (GDI), and Human development index (HDI).

In this study, we use Sarma (2008)'s technique to construct the FII, which is based on three indicators: number of ATMs per 100,000 adults, commercial bank branches per 100,000 adults, and domestic credit to GDP ratio. These indicators represent banking services, banking penetration, and usage of banking. We obtained the FI indicators from the World Bank Development Indicators dataset for the period 2004-2017. The first step in calculating financial inclusion is to determine its dimensions using this procedure.

$$d_i = \frac{A_i - m_i}{M_i - m_i} \tag{1}$$

To calculate the dimension of financial inclusion for a country, we first need to determine its actual value, denoted as Ai, as well as the minimum value (mi) and maximum

value (Mi) for that dimension. Using these values, we can calculate the Euclidean distance (di) between the actual value and the ideal point (l), which is equal to 1. We then take the normalized inverse of this distance to obtain the index of financial inclusion for that country. This can be expressed using the following formula:

$$FII_i = 1 - \sqrt{((1-d_i)^2 + (1-d_2)^2 + (1-d_3)^2 + ...(1-dn)^2}/\sqrt{n} \quad (2)$$

Equation (2) uses the dimension calculated in equation (1), denoted as "di". The formula allows us to determine the financial inclusion index, with a value that ranges from 0 to 1. A higher index value signifies a more inclusive financial system in a given country, while a lower index indicates a less inclusive system.

The dimensions used in this calculation are as follows: 1. d1: Number of ATMs per 100,000 adults 2. d2: Number of commercial bank branches per 100,000 adults 3. d3: Domestic credit to GDP ratio.

Model Specification

In this paper, The same model is run separately to compare the case of developed and developing countries. Equation (3) shows the model of developed countries.

$$FII_{it} = \beta_0 + \beta_1 IIU_{it} + \beta_2 EMP_{it} + \beta_3 MSC_{it} + \beta_4 GDP_{it} + \beta_5 RQLT_{it} + \beta_6 POP_{it} + \mu \quad (3)$$

Where, FII_{it} = Financial Inclusion Index of Developed countries at time t. IIU_{it} = Individual Internet User of Developed countries at time t. EMP_{it} = Employment to Population of Developed countries at time t. MSC_{it} = Mobile Cellular Subscription of Developed countries at time t. GDP_{it} = Gross Domestic Product of Developed countries at time t. $RQLT_{it}$ = Regulatory Quality of Developed countries at time t. POP_{it} = Population of Developed countries at time t.

Equation (4) shows the model of developed countries.

$$FII_{it} = \beta_0 + \beta_1 IIU_{it} + \beta_2 EMP_{it} + \beta_3 MSC_{it} + \beta_4 GDP_{it} + \beta_5 RQLT_{it} + \beta_6 POP_{it} + \mu \quad (4)$$

Where, FII_{it} = Financial Inclusion Index of Developing countries at time t. IIU_{it} = Individual Internet User of Developing countries at time t. EMP_{it} = Employment to Population of Developing countries at time t. MSC_{it} = Mobile Cellular Subscription of Developing countries at time t. GDP_{it} = Gross Domestic Product of Developing countries at time t. $RQLT_{it}$ = Regulatory Quality of Developing countries at time t. POP_{it} = Population of Developing countries at time t.

Data Sources and Econometric Technique

In this paper, we created two separate panels consisting of 25 developed and 70 developing countries, as well as Pakistan, and performed a comparative analysis between these

two economies. The period covered in the analysis was from 2004 to 2017. The dependent variable in both models was the FII, which is our calculated index incorporating the methodology of Sarma (2008) with three dimensions: 1) number of ATMs per 100,000 adults, 2) commercial bank branches per 100,000 adults, and 3) domestic credit to GDP ratio. All the dimensions of FI were obtained from the World Bank. The explanatory variables used were: 1) individuals using the Internet (% of the population), 2) employment to population, total (%), 3) mobile cellular subscriptions, 4) population, 5) GDP, and 6) Regulatory Quality (capitalized as it is a proper noun). All the dimensions of FI were obtained from the WDI.

Random effects models are statistical models that incorporate some parameters or effects that have some form of random variation. These models describe the variation of observed variables in terms of both systematic and unsystematic components. In contrast to fixed-effects models, where systematic effects are considered non-random, random-effects models incorporate some random systematic effects. When a model includes both fixed and random effects, it is referred to as a mixed-effects model. Randomness in these models typically arises from the random sampling of units in the data collection process. Random effects models are useful when effects can have different values for each sampled unit, which makes it natural to consider them as random effects.

Fixed-effects models have only one source of random variability, which is the random sample used to measure the variables. This variability can arise from individual patients in a health center or students in a school system. The variability is called the "residual" variance of individuals and represents the variability not explained by the model's fixed effects.

Generalized mixed linear or linear effects models are different as they have more than one source of random variability. For instance, in patient data, there may be random variability among the doctors treating the patients, in addition to the variability among the patients. Incorporating random effects allows us to account for differences in outcomes for patients treated by different doctors. This variability is accounted for through random gradients that allow the fixed effects to vary for each doctor.

Random effects are usually discussed in terms of variability, rather than individual effects. This approach allows us to make more general inferences about the larger patient population, independent of a particular doctor. By integrating physician-to-physician variability in inpatient recovery, we can improve our ability to describe how fixed effects are linked to outcomes.

Empirical Analysis

The descriptive statistics and correlation matrices of all variables are reported in Table 6 and Table 7 for developing countries. The descriptive statistics and correlation matrices of all variables are reported in Table 8 and Table 9 for developed countries. To achieve the objectives of our study, we first analyzed the model for developing countries. For this purpose, we created a panel of 70 countries that are based on developing countries and another panel of 25 countries that are based on developed countries for the period

2004 to 2017. We estimated the model for developing countries and obtained the results of pooled OLS regression, random effect, and fixed-effect models, which are shown in Table 01. Next, we analyzed the second model for a developed country. The model was estimated for a developed country, and the results obtained from pooled OLS regression, random effect, and fixed effect models are shown in Table 02. Lastly, we also estimated a case of Pakistan, which is a time series analysis from the period 2004 to 2017, by applying the co-integration technique, and the results are shown in Table 03.

Table 1
Results for Financial Inclusion and Internet User (Developing Countries Case)

	Result of Pooled Ordinary Least Square	**Result of Random Effect Model**	**Result of Fixed Effect Model**
Variables	**Coefficients**	**Coefficients**	**Coefficients**
IIU	0.34*	0.31*	0.10*
	-6.73	-6.91	-1.9
MCS	0.37*	0.44*	0.35*
	-15.99	-21.27	-11.14
LGDP	-11.33*	-11.49*	18.69*
	(-11.88)	(-11.67)	-6.07
LPOP	10.88**	11.13*	15.72**
	-11.44	-11.29	-1.84
EMP	0.10*	0.11**	1.35*
	-2.09	-1.96	-6.87
RQ	-1.53	2.26***	2.07
	(-1.34)	-1.86	-0.62
R-square Value:	0.36	0.42	0.61

Note: Values in bracket represent the T-statistics
*, ** and *** Shows significant at 1% level, 5% level and *** 10% level of significance.
Source: Author's Calculation

Table 1 shows the results of the pooled Ordinary Least Squares, random effects, and fixed effects models for the relationship between financial inclusion and internet usage in developing countries. The sample consists of 70 countries over the period from 2004 to 2017, and the explanatory variables include internet users, mobile cellular subscriptions, GDP, employment, regulatory quality, and population. According to the results of the pooled OLS model and random effects regressions, internet users, mobile cellular subscriptions, GDP, employment along with population and regulatory quality are significant at the 1%, 5% and 10% level of significance. The fixed effects regression results are in accordance with OLS and random effects regression results. Based on the Hausman test (see Table 10 in the appendix), the random effects model is found to be more appropriate than the fixed effects model for developing countries.

The estimated coefficient of individual internet users has a positive and significant effect on financial inclusion in all cases (Pooled OLS, Random effect, and Fixed Effect). The results indicate that internet users are the key variable contributing to the betterment of financial inclusion in developing countries. Nowadays, financial inclusion is a targeted indicator in most countries because it ensures the ease of access, availability, and use of the formal financial system by all members of an economy, thereby reducing poverty and facilitating access to loans. Martinez (2011) identified financial access as an important policy tool used by governments to combat and stimulate growth due to its ability to facilitate

efficient allocation of productive resources and reduce the cost of capital. To achieve high levels of financial inclusion, we need to consider the role of individual internet users. When people have easy access to the internet, online transactions, payments, shopping, banking, and more will increase, leading to an increase in the financial inclusion index.

The estimated coefficient of Mobile Cellular Subscription (MCS) has a positive and significant effect on financial inclusion in all cases (Pooled OLS, Random effect, and Fixed Effect). The results indicate that there is a two-way relationship between MCS and financial inclusion. Economic growth depends on quality infrastructure, which mainly includes communication and power. MCS includes the number of postpaid subscriptions and prepaid accounts, which make it easier to access banks. In the financial inclusion index, we consider several dimensions such as banks, ATMs, bank accounts, borrowing, and lending. If the MCS facility is available to all banks, then they can perform their work in an appropriate manner, which will help boost the financial inclusion index. Through MCS, account holders receive updates on every transaction by SMS and also receive information about services and products via SMS.

The estimated coefficient of GDP has a negative and significant effect on financial inclusion in all cases (Pooled OLS and Random effect) and a positive and significant effect on financial inclusion in the case of fixed effect. The relationship between financial inclusion and GDP can be positive or negative. Many types of research have been conducted to prove both relationships (positive and negative). After reviewing several empirical studies, it is assumed that financial inclusion boosts economic growth, but this assumption is not always valid. Most researchers claim that a weak financial system, inappropriate policies, and limited access to financial instruments hinder the significant financial impact on growth. Barajas, Chami, and Yousefi (2013) suggest that there may not be a positive link between financial inclusion and growth for the entire economic system. On the other hand, Odedokun (1998) claimed that financial inclusion and economic growth are positively related to each other in developing countries regardless of the level of economic development. Furthermore, Mehrotra et al. (2009) analyzed that when financial banking systems are accessible to people, they can deposit their money in formal financial institutions, which can promote economic growth through the multiplier effect.

The population coefficient has a positive and significant effect on financial inclusion in all cases. Developing countries have a high proportion of young people who aspire for financial inclusion. An increasing population contributes to economic productivity, leading to an environment for lending, borrowing, and investment, which increases the financial inclusion index.

The employment coefficient has a positive and significant effect on financial inclusion in all cases. An increase in employment ratio leads to greater involvement in the banking system for lending, borrowing, and ATM purposes, indicating greater financial inclusion. In advanced economies, employment provides pay and benefits such as health insurance. Functioning financial markets can mobilize national savings and allocate capital to companies with high return potential. Financial mediation promotes economic growth, creates jobs, and leads to higher wages. Globally, institutions use bank accounts to pay employee salaries, leading to an increase in bank users.

Table 2 shows the results of pooled OLS regression, random effect, and fixed effect

of financial inclusion and internet user relationship for developed countries that consist of a panel of 25 countries for the period from 2004 to 2017. The explanatory variables are Internet users, Mobile Cellular Subscription, GDP, Employment, regulatory quality, and Population. According to the result of the pooled OLS and Random effect model; Internet users, Mobile Cellular Subscription, and GDP are significant at a 1% level of significance. On the other hand, the population is significant at 5% level of significance. The result of the Fixed Effect model shows that GDP, population, and Employment are significant at a 1% significance level and Mobile Cellular Subscription is significant at a 5% level of significance. In the case of developed countries, the random effect result is more appropriate than the fixed effect based on the Hausman test (see table-11 in appendix).

Table 2
Results for Financial Inclusion and Internet User (Developed Countries Case)

	Result of Pooled Ordinary Least Square	**Result of Random Effect Model**	**Result of Fixed Effect Model**
Variables	**Value of Coefficients**	**Value of Coefficients**	**Value of Coefficients**
IIU	0.55*	0.33*	0.001
	-2.65	-3.49	-0.0005
MCS	0.33*	0.26*	0.20**
	-3.26	-3.63	-1.93
LGDP	26.09*	10.58*	48.28*
	-3.83	-2.32	-5.68
LPOP	112.28	9.50**	140.4*
	-1.45	-1.98	-3.75
EMP	0.28	0.2	1.07*
	-0.97	-1.52	-3.53
RQ	5.45	3.45	9.84
	-1.04	-0.74	-1.26
R-square Value:	0.76	0.58	0.31

The estimated coefficient of individual internet users has a positive and significant effect on financial inclusion in both cases (Pooled OLS and Random effect). Ozili (2018) analyzed that there is a positive effect of digital finance on financial inclusion for both developed countries and emerging markets. In developed countries, financial inclusion plays a crucial role in social inclusion, including health, education, employment, and housing. Internet usage or digital finance is relatively more prevalent in developed countries compared to developing countries because developed nations are more advanced in using advanced technologies. Therefore, internet users play a highly significant role in financial inclusion.

The estimated coefficient of Mobile Cellular Subscription has a positive and significant effect on financial inclusion in all cases (Pooled OLS, Random effect, and Fixed Effect). The results indicate that by using MCS, a bank can convey all the details of a client's account activities, such as transaction alerts, bank statements, and other information, which ultimately helps boost financial inclusion. The estimated coefficient of GDP has a positive and significant effect on financial inclusion in all cases (Pooled OLS and Random effect). By reviewing much empirical research, it is assumed that financial inclusion boosts economic growth. According to Sethi and Acharya (2018), there is a long-term and positive relationship between FI and economic growth. This paper also suggests that governments

should prioritize the financial sector to increase the value of the financial inclusion index, which results in economic growth in a country.

The estimated coefficient of the population has a positive and significant effect on financial inclusion in both cases (Random effect and Fixed Effect). In developed countries, per-capita income is higher than in developing countries, which means that more people in developed countries have access to formal bank accounts and can use debit and credit cards. Therefore, as the population increases, the number of financial service users also increases, which boosts the value of IFI.

The Fixed Effect result shows that the estimated coefficient of employment has a positive and significant effect on financial inclusion. According to Sarma (2008); Yorulmaz (2016); Wokabi (2018), all of whom analyzed the relationship between unemployment and FI, the results suggest that there is a negative and significant effect of unemployment on FI.

Table 3
Results for Financial Inclusion and Internet User (Pakistan Country Case)

Ordinary Least Square	
Variables	**Value of Coefficient**
IIU	0.34*
	-6.73
MCS	0.37*
	-15.99
LGDP	-11.33*
	(-11.88)
LPOP	10.88**
	-11.44
EMP	0.10*
	-2.09
RQ	-1.53
	(-1.34)
R-square Value:	0.36

Table 3 shows the results of a pooled OLS regression of the relationship between financial inclusion and internet usage for Pakistan, covering the period from 2004 to 2017. The explanatory variables include internet users, mobile cellular subscriptions, GDP, employment, regulatory quality, and population. According to the results of the pooled OLS, internet users, mobile cellular subscriptions, GDP, and employment are significant at a 1% level of significance, while population is significant at a 5% level of significance. The estimated coefficient for individual internet users has a positive and significant effect on financial inclusion, which is a key variable targeted by the State Bank of Pakistan to drive economic growth. The government of Pakistan should consider other factors that indirectly affect the financial inclusion index, with internet usage being a key factor contributing to its increase. In the past, conventional banking was not widely accepted due to religious prohibitions on interest rates, but Islamic banking is gaining popularity and has become a key factor in increasing financial inclusion in Pakistan. The dimensions used to calculate the financial inclusion index are the same for both conventional and Islamic banking systems, including the use of ATMs, the number of accounts, online transactions, and borrowing from a bank. We found a positive and significant relationship between em-

ployment, GDP, population, and financial inclusion, which is consistent with the results of our models for developed and developing countries.

Conclusion and Policy Recommendation

This paper examines the effects of internet connectivity on financial inclusion for a panel of 25 developed countries and 70 developing countries during the period from 2004 to 2017. We also investigate the impact of other relevant macroeconomic factors, including employment, economic growth, population, mobile cellular subscriptions, and regulatory quality. To estimate the effect of internet users on financial inclusion, we employ Pooled Ordinary Least Squares, Random Effects, and Fixed Effects techniques. Our research finds that internet connectivity, employment, mobile cellular subscriptions, population, and economic growth have favorable effects on financial inclusion in both developed and developing countries. We further estimate the effect of internet connectivity on financial inclusion for the case of Pakistan using the OLS technique and find that internet users play a key role in increasing financial inclusion. The estimates suggest that internet connectivity expands economic activity by facilitating access to and use of the formal financial system by all members of an economy. Therefore, achieving high levels of financial inclusion requires considering the role of individual internet users, as increased access to the internet leads to more online transactions, payments, shopping, banking, etc., ultimately increasing the financial inclusion index.

Effective policies have been suggested that make it easier to track the status of internet users, telecommunications, mobile phones, and digital technologies, which provide opportunities for expanding financial services into previously undeserved markets and increasing financial inclusion. While technology is only one factor in improving financial inclusion, low savings rates in many countries, as documented by data in the Global Financial Inclusion Database (Findex), demonstrate that people generally prefer spending today over saving for tomorrow. Therefore, increasing the saving environment in a country is crucial. There are several ways to promote financial inclusion, but this discussion focuses on the link between internet connectivity and financial inclusion. To achieve this, the government can allow more financial institutions to operate online and promote mobile account banking, which is easy and affordable for every segment of society compared to applications used for online transactions provided by different financial institutions. These services are easy to use, have low transaction costs, and are low-cost to set up. By promoting these simple modes of transactions, dealing in cash in underground economies can be reduced, giving the government access to the flow of the economy.

References

Aduda, J., & Kalunda, E. (2012). Financial inclusion and financial sector stability with reference to Kenya: A review of literature. *Journal of Applied Finance and Banking*, *2*(6), 95-120.

Allen, F., Carletti, E., Cull, R., Qian, J., Senbet, L., & Valenzuela, P. (2014). Resolving the african financial development gap: Cross-country comparisons and a within-country study of Kenya. In *African Successes, Volume III: Modernization and Development* (pp. 13–62). University of Chicago Press.

Ashraf, N., Karlan, D., & Yin, W. (2006). Tying odysseus to the mast: Evidence from a commitment savings product in the Philippines. *The Quarterly Journal of Economics*, *121*(2), 635–672.

Babajide, A. A., Adegboye, F. B., & Omankhanlen, A. E. (2015). Financial inclusion and economic growth in Nigeria. *International Journal of Economics and Financial Issues*, *5*(3), 629–637.

Barajas, M. A., Chami, M. R., & Yousefi, M. R. (2013). *The finance and growth nexus re-examined: Do all countries benefit equally?* International Monetary Fund.

Brynjolfsson, E., & Hitt, L. M. (2000). Beyond computation: Information technology, organizational transformation and business performance. *Journal of Economic Perspectives*, *14*(4), 23–48.

Campiglio, E., Dafermos, Y., Monnin, P., Ryan-Collins, J., Schotten, G., & Tanaka, M. (2018). Climate change challenges for central banks and financial regulators. *Nature Climate Change*, *8*(6), 462–468.

Chitokwindo, S., Mago, S., & Hofisi, C. (2014). Financial inclusion in Zimbabwe: A contextual overview. *Mediterranean Journal of Social Sciences*, *5*(20), 415.

Dacanay, J. C., Nito, B., & Buensuceso, P. (2011). Microfinance, financial inclusion and financial development: An empirical investigation with an international perspective. In *Proceedings of the International Conference on Managing Services in the Knowledge Economy, Universidade Lusíada de Famalicão, Vila Nova de Famalicão, Portugal* (pp. 153–173).

Gareth, L., Stephen, G., Hua, Z., & Juan, M. (2016). *Global tech spending forecast: Banking edition* (Tech. Rep.). Technical Report, Celent.

Ghosh, S. (2016). Does mobile telephony spur growth? evidence from Indian states. *Telecommunications Policy*, *40*(10-11), 1020–1031.

Izquierdo, N. C., & Tuesta, D. (2015). Factors that matter for financial inclusion: Evidence from Peru. *Aestimatio: The IEB International Journal of Finance*(10), 10–31.

JishaJoseph, M., & Varghese, T. (2014). Role of financial inclusion in the development of Indian economy. *growth*, *5*(11).

Khan, H., et al. (2011). Financial inclusion and financial stability: are they two sides of the same coin. *Address by Shri HR Khan, Deputy Governor of the Reserve Bank of India, at BANCON*, 1–12.

Klein, M. U., & Mayer, C. (2011). Mobile banking and financial inclusion: The regulatory lessons. *World Bank Policy Research Working Paper*(5664).

Maity, C., & Sahu, T. N. (2018). Bank branch expansion and financial inclusion: Evidence from selected commercial banks in India. *Al-Barkaat Journal of Finance & Management*, *10*(1), 48–65.

Martinez, M. V. (2011). *The political economy of increased financial access* (Unpublished doctoral dissertation). Georgetown University.

Mbutor, M. O., & Uba, I. A. (2013). The impact of financial inclusion on monetary policy in Nigeria. *Journal of Economics and International Finance*, *5*(8), 318–326.

Migap, J., Okwanya, I., & Ojeka, G. (2015). Financial inclusion for inclusive growth: The nigerian perspective. *International Journal of Information Technology and Business Management*, *37*(1), 1–8.

Munyange, M. M. (2012). *The influence of the provision of mobile money transfer service on the socio-economic status of the service providers: Case study of central business district, Kenya* (Unpublished doctoral dissertation). University of Nairobi.

Nkwede, F. (2015). Financial inclusion and economic growth in Africa: Insight from Nigeria. *European Journal of Business and Management*, *7*(35), 71–80.

Ouma, S. A., Odongo, T. M., & Were, M. (2017). Mobile financial services and financial inclusion: Is it a boon for savings mobilization? *Review of development finance*, *7*(1), 29–35.

Ozili, P. K. (2018). Impact of digital finance on financial inclusion and stability. *Borsa Istanbul Review*, *18*(4), 329–340.

Park, C.-Y., & Mercado, R. (2015). Financial inclusion, poverty, and income inequality in developing Asia. *Asian Development Bank Economics Working Paper Series*(426).

Park, C.-Y., & Mercado, R. V. (2016). Does financial inclusion reduce poverty and income inequality in developing Asia? *Financial inclusion in Asia: Issues and Policy Concerns*, 61–92.

Sarma, M. (2008). *Index of financial inclusion* (Tech. Rep.). Working paper.

Seghers, A., Manigart, S., & Vanacker, T. (2012). The impact of human and social capital on entrepreneurs' knowledge of finance alternatives. *Journal of Small Business Management*, *50*(1), 63–86.

Sethi, D., & Acharya, D. (2018). Financial inclusion and economic growth linkage: Some cross country evidence. *Journal of Financial Economic Policy*, *10*(3), 369–385.

Siddik, M. N. A., Sun, G., Kabiraj, S., Shanmugan, J., & Yanjuan, C. (2016). Impacts of e-banking on performance of banks in a developing economy: empirical evidence from Bangladesh. *Journal of Business Economics and Management*, *17*(6), 1066–1080.

Wokabi, V. W. (2018). *Determinants of financial inclusion in East Africa* (Unpublished doctoral dissertation). Kca University.

Yorulmaz, R. (2016). Construction of a financial inclusion index for the member and candidate countries of the European Union. *Sayıştay Dergisi*(102), 91–106.

Table 4
List of Developed Countries

1	Australia	15	Japan
2	Austria	16	Luxembourg
3	Belgium	17	Netherlands
4	Canada	18	New Zealand
5	Cyprus	19	Norway
6	Denmark	20	Portugal
7	Estonia	21	Singapore
8	Finland	22	Slovenia
9	France	23	Spain
10	Greece	24	Sweden
11	Iceland	25	Switzerland
12	Ireland	26	Turkey
13	Israel	27	United Kingdom
14	Italy	28	United States

Table 5
List of Developing Countries

1	Afghanistan	38	Kazakhstan
2	Albania	39	Kenya
3	Algeria	40	Kuwait
4	Angola	41	Kyrgyz Republic
5	Argentina	42	Lebanon
6	Armenia	43	Libya
7	Azerbaijan	44	Macao SAR, China
8	Bangladesh	45	Madagascar
9	Belarus	46	Malaysia
10	Belize	47	Malta
11	Bhutan	48	Mauritius
12	Botswana	49	Mexico
13	Brazil	50	Moldova
14	Brunei Darussalam	51	Morocco
15	Bulgaria	52	Mozambique
16	Burundi	53	Nicaragua
17	Cabo Verde	54	Nigeria
18	Cambodia	55	Pakistan
19	Cameroon	56	Peru
20	Chile	57	Philippines
21	Comoros	58	Poland
22	Costa Rica	59	Qatar
23	Croatia	60	Russian Federation
24	Czech Republic	61	Rwanda
25	Dominican Republic	62	Saudi Arabia
26	Ecuador	63	Serbia
27	Eswatini	64	Seychelles
28	Fiji	65	Solomon Islands
29	Georgia	66	South Africa
30	Guinea	67	St. Lucia
31	Guyana	68	Thailand
32	Honduras	69	Tonga
33	Hungary	70	Tunisia
34	India	71,	Uganda
35	Indonesia	72	Ukraine
36	Iran, Islamic Rep.	73	Zambia
37	Jamaica		

Table 6
Descriptive Statistics of Developing Countries

	FII	EMP	IIU	GDP	POP	MCS	RQ
Mean	48.4156	36.02572	28.41788	10.39421	2.225063	82.36838	-0.17929
Median	48.2512	35.123	22.82856	10.51412	2.322901	79.94102	-0.27608
Maximum	99.84734	78.412	97.99999	14.79103	7.199813	321.803	1.781477
Minimum	-0.11854	0	0.105809	5.435285	-2.49526	0.654559	-2.27446
Std. Dev.	27.5057	14.72982	23.28567	2.039298	1.931898	47.62316	0.714927
Skewness	-0.00241	0.549075	0.657389	-0.0869	-0.24996	0.680512	0.238393
Kurtosis	1.97111	3.613838	2.360086	2.321183	2.907078	4.901362	2.80983
Jarque-Bera	45.08031	67.39789	90.69235	20.90834	11.01001	232.8271	11.2203
Probability	0.000	0.000	0.000	0.000029	0.004066	0.000	0.003661
Sum	49480.74	36818.29	28929.41	10622.88	2274.014	84180.48	-183.232
Sum Sq. Dev.	772451.6	221524.1	551440.3	4246.071	3810.605	2315593	521.8536

Table 7
Correlation Matrix of Developing Countries

	FII	EMP	IIU	GDP	POP	MCS	RQ
FII	1						
EMP	-0.128	1					
IIU	0.400756	-0.29708	1				
GDP	0.118238	-0.08412	0.346493	1			
POP	0.023328	0.155553	-0.09664	0.813948	1		
MCS	0.51223	-0.27846	0.747262	0.373909	-0.03791	1	
RQ	0.131885	-0.10364	0.467463	0.193496	-0.10868	0.431521	1

Table 8
Descriptive Statistics of Developed Countries

	FII	IIU	GDP	POP	MCS	GE	EMP
Mean	49.1765	73.00723	12.88694	2.323055	113.0226	1.482486	41.88185
Median	47.60203	76.6	12.87156	2.186152	111.6602	1.584496	40.636
Maximum	97.6172	98.28003	16.78518	5.786036	172.1787	2.436975	77.571
Minimum	-0.11854	14.58	9.397583	-1.23075	47.01181	0.008839	12.313
Std. Dev.	22.20179	17.72182	1.629929	1.609726	21.44751	0.509315	14.53247
Skewness	0.049527	-0.94009	-0.08793	-0.06254	0.040044	-0.86868	0.130885
Kurtosis	2.202248	3.43744	2.824913	2.706511	3.275782	3.273449	2.126641
Jarque-Bera	10.55493	60.86485	1.005824	1.662427	1.347005	50.52268	13.57759
Probability	0.005105	0.000	0.604767	0.43552	0.50992	0.000	0.001126
Sum	19277.19	28618.83	5051.681	910.6376	44304.87	581.1346	16417.69
Sum Sq. Dev.	192731.6	122798.6	1038.758	1013.166	179858.3	101.4261	82576.38
Observations	392	392	392	392	392	392	392

Table 9
Correlation Matrix of Developed Countries

	FII	IIU	GDP	POP	MCS	GE	EMP
FII	1						
IIU	-0.07489	1					
GDP	0.029916	0.014535	1				
POP	0.031592	-0.19716	0.949841	1			
MCS	0.095055	0.306838	-0.20823	-0.29472	1		
GE	-0.05125	0.617542	0.015946	-0.20693	0.053703	1	
EMP	-0.04365	0.424005	0.048588	-0.08174	-0.14305	0.594142	1

Table 10
Hausman Test Result for Developing Countries

Null hypopaper: Fixed effect model is appropriate **Alternate hypopaper: Random effect model is appropriate**		
Test Summary	**Chi-Sq. Statistic**	**Prob.**
Cross Section Random	400.5381	0.000
Decision: Hausmanís result shows that Chi square value is less than the critical value at 5%, therefore we reject null hypopaper and Random effect is appropriate in case of developing countries.		

Table 11
Hausman Test Result for Developed Countries

Null hypopaper: Fixed effect model is appropriate **Alternate hypopaper: Random effect model is appropriate**		
Test Summary	**Chi-Sq. Statistic**	**Prob.**
Cross Section Random	60.12291	0.000
Decision: Hausmanís result shows that Chi square value is less than the critical value at 5%, therefore we reject null hypopaper and Random effect is appropriate in case of developed countries.		