European Online Journal of Natural and Social Sciences 2019;
Vol.8, No 3 pp. 411-425
ISSN 1805-3602
www.european-science.com

Impact of Openness on Economic Growth in Developing Economies: An Empirical Analysis

Bin Sheng[1], Sumbal Fatima[2], Muhammad Saqib Irshad[3], Muhammad Ramzan[1*]
[1]Institute of International Economics, Collaborative Innovation Center for China Economy, Nankai University, Tianjin, China; [2]Institute of Higher Education, Zhou En Lei School of Government, Nankai University, Tianjin, China; [3]Department of Economics, Government College University, Faisalabad, Pakistan.
*E-mail: ramzanalam2015@hotmail.com

Received for publication: 21 March 2019.
Accepted for publication: 10 June 2019.

Abstract

A country's openness has been one of the primary driving forces for stimulating growth. Among researchers, it is still controversial to conclude openness-growth relationship. It might be the result of ignoring the mediation effect of some conditional variables. Although some papers have found that openness has a positive impact on economic growth, others have seriously questioned the significance of this finding. The objective of this study is to empirically explore openness-growth relationship using fixed capital stock as a mediator variable in a panel data set of 19 developing economies spanning 1980 to 2013. The study examines the relationship between trade openness and economic growth. The results outline that the direct impact of trade openness on economic growth is negative, while it tends to exert a positive effect on economic growth when fixed capital formation is taken as a mediating variable and show a threshold. The findings of the study may help policy-makers in selected developing countries to take advantage of increasing international trade by considering domestic development level of fixed capital formation.

Keywords: Openness; Economic growth; Fixed capital stock; Developing countries; Sys-GMM

Introduction

Over the last three decades, the world economy has become more globalized and international trade have grown faster than many other economic activities (Anwar Sekiou, 2017). The fast growth in international trade and FDI has opened up new opportunities for developing countries to participate in world production. The endogenous growth models stressing the diffusion of innovations as a determinant of growth. The openness policies can play an important role in the process of attracting open trade and FDI (Grossman and Helpman, 1991; Barro and Sala-i-Martin, 1996, Aghion and Howitt, 1998). Sachs and Warner (1995) confirmed the hypothesis of a positive correlation between the adoption of trade openness policies, increasing fixed capital formation, human capital accumulation, technological improvement and economic growth. Theories citing the linkage between trade and growth date back to A. Smith and D. Ricardo. These traditional theories claim that trade rises the wealth of nations. According to macroeconomics, free trade is beneficial for nations as long as it enables the economy to grow. Advanced growth models developed by Romer (1986), Lucas (1988) state that technological change is assumed to be endogenous which makes it possible to model the long-term growth patterns.

A number of studies, for example, Balassa (1985), Dollar (1992), have found a positive relationship between trade openness and countries' economic growth performance. In an interesting

study of β-convergence, Sachs and Warner (1995) measure the impact of post-war trade liberalization on economic performance and provide evidence in support of the striking proposition that liberalization of trade leads to convergent rates of growth. In other words, trade openness leads to higher growth rates in the poor as compare to rich economies. Based on World Trade Organisation (WTO) the global economy has experienced the large amount of growth due to globalization and trade liberalization over the last four decades (Muhammad Shahbaz et al, 2016).

The endogenous growth theories generally imply that an open attitude toward trade should increase economic growth by increasing the available technology and fixed capital stock (Coe and helpman, 1995). Rodriguez and Rodrick (2000) contend that the literature is vague and there is a significant gap between the results derived from theory and the facts. Therefore, the net impact of trade openness on economic growth has been inconclusive. There is also a prevalent belief among policymakers that trade openness and foreign direct investment (FDI) enriches the yield of host nation and boosts economic growth. This belief explains the fact that FDI not only delivers direct investment funding but also generates constructive externalities through the acceptance of imported technology and skill and capital formation. The macro experiential literature discovers weak backing for an exogenous optimistic influence of FDI on economic growth. Borensztein, De Gregorio, and Lee (1998) and Xu (2000) show that FDI brings technology, which translates into higher growth only when the host country has a minimum threshold of human capital stock. Alfaro, Chanda, Kalemli-Ozcan and Sayek (2004), Durham (2004), and Hermes and Lensink (2003) provide evidence that only countries with well-developed financial markets make significant gains from international trade and FDI in terms of their growth rates.

Although there is relative theories and evidence that both trade openness and FDI generate positive economic growth effect for developing countries, more empirical evidence is still needed to confirm this belief; in the particular case of developing countries. Furthermore, the total openness effect to a country's economic growth seems to depend on some mediator variables which generate the total nonlinear effect of trade openness. There are also a few literatures providing evidence of the conditionality effect of openness. For instance, Marie Daumal (2011) analyses the impact of openness on growth by using the initial income level as a mediation condition for 26 Brazilian states.

By using a panel data set of 19 selected developing economies spanning 1980 to 2013, this study identifies the trade openness and FDI effects in line with the economic growth. The mechanism in this paper emphasizes the role of fixed capital stock as a mediator variable in enabling openness to promote growth. Hence, the selected countries will benefit from the international trade when their fixed capital formation value increases to certain level. We also test the same conditional openness effect on different regions, time periods and non-linear regression to make the conclusion more robust.

The remainder of the paper is structured as follows: Section 2 briefly reviews the literature to date. Section 3 sets out the model specification and empirical methodology. Sections 4 reports the details and discuss the implications of the results and Section 5 concludes.

Review of literature

It is always remained a subject of debate that the way in which the international economic policies of governments affect the growth rates of their economies. The chief objective of moving towards free trade and open borders, is to achieve the macroeconomic goals of their economies, among which economic growth is paramount. The nature of the association between trade openness and economic growth has been theoretically debatable. Theoretical grounds of the potential positive relations between trade openness and economic growth rise from two sources. First, the neoclassical

growth theories explaining the gains of trade openness by comparative advantages. Second, the endogenous growth theories suggesting that in the long run, trade openness boost economic growth through technology diffusion from developed to developing countries and knowledge dissemination (Barro & Sala-i Martin, 1997).

On the other hand, some theories from the endogenous growth models propose that trade openness may have a mixed effect on economic growth, depending on whether the force of comparative advantage familiarizes the economy's resources toward activities that produce long-run growth through externalities in research and development or whether they divert from such kind of activities. The early studies of Lucas (1988) and Young (1991) suggest that trade openness can be either welfare-increasing or welfare-reducing, hence showing both positive or negative effects across countries.

There are many empirical studies in this field, to examine the relationship between trade openness and economic growth, but the outcomes are still debatable. Many cross-country studies provide evidence that increasing openness has a positive impact on growth (Dollar, 1992; Sachs and Warner, 1995; Sala-i-Martin, 1996; Dollar and Kraay, 2002; Wacziarg and Welch, 2008). On the other hand, the studies of Levine and Renelt (1992), Rodriguez and Rodrik (2000), Yanikkaya (2003) reported that it is difficult to find robust positive relationships, and even that there appears to be a negative relationship between openness and growth. Currently, the number of the studies revealed that the panel data analysis has been raised. Harrison (1996) showed that there was a moderately positive impact of openness to trade on growth, when different indicators for trade were taken into account. Fetahi-Vehabi, Sadiku and Petkovski (2015) implemented a system generalized methods of moments (GMM) and found that trade has a positive impact on the countries which have higher income per-capita, FDI and capital formation. Greenaway, Morgan and Wright (2002) investigated the impact of trade liberalization on growth for developing countries using dynamic panel data analysis and determined that trade openness affected growth with a time lag. Yanikkaya (2003) pointed out there was a simple link between trade openness and economic growth by using alternative measures of trade and applying panel data analysis.

In the theoretical model, FDI is generally considered as a channel for technology transfer from developed countries to developing countries (Balasubramanyam et al., 1996; Borensztein et al., 1998) as it is introduced in a Romer's (1990) model framework. However, the Borensztein et al. (1998) model succeeded in introducing FDI as a main determinant of economic growth but fails to account for the endogeneity of that investment. Many authors have concentrated more on empirical literature which focuses the impact of FDI on economic growth in developing countries. (Ariyo 1998) studied the investment trend and its impact on African economic growth over the years. He found that only private domestic investment consistently contributed to raising GDP growth rates during the period (1970–1995). Moreover, there is no trustworthy indication that all the investment variables included in his analysis have any tangible influence on economic growth. From Gregorie 1992, using a panel data model for 12 Latin American countries over a quarterly period from 1950 to 1985. Balasubramanyam (1996) has reached a similar conclusion.

In present years, some researchers have introduced conditional effect by using different variables to investigate the openness-growth relationship. Galaye Ndiaye (2016) argued FDI contributes to economic growth directly through new technologies and indirectly through improving institutions. Blomstrom et al. (1994) has reported that FDI pays a positive impact on economic growth conditioned by a threshold level of income. The empirical work of Calderon et al. (2004) in a panel of 76 countries over the period 1970-2000, using growth effects of external conditions is quite positive regarding the beneficial impact of trade and FDI. Rivas, M. G. (2007) conducted a similar study

using conditional effect, of Mexican states and draws the conclusion that trade openness in Mexico is more beneficial for states with higher levels of income. Marie Daumal and Selin Özyurt (2011) explored the impact of trade Openness on growth of 26 Brazilian states and concluded that trade openness-growth effect is conditioned by the level of initial income of the states. That is to say, trade openness encourages the growth of richer states more than poorer ones.

To summaries, the existing literature has had a great contribution in the field but also some limitations. Firstly, vast of the literature empirically explored the openness-growth linkage but ignored the mediation effect. Secondly, by using variables like income level and human capital as a conditional effect, some researchers have also investigated the same relationship, but some other conditional or mediator variables are still need to be tested. Thirdly, the existing literature focuses only on single openness path, trade or FDI, but we considered both paths simultaneously. Fourthly, in previous literatures the identification strategies need some further improvements to reduce the endogeneity problem. Finally, studies concerning developing countries on this topic are not sufficient for policy-makers to promote openness-growth strategy.

Most of the empirical literatures indicate the trade-growth linkage, but don't explain fixed capital stock as a mediation effect to investigate the impact of trade openness and FDI on economic growth in developing countries. Our empirical evidence indicates that fixed capital stock plays a vital role towards economic growth through openness paths i.e., trade openness and FDI. By using econometric specifications and inclusion of fixed capital stock as an interaction term with trade openness and FDI, exerts a robust and positive impact on economic growth in our selected sample countries.

Methodology

Model Design

Our model is based on the assumption that trade openness and FDI contributes to economic growth through fixed capital stock as a mediator variable. Fixed capital stock is commonly used as a factor for evaluating level of economic development. Through investigation of literature we found human capital and income level have already been used as certain kinds of mediators in some economic propositions. A natural thought would be the examination of fixed capital stock as a mediator for openness-growth effect.

A country's openness is measured in two different paths, i.e. trade openness and FDI. We use the index for trade openness, as commonly measured imports plus exports divided by GDP, and the FDI is measured by the ratio of foreign direct investment to GDP. It is a fact that the indices to measure the openness are problematical. However, to measure the trade openness some researchers have created indices, including Leamer (1988), Dollar (1992), and Sachs and Warner (1995). The most repeated in literature is total trade contribution which is calculated as $\boldsymbol{open_{it} = (IM_{it} + EX_{it})/GDP_{it}}$.

Consider the simple Cobb-Douglas version of the aggregate function, equation (1) and (2) below are our basic model equations; representing the two different paths of countries' openness. i.e. trade openness and FDI respectively.

$$lny_{it} = \beta_0 + \beta_1 lnopen_{it} + \beta_2 lnfcf_{it} + \beta_3 lnl_{it} + \beta_4 lnfd_{it} + \beta_5 lnhc_{it} + \beta_6 lnfdi_{it} + \beta_7 (lnopen_{it} * lnfcf_{it}) + \mu_{it} \quad (1)$$

Where $\boldsymbol{i}$ denotes country and $\boldsymbol{t}$ time; and $\boldsymbol{open}$ is the index for trade openness; $\mathbf{lnfcf_{it}}$ represent fixed capital formation; $\boldsymbol{l}$ is labor force, $\boldsymbol{fd}$ presents the financial development broad money as a percentage of GDP, $\boldsymbol{hc}$ is human capital accumulation proxied by average years of schooling, $\boldsymbol{fdi}$ denotes foreign direct investment, ($\boldsymbol{lnopen * lnfcf}$) represents the interaction

term between trade openness fixed capital stock and μ_{it} denotes the error term. All of the variables cited are employed with their natural logarithm.

In equation (2) all the explanatory variables are same except $\boldsymbol{lnf}$, which represents FDI. From these two equations, we can get the total openness-growth effect by partial differentiation of lny_{it} as follows:

$$\frac{\partial lny_{it}}{\partial open} = \beta_1 + \beta_7 lnfcf \quad (2)$$

For FDI it is also the same. The equation (3) shows that the effect of trade openness-growth is determined by two coefficients, $\boldsymbol{\beta_1}$ and $\boldsymbol{\beta_7}$, also we can measure the mediating effect of fixed capital formation.

Data Illustration

We estimate our model on panel data set for 19 developing countries over the period of 1980-2016. The countries covered in this study are selected from D. Greenaway et al. (2002), depending on the data availability, including; Argentina, Venezuela, Mexico, Chile, Costa Rica, Peru, Colombia, Ghana, Kenya, Madagascar, Nigeria, Senegal, China, Philippine, Thailand, Bangladesh, India, Pakistan, and SriLanka. The variables we use are described in table 1 below.

Much of the data are from the World Bank's World Development Indicators database, including GDP, fixed capital formation, total labor force, and financial development. Data on trade openness and foreign direct investment are from United Nations Conference on Trade and Development (*UNCTAD*). Data on human capital are computed as average years of total schooling extracted from UN data base. The basic descriptive statistics of all variables are shown in Table 2.

Table 1. Variables Description and Sources

Variable	Description	Source
y_{it}	Real GDP per capita measured in Purchasing power parity (PPP)	WDI
open	Trade Openness measured by the ratio of imports plus exports to GDP	UNCTAD
fcf	Fixed capital formation as % of GDP	WDI
lnl	Total Labor Force Absolute Value in thousands	WDI
lnfd	Financial development broad money as % of GDP	WDI
lnhc	Human Capital measure as secondary school enrollment ratio	UN Data
fdi	Foreign Direct Investment	UNCTAD

Table 2. Summary Statistics for all Variables

Variable	Obs.	Mean	Std. Dev.	Min	Max
gdp	619	14165.213	4213.564	522.012	25352.184
open	619	0.253	0.214	0.004	1.089
fcf	619	1.442	1.554	0.118	8.074
lnl	619	9.865	1.482	6.704	13.613
lnfd	619	3.578	0.512	2.357	5.225
lnhc	619	17.840	4.297	0.214	22.155
lnfdi	619	6.438	2.422	-1.386	11.728

Note: 27 missing observations in certain years and counties are detected. Hence the total observations are less than the balanced panel data 646 (19 countries*34 years).

Identification Strategy

In recent literature, empirical disputes arising from the estimation of growth models have been widely discussed in the studies of Caselli et al., 1996; Dollar and Kraay, 2004. They concluded

that the system GMM estimator is a suitable way to reduce the endogeneity problems. The system GMM estimator could reduce the potential endogeneity of the explanatory variables through internal instruments. Thus, we use the system GMM estimator proposed for dynamic panel data models (Arellano & Bover, 1995; Blundell & Bond, 1998). The main advantage of this estimator is that it does not require any external instrument rather could reduce the potential endogeneity of the explanatory variables through internal instruments, as several studies employed the lagged values of the corresponding explanatory variables as internal instruments to deal with endogeneity (reverse causation, omitted variables, simultaneity and measurement error). The idea of GMM-difference is to take the first differences of the basic growth equation that remove the source country-specific effect. While, to reduce the endogeneity and simultaneity bias the levels of the explanatory variable lagged two and further periods. Under these conditions, lagged levels of regressors tend to be weak instruments for subsequent first differences and produces biased estimates. Therefore, Arellano and Bover (1995) and Blundell and Bond (1998) suggest to retain the system GMM estimator, that combines the regression equations into one system in first differences and in levels, where instruments used for level equations are lagged first differences of the series. Explicitly, the GMM-system estimator control for the potential endogeneity of all explanatory variables by using the instrumented variable.

The GMM-system procedure has several advantages in analyzing the economic growth model. In particular, by taking a first difference to remove unobserved time-invariant country-specific effect, this has eliminated the bias caused by any omitted variable that is constant over time (Bond et al. 2001). Many studies employed the lagged values of the corresponding explanatory variables as internal instrument variables, for example, M. Ramzan et al. (2019), Darku (2018) and Marie Daumal and Selin Özyurt (2011) among others. Taking advantages of this empirical method, our study explores the impact of countries' trade openness on economic growth by using the system GMM estimators.

Results and Discussion

In this section, first we fit the basic models by using OLS and panel fixed effect regression methods, then the GMM- estimation technique is applied to reduce the endogeneity problem. The results are reported for interpretation in table 3 and table 4 respectively. Section 4.2 describes robustness and further discussions.

Results for Basic Model

In table 3, Column (1) reports the OLS regression results. The coefficient of trade openness in Column (1) is statistically significant with negative sign, that means the direct impact of trade openness on economic growth is negative. This finding is inconsistent with majority of the existing literature. In Column (2) and (3), we estimate our model by using fixed-effect method, following Harrison (1996), and Wacziarg and Welch (2008). Column (3) reports the results without interaction term. The coefficient of trade openness is still significantly negative. This reveals that the total positive impact of trade openness-growth is caused by mediator variable (fixed capital formation).

Table 3: OLS and Fixed Effect Regression Results for Basic Equation Model (1)

$\mathbf{lny_{it}}$	(1)	(2)	(3)
	OLS	**FE**	**FE**
open	-0.327***	-1.068***	-1.303***
	(0.105)	(0.338)	(0.300)
lnfcf	0.044***	0.041***	0.023**
	(0.006)	(0.006)	(0.014)

lny_{it}	(1)	(2)	(3)
	OLS	FE	FE
lnOpen*lnfcf			0.655**
			(0.283)
lnl	1.005***	0.493***	0.650***
	(0.013)	(0.118)	(0.136)
lnfd	0.431***	0.323***	0.240***
	(0.043)	(0.101)	(0.079)
lnhc	-0.027***	-0.067	-0.111
	(0.003)	(0.109)	(0.108)
lnfdi	0.492***	0.270***	0.271***
	(0.011)	(0.001)	(0.015)
Constant	-3.887***	1.274	0.294
	(0.271)	(2.459)	(1.796)
Observations	619	619	619
R-squared	0.736	0.852	0.858
No. of countries	19	19	19

Note: Robust standard errors in parentheses. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

There are several studies describing the fact that there remains an endogeneity problem to rely only on the results of fixed-effect model estimates as measures of trade openness probably correlated with the residuals of the equation. The unobserved factors or country characteristics might be another reason that affects both the openness and growth simultaneously. For example, openness promotes spillover effect of knowledge and stimulate economic growth, but sometimes countries with higher growth rate tend to employ openness due to have certain advanced technology or product. This may create identification problems and potentially biased estimators (Cavallo and Frankel, 2008). In addition, there are potential omitted variables that are likely to be correlated with both trade openness and real GDP growth (Bernard et al, 2017).

Table 4 represents the results of GMM. The system GMM estimating technique was proposed by Blundell and Bond (1998), Arellano and Bover (1995) Arellano and Bond (1991), offers an appropriate approach to overcome the endogeneity problem. The GMM estimator is consistent only if the lagged values of the explanatory variables are valid instruments. We use both one and two time-periods (years) lagged trade openness index.

Table 4: GMM Results for Basic Equation Model (1)

lny_{it}	(1)	(2)	(3)
	open $lag1_1$	open lag_2	open $lag_{1\&2}$
open	-1.361***	-1.425***	-1.357***
	(0.112)	(0.129)	(0.124)
lnfcf	0.030***	0.034***	0.028***
	(0.007)	(0.008)	(0.007)
lnopen*lnfcf	0.856***	1.009***	0.894***
	(0.152)	(0.191)	(0.171)

lny_{it}	(1)	(2)	(3)
	open $lag1_1$	**open lag_2**	**open $lag_{1\&2}$**
lnl	0.645***	0.639***	0.601***
	(0.055)	(0.066)	(0.064)
lnfd	0.218***	0.184***	0.205***
	(0.037)	(0.041)	(0.037)
lnhc	-0.106**	-0.111**	-0.097*
	(0.0478)	(0.051)	(0.050)
lnfdi	0.235***	0.253***	0.226***
	(0.009)	(0.011)	(0.007)
Observations	586	565	556
R-squared	0.958	0.958	0.959
K-Paap LM	55.980***	46.215***	52.635***
K-Paap Wald	189.583**	94.406*	110.537**
Hansen J	71.169	80.589	81.895
P-Value	0.556	0.614	1.0000
AR2	0.571	0.410	0.249
P-Value	0.556	0.614	0.540

Note: Robust standard errors in parentheses. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent levels, respectively. K-Paap LM= Kleibergen-Paap, and K-Paap Wald= LM Kleibergen-Paap Wald F

From table 4, column (1) reports the results for one-year lagged trade openness as an instrument variable. It shows that the coefficient with magnitude -1.361 is significant at one percent level, while the coefficients of interaction term (ln*topen*lnfcf*) from column (1) to column (3) is are positive and significant at one percent level. That means the total effect of trade openness is -1.361+0.856lnfcf, according to equation (2) we posted above in section 3.1. By taking the partial derivative, the value of fixed capital formation will be 1.590. That is to say, when a country's fixed capital formation is greater than 1.590 (fixed capital formation >1.590), the trade openness-growth effect would be positive. On contrary, when the fixed capital formation is lower than this critical value (fixed capital formation <1.590), the trade openness-growth effect would be negative. Hence, 1.590 is a minimum threshold of the trade openness-growth measured by mediator variable (fixed capital formation). The critical value located in the range of observations, 12 out of 19 countries' fixed capital formation value is above the critical value for few years. On the other hand, some of the selected developing countries show fixed capital formation value below the critical value during the whole observed period, are still waiting for catch-up to take advantage of positive trade openness-growth effect. Hence, from Column (3), the trade openness shows a turning point while column (2) and (3) represent the results of two years and one and two years lagged openness as instrument variables respectively. The results are consistent with the separated one and two time-periods lagged estimations. For all these three different time lags, the coefficients for both openness and interaction terms are similar, accordingly with similar threshold for trade openness.

To justify for the validity of instrument variables (IVs), we conduct three tests and report corresponding statistics: The Kleibergen-Paap LM test for under-identification, the Kleibergen-Paap Wald F test for weak identification, and the Hansen J test for over identification for all IVs. These

econometric specification tests presented in table 4 support the validity of these IVs with statistical significance. The Hansen J test of over identification, do not reject the null hypothesis of correct specification. The tests for first-order (AR1), and second-order-serial correlation (AR2) along with P-values are reported in the lower part of the table 4, and do not reject the null hypothesis for second second-order-serial correlation. The results for control variables are robust as expected in our basic specification. The coefficient of fixed capital formation is positive as expected and significant for all models. The coefficient of labor force is positive and statistically significant for all lagged GMM equations as the developing countries are commonly to be more labor-intensive. The Coefficient of financial development, is positive and statistically significant for all lagged equations. Meanwhile, the coefficients of human capital are negative. One possible interpretation of this result is that most of the developing countries are less developed in human capital accumulation. For the whole equation, the high F-statistic and adjusted R-squared confirm the goodness of fit of regression models.

In sum, the results reveal that the growth effect of trade openness is conditional to the development level of fixed capital formation. In simple words, according to our calculations, the total effect of trade openness on economic growth is positive for the countries whose development level of fixed capital formation is above the critical value. Fixed capital formation as a mediator influences the trade openness-growth effect, i.e. the turning point mediation effect for trade openness. The results are consistent with our theoretical assumption. What's more, the turning point mediation effect for trade openness gives an explanation to the debate of literatures on the impact of trade openness to the economic growth. This study fills the gap in the theoretical research and empirical evidence for the conflict of trade openness-growth effect. Furthermore, the results outline that trade openness is more beneficial for the sample countries well-endowed in fixed capital formation. Government of the developing economies should pay her more attention to develop the level of domestic fixed capital formation in order to take full advantage of international trade.

Further Discussion and Robust Analysis

To access the robustness of our findings, we make three different tests: First, estimation of sub- regions, including; Latin America, Sub-Saharan Africa, East Asia and South Asia respectively. Second, estimation of sub- periods (before and after the financial crisis of 2008). Third, non-linear regression analysis.

Robustness test 1: Regional Analysis Models

It might be valuable to look at the results by regions. We want to see that is there any evidence of change in the relationship between trade openness and economic growth? Study demonstrated that the relationship could have changed from one region to the next. Table 5 report the results of the impact of trade openness on economic growth using GMM estimator for all four different sub-regions. In table 5, the results show that the coefficient of trade openness is negative and statistically significant at one percent level. The coefficients of interaction terms in column (1) to (4) are *(lntopen*lnfcf)* are positive and significant at one and five percent level respectively. Hence, we can say that the overall results of GMM estimator for sub-regions are strictly consistent with findings of our main basic model as reported in Table 4. The critical value for fixed capital formation and turning point for trade openness still exists and significant in all four regions.

Furthermore, we notice that the turning point values (fixed capital formation=0.888, 0.898, 0.630 and 0.121) associated with fixed capital formation are slightly differ in magnitude for all four regions respectively. The turning point value of fixed capital formation for Latin America and SSA is quite similar. However, the turning point for East Asia is 30% lower than in Latin America and SSA. But it is much lower in South Asia, accounted for 10-20% than that of in Latin America, SSA and East Asia respectively. The existing pattern might be due to two reasons. Firstly, there might be

some other mediators need to be investigated. Secondly, some economic factors are with great difference that influence the openness-growth effect in these regions, for instance, export-oriented development strategies are generally adopted by South, and East Asia than that of in Latin America and SSA.

What's more, GMM estimator using both one and two time-period (year) lagged as an instrument variable. However, these are weak instrument variables for representing endogeneity problem in SSA equation. Since the Kleibergen-Paap Wald F test for weak IV is unable to reject the null hypothesis at 10 percent level. If we change to exactly identified case, like using one time-period lagged for SSA equation, the truing point will change to fixed capital formation=1.613, even higher than that of using both two time-period lagged, though the lagged trade openness is still weak instrument variable.

Table 5: GMM Results of Sub-regions: Impact of on trade openness on economic growth

lny_{it}	(1)	(2)	(3)	(4)
	Latin America	**SSA**	**East Asia**	**South Asia**
lnopen	-0.554***	-1.836***	-2.168***	-1.182***
	(-0.658)	(-0.457)	(-0.827)	(-0.678)
lnfcf	0.906***	0.937***	0.934***	1.644***
	(0.041)	(0.011)	(0.030)	(0.014)
lnopen*lnfcf	0.624***	2.041***	3.439**	9.788**
	(1.165)	(1.563)	(0.363)	(0.410)
lnl	0.638***	0.636***	2.007***	1.053***
	(0.951)	(1.877)	(1.421)	(0.880)
lnfd	0.001	0.092	-0.749***	-0.208***
	(0.016)	(1.293)	(-1.384)	(-1.025)
lnhc	0.196***	(0.143)	0.170	-0.068
	(0.311)	(-0.837)	(0.792)	(-0.501)
lnhc	0.196***	(0.143)	0.170	-0.068
	(0.311)	(0.837)	(0.792)	(-0.501)
Observations	202	141	89	129
R-squared	0.971	0.980	0.974	0.992
No. of countries	7	5	3	4
K-Paap LM	20.171***	9.058**	16.120**	29.568***
K-Paap Wald F	13.374**	2.558	62.693**	12.170**
Hansen J	72.508	81.607	82.556	81.006
P- Value	0.285	0.448	0.459	0.605
AR2	-0.409	-0.469	0.613	0.612
P-Value	0.254	0.217	0.240	0.231

Note: Robust standard errors in parentheses. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

The coefficients of interaction terms for all four regions are positive and significant, which shows that trade openness tends to exert a positive impact on economic growth in selected developing economies through fixed capital formation. The results are basically consistent with our main model.

Robustness test 2: Sub-Period Analysis Models

In order to study the results by sub-periods we examine the estimates of the sub-periods. Total time period is divided into two sub periods, i.e. before financial crisis of 2008 (from 1980 to 2008) and after financial crisis (from 2009 to 2013). We are interested to explore whether the trend changes before and after 2008 crisis. Unlike the crisis in 1997, the 2008 financial crisis influenced wide region around the globe.

Table 6 illustrates the results of both periods for trade-growth effect. In Column (1) and (2), the coefficient of trade openness is negative and statistically significant, while interaction term in each column are positive and statistically significant. Hence, the results are also consistent with our basic model. Dissimilarities are also identified in comparison of the results before and after 2008 crisis. First, the turning point before 2008 is when fixed capital formation=1.370, compared to after 2008, the turning point at fixed capital formation=0.521, which is only about 40% as before for developing countries. This could be due to the globalization, fast-communication, innovative technology and knowledge spillovers. Second, after 2008 crisis by using different lags the instrument variables are weak or under identified. This may cause to change the situation after 2008, or simply we need longer time-period data to check the robustness of our basic findings.

Table 6: GMM Results of sub-periods: Impact of trade openness on economic growth

lny_{it}	(1)	(2)	(3)	(4)
	open $lag1_1$	open lag_2	open $lag1_1$	open lag_2
	Years ≤ 2008	**Years** > 2008	**Years ≤ 2008**	**Years** > 2008
open	-0.470***	-0.788***	-0.129***	-0.115***
	(-0.630)	(-0.358)	(0.022)	(0.018)
lnfcf	1.073***	1.184***	1.644***	1.562***
	(5.089)	(3.463)	(0.017)	(0.012)
open*lnfcf	0.726***	0.714***	0.016***	0.007***
	(0.007)	(0.011)	(5.576)	(2.681)
lnl	0.031***	0.192***	0.009*	0.026**
	(3.759)	(3.537)	(1.841)	(2.483)
lnfd	0.699***	1.897**	0.583***	1.873***
	(8.897)	(2.498)	(7.658)	(4.093)
lnhc	0.183***	-0.170*	0.227***	-0.232
	(4.778)	(-1.722)	(3.646)	(-1.270)
lnfdi	0.078**	0.073**	0.015***	0.365**
	(1.271)	(0.282)	(0.174)	(1.533)
Observations	464	410	446	410
R-squared	0.936	0.339	0.868	0.85
No. of countries	29	5	29	5
K-Paap LM	41.746***	4.623	50.404***	0.401
K-Paap Wald F	69.520**	2.094	23.799**	0.088
Hansen J	44.058	45.203	43.313	41.179
P- Value	0.1315	0.174	0.191	0.214
AR2	-0.254	-0.458	0.413	0.512
P-Value	0.158	0.207	0.149	0.137

Note: Robust standard errors in parentheses. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Robustness test 3: Nonlinear Analysis Models

The mediation effect implied that the openness-growth effect could fit nonlinear models. However, nonlinear models demonstrate only the turning point of openness, instead of the mediation effect, by taking the example of quadratic form. In this article, we are aiming at to test the mediation effect of fixed capital formation.

$$lny_{it} = \beta_0 + \beta_1 topen^2 + \beta_2 topen_{it} + \beta_3 lnk_{it} + \beta_4 lnL_{it} + \beta_5 lnfd_{it} + \beta_6 lnhc_{it} + \beta_7 lni_{it} + \mu_{it} \quad (3)$$

$$lny_{it} = \beta_0 + \beta_1 e^{topen} + \beta_2 lnk_{it} + \beta_3 lnL_{it} + \beta_4 lnfd_{it} + \beta_5 lnhc_{it} + \beta_6 lni_{it} + \mu_{it} \quad (4)$$

$$lny_{it} = \beta_0 + \beta_1 / topen + \beta_2 lnk_{it} + \beta_3 lnL_{it} + \beta_4 lnfd_{it} + \beta_5 lnhc_{it} + \beta_6 lni_{it} + \mu_{it} \quad (5)$$

$$lny_{it} = \beta_0 + \beta_1 / (1 + e^{topen}) + \beta_2 lnk_{it} + \beta_3 lnL_{it} + \beta_4 lnfd_{it} + \beta_5 lnhc_{it} + \beta_6 lni_{it} + \mu_{it} \quad (6)$$

Equations (3) to (6) are built for the nonlinear estimation of trade openness. Table 7 reports the results for trade openness. Equation (3) is a quadratic function model trying to fit the openness to economic growth into a bell-shape curve. The coefficient for open and topen^2 are both significant and consistent with the expected sign. The critical coefficient β_1 from equation (4) to (6) are all significant at 1 percent level, which imply that nonlinear model takes exponential or negative exponential form. The R-square for the four models are all higher enough that leads to a good fit. These results confirm the conclusion of our basic models.

Table 7: Results of Nonlinear Regression: Impact of trade openness on economic growth

lny$_{it}$	**eq.(3)**	**eq.(4)**	**eq.(5)**	**eq.(6)**
open	-2.603***			
	(-3.155)			
open^2	1.450**			
	(2.402)			
b1		-0.169***	0.005***	1.434***
		(-2.885)	(4.445)	(3.153)
lnl	0.364***	1.011***	1.004***	1.003***
	(2.963)	(77.611)	(80.154)	(74.046)
lnfd	0.287***	-0.429***	-0.478***	-0.431***
	(3.438)	(-9.769)	(-10.289)	(-9.819)
lnhc	-0.104	-0.027***	-0.028***	-0.027***
	(-0.981)	(-8.478)	(-8.626)	(-8.548)
lnfdi	0.663***	0.841***	0.839***	0.833***
	(6.835)	(38.313)	(39.723)	(35.749)
constant	4.037	-3.867***	-3.881***	-4.571***
	(1.433)	(-13.671)	(-15.968)	(-25.021)
Observations	619	619	619	619
R-squared	0.957	0.935	0.937	0.936

Note: Robust standard errors in parentheses. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Conclusion

The recent globalization and integrated world economy has increased international trade significantly. Developing countries are persistently facing issues related to trade openness performance. The empirical literature shows mixed response regarding impact of trade openness on economic growth. This study fills the gap in literature by analyzing the link between countries' trade openness and economic growth in the presence of fixed capital stock as a mediator variable in selected developing economies. In addition, we measured the countries' trade openness by the index commonly used in literature i.e. total trade contribution (imports plus exports divided by GDP). The conclusion suggests that fixed capital formation is a significant mediator for trade openness.

Particularly, the fixed capital formation impacted trade openness with a nonlinear effect. Trade openness encourages the growth of an economy well-endowed in fixed capital formation. Therefore, it is recommended that a developing economy that wants to follow the pace of economic growth should initiate to develop its level of fixed capital formation to compete favorably in the world trade.

This empirical study uses the dataset with 19 developing countries spanning 1980-2013. System GMM estimators and instrument variables are employed to deal with endogeneity problem. What's more, to make the conclusion more robust, we also test the model for sub-regions, sub-periods and non-linear regression. Consistent results are obtained which confirmed our basic findings.

By summing up, our empirical findings indicate that fixed capital formation is an important channel used as a mediator to promote economic growth through international trade for selected developing countries. Policy- makers need to consider the mediation effect for promoting growth, and take advantage of integrated world economy. Although there might be some other channels in this context, considering the non-linearities and threshold regression would be meaningful and a productive area for future research.

References

Aghion, P., Howitt, P., Brant-Collett, M., & García-Peñalosa, C. (1998). *Endogenous Growth Theory*. MIT press.

Alfaro, L., Chanda, A., Kalemli-Ozcan, S., & Sayek, S. (2004). FDI and economic growth: the role of local financial markets. *Journal of International Economics*, 64(1), 89-112.

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies*, 58(2), 277-297.

Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*, 68(1), 29-51.

Ariyo, A. (1998). Investment and Nigeria's economic growth. In *Investment in the Growth Process Proceedings of Nigerian Economic Society Annual Conference 1998* (pp. 389-415).

Balassa, B. (1985). Exports, policy choices, and economic growth in developing countries after the 1973 oil shock. *Journal of Development Economics*, *18*(1), 23-35.

Balasubramanyam, V. N., Salisu, M., & Sapsford, D. (1996). Foreign direct investment and growth in EP and IS countries. *The Economic Journal*, 92-105.

Barro, R. J., & Lee, J. W. (1996). International measures of schooling years and schooling quality. *The American Economic Review*, 86(2), 218-223.

Berthélemy, J. C., & Demurger, S. (2000). Foreign direct investment and economic growth: theory and application to China. *Review of Development Economics*, *4*(2), 140-155.

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87(1), 115-143.

Borensztein, E., De Gregorio, J., & Lee, J. W. (1998). How does foreign direct investment affect economic growth, *Journal of International Economics*, *45*(1), 115-135.

Calderon, C., Loayza, N., &Schmidt-Hebbel, K. (2004). External Conditions and Growth Performance. Working Papers Central Bank of Chile 265, Central Bank of Chile.

Caselli, F., Esquivel, G., & Lefort, F. (1996). Reopening the convergence debate: a new look at cross-country growth empirics. *Journal of Economic Growth*, 1(3), 363-389.

Cavallo, E. A., & Frankel, J. A. (2008). Does openness to trade make countries more vulnerable to sudden stops, or less? Using gravity to establish causality. *Journal of International Money and Finance*, 27(8), 1430-1452.

Coe, D. T., & Helpman, E. (1995). International R&D spillovers. *European Economic Review*, 39(5), 859-887.

Dollar, D. (1992). Outward-oriented developing economies really do grow more rapidly: evidence from 95 LDCs, 1976-1985. *Economic Development and Cultural Change*, 40(3), 523-544.

Dollar, D., & Kraay, A. (2002). Growth is good for the Poor. *Journal of economic growth*, 7(3), 195-225.

Dollar, D., & Kraay, A. (2004). Trade, growth, and poverty. *The Economic Journal*, 114(493).

Durham, J. B. (2004). Absorptive capacity and the effects of foreign direct investment and equity foreign portfolio investment on economic growth. *European Economic Review*, 48(2), 285-306.

Fetahi-Vehapi, M., Sadiku, L., & Petkovski, M. (2015). Empirical Analysis of the Effects of Trade Openness on Economic Growth: An Evidence for South East European Countries. *Procedia Economics and Finance*, 19, 17-26.

Frankel, J. A., & Romer, D. (1999). Does trade cause growth? *American Economic Review*, 89 (3), 379-399.

Greenaway, D., Morgan, W., & Wright, P. (2002). Trade liberalization and growth in developing countries. *Journal of Development Economics*, 67(1), 229-244.

Gregory, A., & Mc Corriston, S. (2005). Foreign acquisitions by UK limited companies: short-and long-run performance. *Journal of Empirical Finance*, *12*(1), 99-125.

Grossman, G. M., & Helpman, E. (1991). Trade, knowledge spillovers, and growth. *European economic review*, 35(2-3), 517-526.

Harrison, A. (1996). Openness and growth: A time-series, cross-country analysis for developing countries. *Journal of Development Economics*, 48(2), 419-447.

Hermes, N., & Lensink, R. (2003). Foreign direct investment, financial development and economic growth. *The Journal of Development Studies*, *40*(1), 142-163.

Krueger, A. O. (1978). Liberalization, Direction of Bias, and Economic Growth. In *Liberalization Attempts and Consequences* (pp. 277-300). NBER.

Kwan, A. C., & Kwok, B. (1995). Erogeneity and the export-led growth hypothesis: the case of China. *Southern Economic Journal*, 1158-1166.

Leamer, E. E. (1988). Measures of openness. In *Trade policy issues and empirical analysis* (pp. 145-204). University of Chicago Press.

Levine, R., & Renelt, D. (1992). A sensitivity analysis of cross-country growth regressions. *The American Economic Review*, 942-963.

Lucas, R. (1988). On the mechanisms of development planning. *Journal of Monetary Economics*, *22*(1), 3-42.

Myint, H. (1958). The" classical theory" of international trade and the underdeveloped countries. *The Economic Journal*, *68*(270), 317-337.

Nakov, A. (2004). Foreign direct investment and growth in transition: panel data and time series evidence, 1991-2001. *Croatian International Relations Review*, 10(34/35), 7-16.

Ndiaye, G., & Xu, H. (2016). Impact of Foreign Direct Investment (FDI) on Economic Growth in WAEMU from 1990 to 2012. *International Journal of Financial Research*, 7(4), 33.

Özyurt, S., & Daumal, M. (2013). Trade openness and regional income spillovers in Brazil: A spatial econometric approach. *Papers in Regional Science*, *92*(1), 197-215.

Ramzan, M., Sheng, B., Shahbaz, M., Song, J., & Jiao, Z. (2019). Impact of trade openness on GDP growth: Does TFP matter? The Journal of International Trade & Economic Development, 1-36.

Rivas, M. G. (2007). The effects of trade openness on regional inequality in Mexico. *The Annals of Regional Science*, 41(3), 545-561.

Rodriguez, F., & Rodrik, D. (2000). Trade policy and economic growth: a skeptic's guide to the cross-national evidence. *NBER Macroeconomics Annual*, 15, 261-325.

Romer, P. M. (1986). Increasing returns and long-run growth. *Journal of Political Economy*, *94*(5), 1002-1037.

Romer, P. M. (1990). Endogenous technological change. *Journal of Political Economy*, *98*(5, Part 2), S71-S102.

Sachs, J. D., Warner, A., Åslund, A., & Fischer, S. (1995). Economic reform and the process of global integration. *Brookings Papers on Economic Activity*, 1995(1), 1-118.

Sala-i-Martin, X. X. (1996). The classical approach to convergence analysis. *The Economic Journal*, 1019-1036.

Wacziarg, R., & Welch, K. H. (2008). Trade liberalization and growth: New evidence. *The World Bank Economic Review*, *22*(2), 187-231.

Wacziarg, R., & Welch, K. H. (2008). Trade liberalization and growth: New evidence. *The World Bank Economic Review*, *22*(2), 187-231.

Xu, B. (2000). Multinational enterprises, technology diffusion, and host country productivity growth. *Journal of Development Economics*, *62*(2), 477-493.

Yanikkaya, H. (2003). Trade openness and economic growth: a cross-country empirical investigation. *Journal of Development Economics*, *72*(1), 57-89.

Young, A. (1991). Learning by doing and the dynamic effects of international trade. *The Quarterly Journal of Economics*, *106*(2), 369-405.

Zaman, K., Shahbaz, M., Loganathan, N., & Raza, S. A. (2016). Tourism development, energy consumption and Environmental Kuznets Curve: Trivariate analysis in the panel of developed and developing countries. *Tourism Management*, *54*, 275-283.