Determinants of Advancement in Information Communication Technologies and its Prospect under the role of Aggregate and Disaggregate Globalization

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ABSTRACT

This article has examined the impact of aggregate and disaggregate globalization on the advancement of information and communication technologies (ICT) in the case of 87 developed and developing countries for 2000-2019. Panel least square and pairwise Dumitrescu-Hurlin panel causality tests have been used for empirical analysis. We have divided our empirical analysis into six models, i.e. aggregate globalization model for whole sample countries, disaggregate globalization model for whole sample countries, aggregate globalization model for developed countries, disaggregate globalization model for developed countries, aggregate globalization model for developing countries, and disaggregate globalization model for developing countries. Our estimated outcomes of the aggregate globalization model for the whole sample countries and developing countries show that globalization has a positive and significant impact on the advancement of information and communication technology. Our outcomes show that economic globalization, social globalization, political globalization, and availability of physical capital have a positive and significant impact on the advancement of ICT in developing countries. In the case of developed countries, aggregate globalization, political globalization, and social globalization reduce the advancement of ICT, whereas the availability of physical capital and economic

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globalization are raising the advancement of ICT. The results of the causality test show that all the variables have a causal relationship with each other except some variables of developed countries in the disaggregate globalization model. Our outcomes recommend that developing countries should promote aggregate and disaggregate globalization to achieve the desired level of ICT.

KEYWORDS
ICT, Globalization, Economic Globalization, Social Globalization, Political Globalization

1. INTRODUCTION

The concept of globalization is still a debatable issue because different disciplines and researchers are using different interpretations to explain globalization. But all are agreed that globalization somehow links to internationalization, opened borders for investment and trade, and liberalized movements of physical and human capital. International organizations (e.g. UNO) and governments play a vital role in the smooth process of globalization (Dumont and Lemaitre, 2005). Wolf (2005) explains that globalization is attached to trade liberalization and low cost of production. Now, globalization covers international economic order i.e., free trade, flexible exchange rate, and easy movement of production factors across borders (Bhandari and Heshmati, 2005). Stiglitz (2002) explains that globalization is the close merger of the different countries and people of the world, which has been brought about by the huge depletion of transportation, communication cost, and the removal of artificial barriers to the flow of goods, capital, knowledge, services, and extent of people across borders.

Presently, globalization means the integration of the world economies with the same technological processes, cultural arrangements, religions, environments, social norms, and governances. The world has become a global village (Ghosh and Ortiz, 1997). For the last few decades, policymakers and economists are much concerned about the convergence of institutions (Solow, 1956; Baumol, 1986; Romer, 1986; Mankiw et al., 1995). There are numerous models of economic growth and most of them are badly failed in developing countries (Rodrik, 2006). It may be traditional models focused on domestic resources and traditional methods of production as well. But now because of globalization, individuals are well educated, connected and countries have external and advanced methods of production (Mago and Mago, 2015).

The first decade of the 21st century is full of dynamic changes in the field of information communication and technology (ICT). ICT has emerged as a new source for transformation in the

culture, geography, politics, and socioeconomic sets of the nations (Bon et al., 2015; Nasir and Kalirajan, 2016; Audi et al., 2021). Shirazi et al., (2009) mention that ICT is not only important for foreign direct investment, infrastructure, finance, and democracy but also for economic growth. On one side, ICT decides the level of absorption capacity of a nation, with maximum utilization of available human capital. On the other side, traditional methods of production have attained their highest level, then ICT plays an important role in enhancing the level of economic growth (Steinmueller, 2001). Thus, from the last three decades, exploring the measures and determinants of ICT has gotten special attention among economists and policymakers.

The end of the 20th century and the emergence of the WTO and World Bank have reshaped the world into a global village. Now, the rising interdependence, growing diffusion, expanding transition of institutions, decreasing transportation costs, and rising consciousness among nations make the world more globalized and ICT oriented (Lechner and Boli, 2008). Following the socioeconomic and political scenarios of developing countries, WTO and World Bank propose globalization for developing countries to attain the desired level of economic growth. Empirical studies explain that in the last two decades, in the presence of globalization, developing countries have experienced higher economic growth as compared to developed countries (Dollar and Kraay, 2004). It is globalization that increases the activities of multinational firms (MNF) and the level of ICT among developing countries. These multinational firms bring new work practices, legal structures related to corporate governance, financial infrastructure, legal structure related to property rights, high technologies, and new production techniques. Developing countries should raise their overall employment by utilizing their idol resources which further enhances economic growth (Rodrik, 1998). Globalization also discourages outdated policies and governance practices among developing countries (Elliot et al., 2004). With every passing day, information and communications technology (ICT) is becoming a driving force of the world economy. Hence, there is a dire need to study the link between globalization and the advancement of ICT. So, for this purpose, this study has examined the impact of aggregate globalization, economic, political, and social globalization on ICT among the selected countries. This study has also provided a comparative analysis to overview the impact of aggregate and disaggregate globalization on the advancement of ICT among developed and developing countries.

2. LITERATURE REVIEW

Globalization's socioeconomic nexus got fabulous popularity in recent times. Literature on globalization and socioeconomic convergence is not much wider; some important studies are discussed here as a review of the literature. Chen and Gupta (2006) explain that economies can grow rapidly because of the assumption of increasing returns to scale. It is international trade openness that spreads knowledge, increases productivity, and raises human capital. Romer (1990) also supports the argument which states that trade openness provides a wide range of capital and intermediate goods to a local producer. As a result, it could be a better way of raising productive knowledge and creating rapid productivity growth.

Qian and Roland (1996) mention that due to the liberalization of trade, capital flight has been witnessed in developing countries. But overall economic growth shows a rising trend, some studies find that trade liberalization raises the level of capital flow and information among the countries (Summers, 2000; Obstfeld and Rogoff, 1998). Prakash and Hart (1999) state that because of globalization organizational impairment decreases with developed political foundations and the extent of the judiciary to support law is improved. Thus, globalization has not demonstrated different impacts of governance for the developed and developing countries.

Redding (1999) theoretically finds that trade openness may decrease the long-run economic growth if the economy is specialized with dynamic comparative disadvantage in different sectors or maybe the areas, where technological innovations are largely exhausted. In these cases, selective protection can encourage rapid technological advances (Young, 1991; Lucas, 1988). Theoretical and empirical studies indicate that massive regulations limit growth, as resources are averted from moving into productive areas (Freund and Bolaky, 2008). Fosu (1990) claims that economic growth in African countries can be improved by raising the level of international trade. However, some studies explain that trade by itself does not raise economic growth, there are some other intermediate factors (Sindzingre, 2005; Ulaşan, 2015).

Saich (2000) states that during the 1980s when the process of globalization had started in China, it generates revolutionary changes among different sectors, industries, and groups. Four crucial challenges of local governance have been discussed here; Firstly, there is a need for the extension of lawful structure for the settlement of capital and foreign trade. Secondly, the improvements had also generated variations in the economies. Thirdly, it had created different problems about the

supply of public goods and services. Fourthly, the challenge to remain impartial from conventional power based on the forces for getting advantages from globalization. Enormous variations had been made by China in trade policies to solve the global problems related to international trade and investment. However, the improper execution and lower clarity had decreased the effectiveness of the network. When free trade started on borders, special types of economic zones were broken down. This had also aroused a dispute between central and domestic governments because of incalculable governance on uncertain lines of power and privileges. When entered into WTO, the pressure was increased on the legal system, especially for the resolution of economic issues. Additionally, the agreement between domestic and international policies was barely expected to appear.

Globalization is often associated with better social relationships among individuals and countries (Deaton, 2003; Lynch. 2006; Pope et al., 2004; Mayer and Sarin, 2005). Many developing countries are passing through a transitional process and need more integration towards the developed world. For achieving the desired convergence, the developing countries are eliminating trade barriers, encouraging human capital movement, and trying to make create convergence among norms and ideas. From previous thousands of years, globalization has contributed to the progress of the world through travel, trade, migration, the spread of cultural influences, and the dissemination of knowledge and understanding. These global interrelations have often been very productive in the modernization of different countries (Sen, 2002). Now, the masses of the developing countries are demanding equal rights like the developed countries (Carr and Chen, 2002). Women are the most deprived part of the population and are getting their desired rights and role in society because of globalization (Carr and Chen, 2002). Globalization is improving and converging the lifestyle among different countries (Friedman, 2004).

Many studies find a negative relationship between economic growth and ICT. Berndt et al., (1992) find that ICT hurts industrial productivity in the case of the USA. ICT has a negative association with banking products in the case of Canada (Parsons et al., 1990). Morrison (1997) mentions that ICT has insignificant relation with ICT and firms' productivity. Hulten and Schwab (1984) find that the manufacturing sector is positively derived by ICT in the case of panel analysis. Robinson and Kelejian (1994), Pereira and Frutos (1999), and Nadiri and Mamuneas (1996) mention that public infrastructure decides the level of domestic and foreign investment in the country. Lau and

Tokutsu (1992) explain that ICT has a positive contribution to economic growth in the USA from 1960 to 1990. Schreyer (2000) points out that ICT has a positive and significant impact on labor productivity in the case of G7 countries. Daveri (2000) also finds the same type of relationship in the case of OECD countries. Poh (2001) finds a positive and significant relationship between ICT and overall productivity in the case of Singapore from 1977 to 1997. Kim et al., (2003) find the same type of relationship between ICT and overall productivity in the case of Korea from 1971 to 2000. Garcia-Mila and McGuire (1992) and Holtz-Eakin (1993) conclude that each country has a unique type of relationship between ICT and economic growth. This study points out that there are some other socioeconomic, political, and cultural factors that play a significant role in deciding economic growth among developed and developing countries.

Polder et al., (2010) analyze the relationship of productivity and ICT in the case of 5000 Dutch firms from 2002 to 2006. The investment in R&D is used as a measure of advancement of ICT. The study highlights that it is the process of innovation that decides the level of ICT. As an input ICT plays an important role in the productivity of the firm. The results of the study reveal that ICT investment is one of the main drivers of firm productivity in the case of Dutch firms. Cirera et al., (2016) examine the impact of ICT on the firms' productivity in the case of six Sub-Saharan countries (i.e., Zambia, Uganda, Tanzania, Kenya, Ghana, and the Democratic Republic of Congo). The study reveals that although these countries are lagging behind the developed countries, advanced ICT has a positive and significant impact on a firm's productivity. The results explain that there is heterogeneity existed among the productivity of each nation. Kenya is using a larger number of internets, software, and computers in the production process, and its productivity is largely impacted by ICT. The ICT of Tanzania and the Democratic Republic of Congo have a lower impact on firms' productivity. The study suggests that ICT is an important factor in the production process of all selected countries but this impact depends on the degree of innovation and advancement in ICT. Niebel (2018) examines the impact of ICT on economic growth in the case of selected developed, emerging, and developing countries. For this purpose, 59 countries have been selected over the period from 1995 to 2010 is used. The panel regressions results show that ICT has a positive impact on GDP and capital growth. The estimated output elasticity of ICT is larger than the ICT factor compensation share, and excess returns to ICT capital. The regressions for the subsamples of developing, emerging and developed countries do not reveal statistically significant differences in the output elasticity of ICT between these three groups of

countries. Thus, the results indicate that developing and emerging countries are not gaining more from investments in ICT than developed economies, calling into question the argument that these countries are 'leapfrogging' through ICT.

The review of the literature shows that an extensive number of studies (Baumol, 1986; Young, 1991; Mankiw et., 1995; Redding, 1999; Deaton, 2003; Freund and Bolaky, 2008; Ulaşan, 2015) have linked globalization to trade liberalization. Although some studies (Prakash and Hart, 1999; Sen, 2002; Stoiglitz, 2002; Carr and Chen, 2002; Friedman, 2004; Wolf, 2005; Sindzingre, 2005) have used globalization KOF index for the measurement of aggregate globalization. But the role of aggregate and disaggregate globalization in determining the advancement of ICT has been ignored. So, this study has tried to fill the existing gap with the help of empirical analysis.

3. THE MODEL

The end of the 20th century brought revolutionary changes in every field of human life, but particular changes have been witnessed in the shape of information and communication technology (ICT). ICT is equally important for the productivity growth, efficiency, political, legal, and socioeconomic life of humans. ICT is the combination of software and hardware (microprocessors, multimedia, broadcasting networks, computers, etc.) which transform information and knowledge from one place to another place easily and cheaply. Almost every country has established electronic societies with the help of public and private sector investments. ICT is creating spillover impact on knowledge, good governance, women empowerment, health care, learning, and economic growth within and among countries. Mckenney and McFarlan (1982), Cooper and Zmud (1990), Arndt (1998), Comin and Hobijn (2004), Crenshaw and Robison (2006), Shirazi et al., (2010), and Farooq et al., (2020) highlight some of the main determinants of ICT, but none of the above studies have used aggregate globalization, political, economic and social globalization as determinants of ICT for developed and developing countries and their comparative analysis. The two main models of this study have been given here.

The functional form of aggregate globalization model:

$$ICT_{it}=f(GLOB_{it}, PHYCAP_{it}, MACROIN_{it}) \qquad (1)$$

Panel least-squares form of aggregate globalization model:

$ICT_{it}=a_0+a_1GLOB_{it}+ a_2PHYCAP_{it}+a_3 MACROIN_{it}+e_{it}$ (2)

The functional form of disaggregate globalization model:

$ICT_{it}= f(ECOGLOB_{it}, SOCGLOB_{it}, POLGLOB_{it}, PHYCAP_{it}, MACROIN_{it})$ (3)

Panel least-squares form of disaggregate globalization model:

$ICT_{it}= b_0+b_1ECOGLOB_{it}+ b_2SOCGLOBit+b_3POLGLOBit+b_4PHYCAPit+b_5MACROINit+u_{it}$ (4)

ICT= ICT goods exports and imports (% of total goods exports and imports) are used for measuring the advancement in information and communication technologies

PHCAP = capital formation as a percentage of GDP is used for measuring the availability of physical resources

GLOB= KOF globalization has been used as a measure of globalization

MACROIN= macro instability has been measured with GDP deflator

ECOGLOB= KOF economic globalization has been used as a measure of economic globalization

SOCGLOB= KOF social globalization has been used as a measure of social globalization

POLGLOB= KOF political globalization has been used as a measure of political globalization

i = Selected countries (87 countries among these 29 are developed and 58 are developing countries, the list of selected countries has been given in the appendix). The selection of countries has been made based on International Monetary Fund's World Economic Outlook database, October 2020.

t = Time period (2000 to 2019)

e_{it}= white noise error term for aggregate globalization model

u_{it}= white noise error term for disaggregate globalization model

The data of selected variables have been taken from freedom house databases, the official website of OECD, and World Development Indicator (WDI) databases maintained by the World Bank.

4. ECONOMETRIC PROCEDURES

For checking the stationarity of the variables PP-Fisher Chi-square (PP-FC), ADF-Fisher Chi-square (ADF-FC), Im, Pesaran and Shin W-stat (IP&S), and Levin, Lin & Chu t* (LLC) unit root tests have been applied. Levin et al., (2002) introduced the panel unit root by using unique specifications, i.e., homogeneity. The common form of an LLC is as:

$$\Delta y_{i,t} = \gamma_{0i} + p y_{it-1+} \sum_{i-1}^{pi} \gamma_{1i} \Delta y_{i,t-j} + u_{i,t} \quad (5)$$

γ_{0i} is intercept in the equation (5) with having unique across the cross-sectional entities and p is identical for the autoregressive coefficient, whereas γ_i denotes for lag order, $u_{i,t}$ is the residual term which has been supposed to be independent for all the across of panel entities. The equation (5) follows the ARMA stationary process for each cross-section becomes as:

$$u_{i,t} = \sum_{j-0}^{\infty} \gamma_{1i} \Delta y_{i,t-j} + \varepsilon_{i,t} \quad (6)$$

Following the equation (6), null and alternative hypotheses can be developed as:

H_0: $p_i = p = 0$

H_a: $p_i = p < 0$ for all i

LLC model is based on t-statistic, where p is supposed to fix across the entities under the null and alternative hypothesis.

$$t_p = \frac{\overset{\Lambda}{p}}{SE(\overset{\Lambda}{p})} \quad (7)$$

In this whole procedure, we have supposed that the residual series is white noise. Further, the regression of the panel has t_p test statistic, which presents the convergence of standard normal distribution when N and $T \to \infty$ $\sqrt{\frac{N}{T}} \to 0$. On the other hand, if any sectional unit is not independent, then the residual series are corrected and have the issue of autocorrelation. Under such these circumstances LLC test proposes a modified test statistic as:

$$t_p = \frac{t_p - N\tilde{T}\hat{S}_N \hat{\sigma}^{-2}(\hat{p})\mathrm{u}_m^*}{\sigma_m^*} \quad (8)$$

Where u_m^* and σ_m^* are modified the error term of the error term and standard deviation of the error term, the values of these are generated from Monte Carlo Simulation by LLC (2002).

By using heterogeneity of the panels, Im et al., (2003) have developed their panel unit root test, this test is followed as:

$$\Delta y_{i,t} = \bar{w}_i + p y_{it-1+} \sum_{i-1}^{pi} \gamma_{1i} \Delta y_{i,t-j} + v_{i,t} \qquad (9)$$

The IPS test allows for heterogeneity in v_i value, the IPS unit root test equation can be written as:

$$\bar{t}_T = \frac{1}{N} \sum_{i-1}^{N} t_{1,i}(\mathrm{p}_i) \qquad (10)$$

where

$t_{i,t}$ is the ADF test statistic, $\mathrm{p_i}$ is the lag order. For the calculation process, this test follows:

$$A_t - = \frac{\sqrt{N(T)}[\bar{t}_T - \mathrm{E}(\mathrm{t}_T)]}{\sqrt{Var(\mathrm{t}_T)}} \qquad (11)$$

5. RESULTS AND DISCUSSION

In this section, the empirical results and discussion have been given. In this article, we have examined the impact of aggregate and disaggregate globalization on the advancement in information and communication technologies (ICT) among developed and developing countries. The empirical analysis has been divided into six parts i.e., aggregate globalization model for the whole sample, disaggregate globalization model for the whole sample, aggregate globalization model for developed countries, disaggregate globalization model for developed countries, aggregate globalization model for developing countries, and disaggregate globalization model for developing countries. The results of descriptive statistic are presented in appendixes table A-1, Table A-3, Table A-5, Table A-7, Table A-9, and table A-11. The descriptive statistic provides the intertemporal properties of the selected variables of all the models, e.g., mean, median, maximum, minimum, standard deviation, skewness, Kurtosis, Jarqua Bera, and the sum of square deviation.

The outcomes of the correlation matrix have been given in appendixes table A-2, table A-4, table A-6, table A-8, table A-10, and table A-12. The outcomes of the correlation show the degree of

association among the variables, the results show that most of the selected variables have a significant correlation with each other.

The overall results of the correlation matrix show that all of the selected explanatory variables of all the models have a significant correlation with the advancement in ICT, whereas all the explanatory variables have a weak correlation among each other, so there is no issue of multicollinearity among the selected explanatory variables of all the models.

The comparative analysis of the correlation matrix of the whole sample, developed and developing countries show that aggregate and disaggregate globalization models of whole sample case, economic globalization, social globalization, political globalization, availability of physical capital, and aggregate globalization have positive and significant correlation with advancement in ICT, whereas macroeconomic instability has a negative and significant correlation with advancement in ICT. But the case of developed countries has a different type of correlation for aggregate and disaggregate globalization models, aggregate globalization, social globalization, and political globalization have a negative correlation with advancement in ICT. Economic globalization and availability of physical capital have a positive and significant correlation with ICT in the case of all models. In aggregate and disaggregate analysis, economic globalization, social globalization, political globalization, availability of physical capital and aggregate globalization have positive and significant correlations with advancement in ICT in the case of developing countries.

For exploring the stationarity of the selected variables of the models, PP-Fisher Chi-square (PP-FC), ADF-Fisher Chi-square (ADF-FC), Im, Pesaran, and Shin W-stat (IP&S), and Levin, Lin & Chu t* (LLC) unit root tests have been applied. The estimated results of unit root tests have been given in appendixes table A-13. The results show that all the selected variables are stationary at level, which is the best situation to apply panel least-squares.

This study has used panel least square for examining the impact of aggregate and disaggregate globalization on the advancement in ICT among developed and developing countries. As we have mentioned in the model section that we have divided our analysis into six models, i.e. aggregate globalization model for whole sample countries, disaggregate globalization model for whole sample countries, aggregate globalization model for developed countries, disaggregate globalization model for developed countries, aggregate globalization model for developing

countries, and disaggregate globalization model for developing countries. The estimated results of all six models of panel least-squares have been given in table 1. The results of aggregate globalization for the whole sample reveal that globalization has a positive and significant impact on the advancement of ICT. A historical overview of the literature shows that globalization has a direct and indirect impact on ICT. Rising globalization is attached to competitiveness, new knowledge, and advanced technological changes, this encourages economies to invest in ICT (Bhandari and Heshmati, 2005). The investment in ICT is attached to the absorption and acquisition capacity of new knowledge by a nation. Various studies (Lau and Tokutso, 1992; Daveri, 2000; Stanley et al., 2015; Niebel, 2018; Audi et al., 2021) highlight the importance of ICT in the process of economic growth. The developed countries are more globalized as compared to developing countries and they have gained higher advantages of ICT. If the developing countries want integrated advancement in ICT, they must adopt an efficient process of globalization (Greenwald and Stiglitz, 1986; Stiglitz, 1988, 1989; Wolfensohn, 1998; Hamelink, 1997; UNCTAD, 2006). Our results explain that a 1 percent rise in globalization, (0.425171) percent rise has occurred in the advancement of ICT. The estimated outcomes reveal that the availability of physical capital has a positive and significant impact on the advancement of ICT. The availability of physical capital works like lifeblood for an economy (King and Levine, 1993; Rikowski, 2003; Ahmad, 2012; Ali, 2015; Ali and Rehman, 2015; Audi et al., 2021). The rising amount of physical capital is attached to a rise in economic activities (Cameron, 1998; Kataria et al., 2012; Pablo-Romero and Gómez-Calero, 2013; Le et al., 2018). Our estimated results show that a 1 percent increase in available capital (0.370712) increase has occurred in the advancement of ICT. This shows that if a country has more resources in the form of physical capital, it has a higher capacity to spend on the advancement of ICT. So, in the case of the whole sample and aggregate globalization model, our study has found a positive and significant relationship between the availability of physical capital and the advancement of ICT. The estimated results show that macroeconomic instability has a negative and significant impact on the advancement of ICT. Macroeconomic situations have a deep-rooted impact on all types of the socioeconomic and political environment of an economy (Sidrauski, 1967; Gokal and Hanif, 2004; Barro, 2013; Ali, 2015; Ali and Rehman, 2015). Our results show that a 1 percent increase in macroeconomic instability will decrease the advancement of ICT by (0.155289) percent. In the presence of an unstable macroeconomic environment, an economy is unable to make much and sufficient

expenditures on the advancement of ICT, thus, an unstable macroeconomic environment discourages the advancement of ICT (Kapurubandara and Lawson, 2006; Nadeem, 2020).

The results of the disaggregate globalization model for whole sample countries have been shown in the 2nd row of table 1. The estimated results show that economic globalization has a positive and significant impact on the advancement of ICT. The results explain that a 1 percent betterment in economic globalization brings (0.283430) percent betterment in the advancement of ICT. This reveals that strong economic connections among the countries increase the demand for the advancement of ICT (Chen and Lin, 2004; Sagi et al., 2004; West and Heath, 2011). Our study finds a positive and significant relationship between the advancement of ICT and social globalization. The estimates explain that a 1 percent increase in social globalization brings (0.114908) percent increase in the advancement of ICT. This reveals that when people around the world have strong social links, they need the fast and quick flow of information from one part of the world to the other part of the world, so they demand the advancement of ICT (Ng and Li, 2003; Pulkkinen, 2007). The results of the study show that political globalization has a positive but insignificant relationship with the advancement of ICT. Presently, the political connections among the countries are strong enough that were not in the past (Sassen, 2004; Bentivegna, 2006). Any political shock of one country has an immediate impact on the political situation of another country, so the demand for the advancement of ICT is also increased (Sassen, 2004; Bentivegna, 2006). The estimated results show that the availability of physical capital has a positive and significant impact on the advancement of ICT (Sidrauski, 1967; Gokal and Hanif, 2004; Barro, 2013; Ali, 2015; Ali and Rehman, 2015). The results show that there is a negative and significant relationship between macroeconomic instability and the advancement of ICT (Kapurubandara and Lawson, 2006; Nadeem, 2020). The findings related to physical capital and macroeconomic instability are in line with the findings of the aggregate globalization model for the whole sample countries.

The results in table 1, 3rd row provides estimated information about the aggregate globalization model in the case of developed countries. The estimated results reveal that there is a negative and significant relationship between aggregate globalization and the advancement of ICT. The results show that a 1 percent increase in aggregate globalization (-1.023360) percent decrease has occurred in the advancement of ICT. This explains that developed countries have achieved a higher

level of convergence at all levels, no further convergence in the advancement of ICT is required by the developed countries (Islam, 2003; Mahler, 2004). The best example is European Union (EU) and OECD countries, so, the rising aggregate level of globalization has a discouraging impact on the advancement of ICT for the developed countries (Carree et al., 2002; Gore, 2003). These findings are not in line with the findings of the aggregate globalization model for whole sample countries. The estimates reveal that the availability of physical capital has a positive and significant impact on the advancement of ICT. This reveals that the advancement of ICT has been encouraged in the presence of more available physical capital. Our results show that a 1 percent increase in the availability of physical resources (0.904763) percent rise has occurred in the advancement of ICT of developed countries. The results show that there is a negative and significant relationship between macroeconomic instability and the advancement of ICT. The availability of physical capital and macroeconomic instability have the same type of impact as they have in aggregate and disaggregate globalization models for the whole sample countries.

The results in table 1, 4th row provide information about the disaggregate globalization model in the case of developed countries. The estimated results of the study show that economic globalization has a positive and significant impact on the advancement of ICT, this result is identical as in the case of the disaggregate globalization model for the whole sample countries. The result shows that social globalization has a negative and significant impact on the advancement of ICT. The estimated result of the study shows that a 1 percent increase in social globalization brings (-0.905708) percent decrease in the advancement of ICT. The main reason behind this negative relation i.e. developed countries has achieved a high level of social convergence, so a further rise in social globalization discourages the advancement of ICT in developed countries. Moreover, there are several studies (Lopez et al., 1994; O'Donnell and Henriksen, 2002) that highlight that for achieving more social relationships developed countries are discouraging the use of ICT. These findings are dissimilar to the disaggregate globalization model for the whole sample countries case. The estimated results of the study show that political globalization has a negative and significant impact on the advancement of ICT. The estimates reveal that a 1 percent increase in political globalization brings (-0.605155) percent decrease in the advancement of ICT. This highlights that for the advancement of ICT developed countries need to reduce political globalization. These findings are dissimilar to the findings of the disaggregate globalization model for the whole sample countries. The estimated results reveal that the

availability of physical capital has a positive and significant impact on the advancement of ICT. Whereas macroeconomic instability has a negative and significant impact on the advancement of ICT. These findings are similar to the findings of the aggregate and disaggregate globalization models for the whole sample countries. So, available physical capital promotes and macroeconomic instability discourages the advancement of ICT in the case of developed countries.

The results in table 1, 5th row provide information about the aggregate globalization model in the case of developing countries. The estimated results of the study show that aggregate globalization has a positive and significant impact on the advancement of ICT. The results show that a 1 percent increase in aggregate globalization brings (0.537684) percent increase in the advancement of ICT in developing counties. This finding is consistent with the aggregate globalization model for the whole sample case, whereas inconsistent with the aggregate globalization model for the developed countries. The estimated results show that the availability of physical capital has a positive and significant impact on the advancement of ICT in developing countries. These findings are consistent with both aggregate globalization models for the whole sample and developed countries' cases. Thus, for the improvement of ICT, developing countries should improve the level of physical capital. Macroeconomic instability has a negative and significant impact on the advancement in ICT of developing countries. These outcomes are in line with the outcomes of both aggregate globalization models for the whole sample and developed countries' cases. This reveals that macroeconomic situations play an important role in deciding all types of activities of the nations (Kapurubandara and Lawson, 2006; Nadeem, 2020). Thus, unstable economic conditions discourage the advancement of ICT in developing countries.

The results in table 1, 6th row explains the outcomes of disaggregate globalization in the case of developing countries. The estimated results of the study show that economic globalization, social globalization, political globalization, and availability of physical capital have a positive and significant impact on the advancement of ICT in developing countries. These results are consistent with the results of the disaggregate globalization model for the whole sample countries. Whereas, the rising macroeconomic instability of the developing countries discourages the advancement of ICT.

The overall results of panel least square explain that economic globalization and availability of physical capital are encouraging the advancement of ICT both in developed and developing

countries. Whereas, macroeconomic instability is depressing the advancement of ICT both in developed and developing countries. The results explain that social globalization and political globalization are most suitable for developing countries in the process of advancement in ICT, but these both have an inverse impact in the case of developed countries. Overall globalization is a big source of advancement of ICT in developing countries, whereas this is inverse in the case of developed countries.

Table 1: Panel Ordinary Least Square:

Dependent Variable: ICT

Sample/Variables	ECOGLOB	SOCGLOB	POLGLOB	GLOB	PHYCAP	MACROIN	C
AGAWC87	-	-	-	0.425171****	0.370712***	-0.155289***	-20.76072
DISAWC87	0.283430***	0.114908**	0.010052	-	0.366871***	-0.123109**	-17.79469
AGAWC29	-	-	-	-1.023360***	0.904763***	-1.027638***	86.67353
DISAWC29	0.640596***	-0.905708***	-0.650155***	-	0.751553***	-1.006951***	87.99274
AGAWC58	-	-	-	0.537684***	0.196666**	-0.097863**	-24.58805
DISAWC58	0.165627***	0.102142**	0.312319***		0.204523***	-0.097954***	-29.22813
Note: ***,**,* present significance level 1%, 5% and 10% respectively.							

AGAWC87=Aggregate Analysis of Whole Sample 87 Countries

DISAWC87=Disaggregate Analysis of Whole Sample 87 Countries

AGAWC29=Aggregate Analysis of Sample Developed 29 Countries

DISAWC29=Disaggregate Analysis of Sample Developed 29 Countries

AGAWC58= Aggregate Analysis of Sample Developing 58 Countries

DISAWC58= Disaggregate Analysis of Sample Developing 58 Countries

The study has applied the pairwise Dumitrescu Hurlin panel causality test for examining the causality among the selected variables of all the models. Like panel least squares causality analysis has six types of arrangement i.e., aggregate globalization model for whole sample countries, disaggregate globalization model for whole sample countries, aggregate globalization model for developed countries, disaggregate globalization model for developed countries, aggregate globalization model for developing countries, and disaggregate globalization model for developing countries. The estimated results of the pairwise Dumitrescu Hurlin panel causality test have been given in table 2. When we use the variables of aggregate globalization model for the whole sample countries for causality analysis, the estimated results show that bidirectional causality is running between the availability of physical capital and advancement of ICT, between aggregate globalization and advancement of ICT, between aggregate globalization and availability of physical capital, between aggregate globalization and macroeconomic instability. The results show that unidirectional causality is running from advancement of ICT to macroeconomic instability, and from availability of physical capital to macroeconomic instability.

When we use the variables of disaggregate globalization model for the whole sample countries for causality analysis, the estimated results show that bidirectional causality is running between economic globalization and advancement of ICT, between social globalization and advancement of ICT, between political globalization and advancement of ICT, between the availability of physical capital and advancement of ICT, between social globalization and economic globalization, between political globalization and economic globalization, between the availability of physical capital and economic globalization, between macroeconomic instability and economic globalization, between political globalization and social globalization, between the availability of physical capital and social globalization, between macroeconomic instability and political globalization. The estimated results show that unidirectional causality is running from advancement of ICT to macroeconomic instability, from social globalization to macroeconomic instability, from political globalization to availability of physical capital, from the availability of physical capital to macroeconomic instability.

When we use the variables of aggregate globalization model for the developed countries for causality analysis, the estimated results show that bidirectional causality is existed between aggregate globalization and advancement of ICT, between the availability of physical capital and advancement of ICT. The outcomes show that unidirectional causality is running from

advancement of ICT to availability of physical capital, from advancement of ICT to macroeconomic instability, from macroeconomic instability to aggregate globalization, and from availability of physical capital to macroeconomic instability.

When we use the variables of disaggregate globalization model for the developed countries for causality analysis, the results show bidirectional causality has existed between economic globalization and advancement of ICT, between political globalization and advancement of ICT, between political globalization and economic globalization. The outcomes explain unidirectional causality is running from advancement of ICT to social globalization, from advancement of ICT to availability of physical capital, from advancement of ICT to macroeconomic instability, from social globalization to economic globalization, from social globalization to availability of physical capital, from political globalization to macroeconomic instability, and from the availability of physical capital to macroeconomic instability. The estimates show that there is no causality existed between the availability of physical capital and economic globalization, between macroeconomic instability and economic globalization, between the availability of physical capital and social globalization, and between macroeconomic instability and social globalization.

When we use the variables of aggregate globalization model for the developing countries for causality analysis, the estimated results show that bidirectional causality is running between aggregate globalization and advancement of ICT, between the availability of physical capital and advancement of ICT, and between the availability of physical and aggregate globalization. The results highlight that unidirectional causality is running from advancement of ICT to macroeconomic instability, from aggregate globalization to macroeconomic instability, and from availability of physical capital to macroeconomic instability.

When we use the variables of disaggregate globalization model for the developing countries for causality analysis, the outcomes explain that bidirectional causality is running between economic globalization and advancement of ICT, between social globalization and advancement of ICT, between the availability of physical capital and advancement of ICT, between social globalization and economic globalization, between political globalization and economic globalization, between the availability of physical capital and economic globalization, between political globalization and social globalization, between the availability of physical capital and social globalization, and between macroeconomic instability and political globalization. The estimated results show that unidirectional causality is running from political globalization to advancement of ICT, from

advancement of ICT to macroeconomic instability, from economic globalization to macroeconomic instability, from social globalization to macroeconomic instability, from political globalization to availability of physical capital, and from availability of physical capital to macroeconomic instability.

The overall causality results show that variables of the aggregate and disaggregate globalization models for the developing countries have somehow the same type of causality as the whole sample analysis. Whereas both the developed countries' models have different causality outcomes.

Table 2: Pairwise Dumitrescu Hurlin Panel Causality Tests

Aggregated Globalization Model for Whole Sample Countries					
PHYCAP ↔ICT	ICT→MACROIN	GLOB ↔ ICT	PHYCAP→MACROIN	GLOB↔PHYCAP	GLOB↔MACROIN
Disaggregated Globalization Model for Whole Sample Countries					
ECOGLOB↔ ICT	SOCGLOB↔ICT	POLGLOB↔ ICT	PHYCAP↔ICT	ICT→MACROIN	SOCGLOB↔ECOGLOB
POLGLOB↔ECOGLOB	PHYCAP↔ ECOGLOB	MACROIN↔ECOGLOB	POLGLOB↔SOCGLOB	PHYCAP↔SOCGLOB	SOCGLOB→MACROIN
	POLGLOB→PHYCAP	MACROIN↔POLGLOB	PHYCAP→MACROIN		
Aggregated Globalization Model for Developed Countries					
GLOB↔ICT	ICT→PHYCAP	ICT→ MACROIN	PHYCAP↔GLOB	MACROIN→GLOB	PHYCAP→MACROIN
Disaggregated Globalization Model for Developed Countries					
ECOGLOB↔ICT	ICT→SOCGLOB	POLGLOB↔ ICT	IC→PHYCAP	ICT→MACROIN	SOCGLOB→ECOGLOB
POLGLOB↔ECOGLOB	PHYCAP—ECOGLOB	MACROIN—ECOGLOB	SOCGLOB→POLGLOB	PHYCAP—SOCGLOB	MACROIN—SOCGLOB
	POLGLOB→PHYCAP	POLGLOB→MACROIN	PHYCAP→MACROIN		
Aggregated Globalization Model for Developing Countries					
GLOB↔ICT	PHYCAP↔ ICT	ICT → MACROIN	PHYCAP↔GLOB	GLOB→MACROIN	PHYCAP→MACROIN
Disaggregated Globalization Model for Developing Countries					
ECOGLOB↔ICT	SOCGLOB↔ ICT	POLGLOB→ ICT	PHYCAP↔ ICT	ICT→MACROIN	SOCGLOB↔ECOGLOB
POLGLOB↔ECOGLOB	PHYCAP↔ ECOGLOB	ECOGLOB→MACROIN	POLGLOB↔SOCGLOB	PHYCAP↔SOCGLOB	SOCGLOB→MACROIN
	POLGLOB→ PHYCAP	MACROIN↔POLGLOB	PHYCAP→MACROIN		
Note: ↔ bidirectional causality; → unidirectional causality; — no causality					

6. CONCLUDING REMARKS AND SUGGESTIONS

In this article, we have examined the impact of aggregate and disaggregate globalization on the advancement of information and communication technologies (ICT). KOF index has been used as a measure of aggregate globalization, whereas sub-indices of the KOF index, economic globalization, social globalization, and political globalization have been used for measuring the disaggregate globalization among developed and developing countries. 87 developed and developing countries are selected for empirical analysis, among the selected countries 58 are developing countries and 29 are developed countries. For checking the stationarity of the variables PP-Fisher Chi-square (PP-FC), ADF-Fisher Chi-square (ADF-FC), Im, Pesaran and Shin W-stat (IP&S) and Levin, Lin & Chu t* (LLC) unit root tests have been applied. Panel least-squares has been applied for empirical analysis, and causality of the variables has been checked with the help of pairwise Dumitrescu Hurlin panel causality tests. We have divided our empirical analysis into six models, i.e. aggregate globalization model for the whole sample countries, disaggregate globalization model for the whole sample countries, aggregate globalization model for the developed countries, disaggregate globalization model for the developed countries, aggregate globalization model for the developing countries, and disaggregate globalization model for the developing countries.

The results of unit root tests show that all the variables are stationary at level, which recommends applying panel least-squares. The results of the aggregate globalization model for the whole sample countries and developing countries reveal that globalization has a positive and significant impact on the advancement of ICT. Globalization has a direct and indirect relationship with the advancement of ICT. The investment in ICT is attached to the absorption and acquisition of new knowledge (Juma and Yee-Cheong, 2005; Goldberg, 2008; Harris and Moffat, 2013). Stanley et al., (2015), Niebel (2018), and Audi et al., (2021) highlight the importance of the advancement of ICT in the process of economic growth. The developed countries are more globalized and they have gained higher socioeconomic advantages due to the advancement of ICT. The outcomes of the study show that economic globalization, social globalization, and political globalization have a positive and significant impact on the advancement of ICT in developing countries. In the case of developed countries, aggregate globalization, political globalization, and social globalization reduce the advancement of ICT, whereas only economic globalization is raising the level of advancement of ICT. The results of all models show that the availability of physical capital has a

positive and significant impact on the advancement of ICT. The results highlight that macroeconomic instability has a negative and significant impact on the advancement of ICT in all the selected models. The results of the causality test show that all the variables have a causal relationship with each other except some variables of the disaggregate globalization model for the developed countries. The study suggests that developing countries should promote economic globalization, social globalization, and political globalization to raise the level of advancement of ICT, which is one of the main determinants of economic growth. Moreover, with reasonable availability of physical capital, both developed and developing countries should stable their macroeconomic situations to achieve the desired advancement in ICT. An unstable macroeconomic environment discourages the advancement of ICT.

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APPENDIXES

Selected Countries (87)

Albania, Argentina, Armenia, Australia, Azerbaijan, Bangladesh, Barbados, Belarus, Benin, Bolivia, Botswana, Brazil, Bulgaria, Cambodia, Cameroon, Canada, Chile, China, Colombia, Costa Rica, Croatia, Cyprus, Czech Republic, Ecuador, Egypt Arab Rep., El Salvador, Estonia, Finland, France, Georgia, Germany, Greece, Guatemala, Guyana, Honduras, Hong Kong SAR China, Hungary, India, Israel, Italy, Jamaica, Japan, Kazakhstan, Korea Rep., Kyrgyz Republic, Lebanon, Luxembourg, Macedonia FYR, Madagascar, Malaysia, Malta, Mauritius, Mexico, Moldova, Morocco, Namibia, Netherlands, New Zealand, Niger, Norway, Oman, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Romania, Russian Federation, Senegal, Singapore, Slovenia, South Africa, Sri Lanka, Sudan, Sweden, Switzerland, Tanzania, Thailand, Togo, Tunisia, Uganda, Ukraine, United Kingdom, United States, Uruguay

Developed Countries (29)

Australia, Canada, Croatia, Cyprus, Czech Republic, Estonia, Finland, France, Germany, Greece, Hong Kong SAR China, Hungary, Israel, Italy, Japan, Korea Rep., Luxembourg, Malta, Netherlands, New Zealand, Norway, Poland, Portugal, Singapore, Slovenia, Sweden, Switzerland, United Kingdom, United States

Developing Countries (58)

Albania, Argentina, Armenia, Azerbaijan, Bangladesh, Barbados, Belarus, Benin, Bolivia, Botswana, Brazil, Bulgaria, Cambodia, Cameroon, Chile, China, Colombia, Costa Rica, Ecuador, Egypt Arab Rep., El Salvador, Georgia, Guatemala, Guyana, Honduras, India, Jamaica, Kazakhstan, Kyrgyz Republic, Lebanon, Macedonia FYR, Madagascar, Malaysia, Mauritius, Mexico, Moldova, Morocco, Namibia, Niger, Oman, Pakistan, Panama, Paraguay, Peru, Philippines, Romania, Russian Federation, Senegal, South Africa, Sri Lanka, Sudan, Tanzania, Thailand, Togo, Tunisia, Uganda, Ukraine, Uruguay

Table A-1: Descriptive Statistic Aggregate Globalization Model for Whole Sample Countries

	ICT	PHYCAP	MACROIN	GLOB
Mean	14.91304	22.80793	5.558904	66.04831
Median	8.118878	22.09820	3.616664	65.11021
Maximum	106.0028	57.71025	185.2908	90.23753
Minimum	0.009781	11.19994	-25.12813	35.49336
Std. Dev.	17.61399	5.506231	8.603855	12.75175
Skewness	2.445074	1.204201	8.617663	-0.065270
Kurtosis	9.232449	6.102309	150.7041	2.188437
Jarque-Bera	3639.903	894.6334	1282586.	39.18915
Sum	20758.96	31748.64	7737.995	91939.25
Sum Sq. Dev.	431561.4	42173.14	102970.6	226186.4
Observations	1740	1740	1740	1740

Table A-2: Covariance Analysis: Ordinary

Aggregated Globalization Model for Whole Sample Countries				
Probability	ICT	PHYCAP	MACROIN	GLOB
ICT	1.000000			
PHYCAP	0.102121***	1.000000		
MACROIN	-0.156892***	-0.000799	1.000000	
GLOB	0.322548***	-0.044917*	-0.262979***	1.000000
Note: ***,**,* present significance level 1%, 5% and 10% respectively.				

Table A-3: Descriptive Statistic Disaggregated Globalization Model for Whole Sample Countries

Variables	ICT	ECOGLOB	SOCGLOB	POLGLOB	PHYCAP	MACROIN
Mean	14.91304	60.12472	62.91099	75.04880	22.80793	5.558904
Median	8.118878	60.43814	64.01129	77.30519	22.09820	3.616664
Maximum	106.0028	93.72647	90.65499	99.54428	57.71025	185.2908
Minimum	0.009781	19.73839	18.35071	28.98305	11.19994	-25.12813
Std. Dev.	17.61399	15.79114	17.19983	16.19901	5.506231	8.603855
Skewness	2.445074	-0.052431	-0.452778	-0.582191	1.204201	8.617663
Kurtosis	9.232449	2.351712	2.401639	2.541511	6.102309	150.7041
Jarque-Bera	3639.903	25.01383	68.32801	90.82784	894.6334	1282586.
Sum	20758.96	83693.61	87572.09	104467.9	31748.64	7737.995
Sum Sq. Dev.	431561.4	346859.7	411505.2	365009.6	42173.14	102970.6
Observations	1740	1740	1740	1740	1740	1740

Table A-4: Covariance Analysis: Ordinary

Disaggregated Globalization Model for Whole Sample Countries						
Variables	ICT	ECOGLOB	SOCGLOB	POLGLOB	PHYCAP	MACROIN
ICT	1.000000					
ECOGLOB	0.356618***	1.000000				
SOCGLOB	0.327214***	0.793101***	1.000000			
POLGLOB	0.076993***	0.111213***	0.331587***	1.000000		
PHYCAP	0.102121***	-0.036879	-0.025222	-0.044521*	1.000000	
MACROIN	-0.156892***	-0.278219***	-0.221332***	-0.122888***	-0.000799	1.000000
Note: ***,**,* present significance level 1%, 5% and 10% respectively.						

Table A-5: Descriptive Statistic Aggregated Globalization Model for Developed Countries

	ICT	GLOB	PHYCAP	MACROIN
Mean	22.84642	80.12011	22.49743	2.131345
Median	15.93287	80.28471	22.24547	1.991139

Maximum	106.0028	90.23753	36.73959	15.43445
Minimum	4.445004	65.04988	11.51858	-6.007731
Std. Dev.	19.31594	5.673872	3.869940	2.232085
Skewness	1.960952	-0.529903	0.392520	0.938358
Kurtosis	6.723758	2.758751	3.754695	7.691038
Jarque-Bera	565.4556	22.84017	22.92645	493.5394
Sum	10600.74	37175.73	10438.81	988.9442
Sum Sq. Dev.	172747.9	14905.28	6934.091	2306.759
Observations	580	580	580	580

Table A-6: Covariance Analysis: Ordinary

Aggregated Globalization Model for Developed Countries				
Variables	ICT	GLOB	PHYCAP	MACROIN
ICT	1.000000			
GLOB	-0.340220***	1.000000		
PHYCAP	0.225855***	-0.240129***	1.000000	
MACROIN	-0.066727	-0.032925	0.232395***	1.000000
Note: ***,**,* present significance level 1%, 5% and 10% respectively.				

Table A-7: Descriptive Statistic Disaggregated Globalization Model for Developed Countries

	ICT	ECOGLOB	SOCGLOB	POLGLOB	PHYCAP	MACROIN
Mean	22.84642	75.24226	80.83482	84.43423	22.49743	2.131345
Median	15.93287	76.03947	81.17271	89.97606	22.24547	1.991139
Maximum	106.0028	93.72647	90.65499	99.54428	36.73959	15.43445
Minimum	4.445004	43.60584	65.89993	28.98305	11.51858	-6.007731
Std. Dev.	19.31594	9.921808	5.360913	14.96185	3.869940	2.232085
Skewness	1.960952	-0.318321	-0.248946	-1.832313	0.392520	0.938358
Kurtosis	6.723758	2.830810	2.233663	6.569157	3.754695	7.691038
Jarque-Bera	565.4556	8.389479	16.14661	505.9216	22.92645	493.5394
Sum	10600.74	34912.41	37507.35	39177.48	10438.81	988.9442
Sum Sq. Dev.	172747.9	45578.77	13306.34	103645.7	6934.091	2306.759
Observations	580	580	580	580	580	580

Table A-8: Covariance Analysis: Ordinary

Disaggregated Globalization Model for Developed Countries						
Variables	ICT	ECOGLOB	SOCGLOB	POLGLOB	PHYCAP	MACROIN
ICT	1.000000					
ECOGLOB	0.345641***	1.000000				
SOCGLOB	-0.025128	0.556971***	1.000000			
POLGLOB	-0.594543***	-0.332803***	-0.148018***	1.000000		
PHYCAP	0.225855***	-0.088280*	-0.280971***	-0.120620***	1.000000	
MACROIN	-0.066727	-0.019682	-0.092260**	0.004119	0.232395***	1.000000
Note: ***,**,* present significance level 1%, 5% and 10% respectively.						

Table A-9: Descriptive Statistic Aggregated Globalization Model for Developing Countries

	ICT	GLOB	PHYCAP	MACROIN
Mean	10.94635	59.01241	22.96318	7.272684
Median	5.668999	60.05870	22.00454	5.592026
Maximum	93.84192	79.61491	57.71025	185.2908
Minimum	0.009781	35.49336	11.19994	-25.12813
Std. Dev.	15.22957	8.902101	6.159683	9.988512
Skewness	3.152361	-0.293310	1.196591	7.786569
Kurtosis	13.48009	2.792332	5.439406	118.9853
Jarque-Bera	5783.830	14.97360	451.5503	529544.7
Sum	10158.22	54763.52	21309.83	6749.051
Sum Sq. Dev.	215008.3	73462.34	35171.95	92487.14
Observations	1160	1160	1160	1160

Table A-10: Covariance Analysis: Ordinary

Aggregated Globalization Model for Developing Countries				
Variables	ICT	GLOB	PHYCAP	MACROIN
ICT	1.000000			
GLOB	0.320967***	1.000000		
PHYCAP	0.088254***	0.021549	1.000000	
MACROIN	-0.090881***	-0.077297**	-0.030206	1.000000
Note: ***,**,* present significance level 1%, 5% and 10% respectively.				

Table A-11: Descriptive Statistic Disaggregated Globalization Model for Developing Countries

	ICT	ECOGLOB	SOCGLOB	POLGLOB	PHYCAP	MACROIN
Mean	10.94635	52.56595	53.94907	70.35608	22.96318	7.272684
Median	5.668999	52.54117	56.75739	71.44514	22.00454	5.592026
Maximum	93.84192	82.37633	83.44630	95.31073	57.71025	185.2908
Minimum	0.009781	19.73839	18.35071	35.35156	11.19994	-25.12813
Std. Dev.	15.22957	12.38614	13.72402	14.69047	6.159683	9.988512
Skewness	3.152361	-0.106651	-0.505630	-0.337839	1.196591	7.786569
Kurtosis	13.48009	2.527529	2.602895	2.175748	5.439406	118.9853
Jarque-Bera	5783.830	10.39077	45.63986	43.92274	451.5503	529544.7
Sum	10158.22	48781.20	50064.74	65290.44	21309.83	6749.051
Sum Sq. Dev.	215008.3	142217.1	174599.3	200055.8	35171.95	92487.14
Observations	1160	1160	1160	1160	1160	1160

Table A-12: Covariance Analysis: Ordinary

Aggregated Globalization Model for Developing Countries						
Variables	ICT	ECOGLOB	SOCGLOB	POLGLOB	PHYCAP	MACROIN
ICT	1.000000					
ECOGLOB	0.136288***	1.000000				
SOCGLOB	0.207112***	0.617645***	1.000000			
POLGLOB	0.281054***	-0.215241***	0.090553***	1.000000		
PHYCAP	0.088254***	0.005317	0.041470	-0.003121	1.000000	
MACROIN	-0.090881***	-0.142248***	-0.018026	-0.011014	-0.030206	1.000000
Note: ***,**,* present significance level 1%, 5% and 10% respectively.						

Table A-13: Panel Unit Root @ at Level I(0)

	Whole Sample				Developed Countries				Developing Countries			
Variables	LLC	IPS	ADF-FC	PP-FC	LLC	IPS	ADF-FC	PP-FC	LLC	IPS	ADF-FC	PP-FC
ICT	-7.06461***	-4.27042***	255.190***	361.999***	-8.8708***	-4.3234***	116.278***	120.554***	-5.7255***	-4.5036***	190.678***	241.445**
PHYCAP	-4.09708***	-1.49675*	201.846*	171.283*	-4.0581***	-2.9053***	93.2711***	68.0480*	-6.3991***	-2.48186**	139.025*	103.235*
MACROIN	-6.57282***	-6.73486***	315.834***	553.192***	-3.1501***	-2.7868***	91.1362***	127.931***	-18.628***	-13.904***	389.545***	425.261***
GLOB	-12.4187***	-4.16469***	270.821***	324.765***	-6.5225***	-2.3741***	86.5191***	97.4743***	-10.719***	-3.4217***	184.302***	227.291***
ECOGLOB	-6.67310***	-2.97587***	248.329***	253.220***	-4.7228***	-3.2640***	100.775***	96.5298***	-5.0321***	-1.41035*	151.674**	156.690***
SOCGLOB	-9.33973***	-1.64896**	219.422**	297.896***	-6.1254***	-2.6562***	91.3810***	134.263***	-13.769***	-2.4643***	155.494***	163.633***
POLGLOB	-20.2786***	-7.67817***	325.595***	365.329***	-7.0813***	-1.62272*	83.5390**	96.2110***	-18.552***	-8.1628***	240.303***	269.119***

Note: ***,**,* present significance level 1%, 5% and 10% respectively.