Causal Relationship between Foreign Direct Investment (FDI) and Economic Growth in Sri Lanka

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ABSTRACT

This study analyzes the causal relationship between FDI and economic growth in Sri Lanka using quarterly time series data for Gross Domestic Product (GDP), Domestic Investment (DIN), Foreign Direct Investment (FDI) and Exports (EX) in real terms from 1978-1 to 2005-4. The production function approach has been used as the theoretical framework for undertaking empirical work to test whether there is any relationship between FDI and economic growth along with other two variables, domestic investment and exports. In the empirical investigation unit root test, cointegration analysis, error correction modeling approaches have been applied. In testing the causality between variables the Engle Granger Causality test is used as techniques for estimating the data. It is confirmed that according to the causality test, the direction of caùsation is not towards from FDI to GDP growth but the direction goes from GDP growth to FDI. Besides, unidirectional causality could be observed from GDP to Exports, GDP to DIN, EX to FDI, EX to DIN and bidirectional causality for DIN and FDI. However, according to the results of the analysis it is evident that Sri Lanka exhibits uni-directional Granger cause between FDI and GDP growth. In other words, GDP in Sri Lanka is not Granger caused by FDI but causality runs more from GDP' !FDI. Theoretically, it can suggest that government policies since 1977 aimed at enhancing economic growth may make the economy attractive to FDI flows (through the effect of economic development.). In this study, Sri Lanka's case seems to support this theory directing the causality from GDP growth to FDI growth. Among measures proposed in this connection is sound investment and financial polices to promote diversified FDI that needs to be well coordinated within the macro-economic policy framework, and the need for consistency, and firm commitment to such policies.

1. Introduction

The role of foreign direct investment (FDI) has been widely recognized as a growth-enhancing factor in developing countries. FDI enables investment receiving (host) countries to achieve investment levels beyond their own domestic saving. More importantly, FDI is an important means of transferring modern technology and innovation from developed to developing countries. However, there is convincing evidence that the growth enhancing effect from FDI seems to vary from country to country and depends on various country specific factors.

The relationship between FDI and economic growth has been intensely debated for decades and has been analyzed across regions and countries by diverse econometric methods. There is a pool of empirical and theoretical literature which explains the roles of FDI in economic growth. A positive relationship between these two factors is conventionally supported by some empirical studies, though there are still conflicting views on heterogeneous impacts of FDI in economic growth. Another interesting aspect related to FDI and economic growth is the causality between these two factors. It is, important to determine the direction of causality between these two variables because it can provide a government with guidelines for their future economic policy making. However, this causality is still controversial and ambiguous since it varies across countries. There is no uniform pattern of the impact of FDI on promoting economic growth.

This study focuses on the causal relationship between FDI and economic growth in Sri Lanka. The remaining parts of the study are structured as follows. Causality between FDI and GDP Growth based on Literature Review are presented in section two. The data and the method of estimation are given in section three. The causal relationship between the selected variables and Granger Causality test are discussed in section four. The results of causality tests are analyzed in section five. Finally, the concluding remarks are given in section six.

2. Literature Review on Causality between FDI and GDP Growth

There is a plethora of case studies supporting the importance of GDP growth in attracting FDI flows, the importance of FDI flows in stimulating GDP growth, or both. Accordingly this section provides a brief review of some studies based on causality of FDI and output growth. Appling a multi-country framework to data from Denmark, Finland, Norway and Sweden, Ericsson and Irandoust (2001) examined the causal effects between FDI growth and output growth for four OECD countries. Constructing a multivariate Vector Auto Regression (VAR) model

including FDI, output and total factor productivity (TFP) growth and using the estimation techniques developed by Toda and Yamamoto (1995) and Yamada and Toda (1998), the authors failed to detect any causal relationship between FDI and output growth for Denmark and Finland. They suggested that the specific dynamics and nature of FDI entering these countries could be responsible for these no-causality results. In particular, they argued that, since most of the multinational firms in Denmark and Finland are in service (especially distribution) sectors and the causal relationship between FDI and GDP may not exist. They found a long run unidirectional causal relationship running from FDI growth to GDP growth for Norway. This finding supports the argument that economic policies promoting FDI inflows in Norway was an effective instrument for stimulating economic growth, but reverse causation was not established from GDP growth to FDI growth. Ericssion and Irandoust (2001) further found support to the bi-directional causal relationship in data from Sweden, which provides evidence that FDI affects economic growth and economic growth itself exerts a major influence to the extent of FDI inflows. In other words, by stimulating economic growth Sweden can promote inflows of FDI and this in turn will have an additional positive impact on output growth.

Using a single country framework, Chakraborty and Basu (2002) examined the link between FDI and output growth in India. Utilizing annual data from 1974 to 1996, during which India undertook tremendous efforts in opening their economy, they considered the probable direct and indirect impact of these policy regime changes on FDI flows via their effects on the host country's market and cost structure. To consider the effects of policy changes on FDI, they studied the interaction among specific endogenous variables within a structural model. They used net inflow of FDI, real GDP, unit cost of labour as specific endogenous variables while the proportion of import duties in tax revenue as an exogenous variable. Further included are three dummy variables to capture the different episodes of liberalization attempted by the Indian government over the last 20 years. Using a cointegration model with a vector error correction mechanism aided with the methodology (An econometric test for determining causality) introduced by Johansen and Juselius (1990), their studies make the following conclusions: (1) Real GDP in India is not Granger caused by FDI and the causality runs more from real GDP to FDI; (2) the trade liberalization policy of the Indian government had some positive short-run impacts on the FDI flows; and (3) FDI tends to lower the unit labour cost, which suggests that FDI in India is labour promoting.

Nyatepe-Coo (1998) assessed the contribution of FDI to economic growth in selected countries in Southeast Asia, Latin America and Sub-Saharan Africa covering the period 1963-1992. Based on the model of endogenous growth and following the work of Borenstein De Gregorio and Lee (1998), Nyatepe-Coo (1998) constructed a model with GDP growth as the dependent variable and FDI, human capital and a matrix of relative determinants (i.e. government consumption, trade policies, inflation and degree of financial development) as independent variables. He finds that FDI promotes economic growth in the majority of the 12 countries examined[1]. He likewise found some evidence suggesting a direct relationship between foreign capital and economic growth. The study of Nyatepe-Coo (1998), however, failed to find a significant link between FDI and economic growth when the variable on investments in human capital is added to the equation. A more unusual finding is the negative relationship between human capital and output growth. The author asserts that the use of working age population enrolled in secondary school as a proxy for human capital accumulation may be misspecification that led to the abnormal results.

Liu, Burridge and Sinclair (2002) tested the existence of a long-run relationship among economic growth, FDI and trade in China. Using a cointegration framework with quarterly data for exports, imports, FDI and growth from 1981 to 1997, the research found the existence of a bi-directional causal relationship among FDI, growth, and exports. However, these economists thought that it would be precarious to conclude or even infer that FDI causes growth by testing for Granger causality alone. They cautioned that it may still be probable that the resulting causalities simply indicate that: "FDI flows pose as a close proxy for the openness of macroeconomic policy stance of the Chinese government and that no evidence has suggested that the surge in FDI in the early 1990s has yet been reflected in GDP growth, export growth or import substitution" (Liu, Burridge and Sinclair, 2002: 1438-1439).

Studying the long-run dynamics of FDI and its spillovers to output by using cointegration and VAR techniques, Bende-Nabende, Ford, Sen

and Slater (2000) found evidence from the Asia-Pacific Economic Cooperation region[2] that FDI positively affects output directly and indirectly (through spillover effects). Adopting a model formulated by the UN conference on Trade and Development (UNCTAD, 1992) and the latter extended by Bende and Ford (1998), their study assumed a simplistic linear relationship between the dependent and independent variables. It included FDI, human capital, employment, new technology, capital formation and international trade as independent variables and output growth as dependent variable. This study revealed that less advanced countries' output responded more to FDI, human capital, capital formation, international trade and new technology than that of advanced countries.

Borenstein De Gregorio and Lee (1998) estimated the effects of FDI on economic growth and investigated the channel through which FDI may be beneficial to growth. In a framework of cross-country regression with data covering 69 developing countries, their results suggest that FDI is in fact an important vehicle for the transfer of technology, contributing to growth to a larger extent than domestic investment. They found a strong complementary effect between FDI and human capital. The empirical results of their study, however, implied that FDI is more productive than domestic investment only when the host country has a minimum threshold stock of human capital.

Using a Granger causality test for five Latin American economies (Brazil, Mexico, Venezuela, Chile and Colombia), De Mello (1997) tested the hypothesis of increasing returns to domestic capital due to FDI flows. Using data covering 1970-1991, his findings suggest that the existence of causality for both directions depends on the recipient economy's trade regime, open economy performance variables and domestic policy variables. On the other hand, his findings show that capital accumulation in Brazil appears to have preceded output growth while TFP growth seems to precede FDI flows. Chile on the other hand, showed the reverse situation where evidence revealed that FDI precedes both output and TFP growth. De Mello's findings (1997) suggest that in addition to the idea of a development threshold, the direction of causation depends on existing factor endowments and scale effects in such a way that larger economies are more attractive to FDI than smaller ones.

De Mello (1999) further attempted to find support for an FDI-led growth hypothesis based on time series analysis and panel data estimation for a sample of 32 OECD and non OECD countries covering the period 1970-1990. He wanted to see a distinction in the effect of FDI on growth in technological leaders and followers. The distinction between OECD and non-OECD countries is critical as de Mello (1999) grouped OECD countries as technological leaders because these countries are assumed to be having more advanced level of technology while non-OECD countries were considered as technological backward countries. His paper estimated the impact of FDI on capital accumulation, output, and TFP growth in the recipient economy. According to the study, his conclusions are as follows: (1) FDI has a positive impact on output growth; (2) there is a dominant complementary effect between FDI and domestic investment; and more importantly, (3) while FDI appears to have a positive impact on the technological change in OECD countries, a negative relationship exists between FDI and TFP in non-OECD countries. This last finding suggests that for technological followers, FDI may reduce TFP growth by fostering producer capital accumulation given the complementarily effect.

Athukorala (2003) has attempted to test the FDI-led growth hypothesis quantitatively in the case of Sri Lanka. The study based on time series data from 1959- 2002. Utilizing the production function model, he investigated the impact of FDI on growth taking foreign direct investment, domestic investment, and trade liberalization as independent variables and GDP as dependent variable. This study mainly consisted of testing the short-run and long-run relationship between FDI and economic growth and also to consider the perception of the civil society and foreign firms toward FDI. However, his study does not provide much support for the view of a robust link between FDI and growth in Sri Lanka. But it does not imply that FDI is unimportant. Rather, his analysis reduces the confidence in the belief that FDI has exerted an independent growth effect in Sri Lanka. The net attitudes of the civil society on the impact of FDI on opportunities for domestic business and economic activities is positive and net attitudes of foreign firms towards FDI reveals that the investment climate has not improved in Sri Lanka as a result of lack of good governance, corruption, political instability and civil disturbance, bureaucratic inertia and poor law and order situation.

Athukorala and Karunatatne (2004) have done a study to test the FDI-economic growth relationship for Sri Lanka using time series data from 1970 to 2003 and have done a questionnaire survey covering civil society and foreign firms. A production function model was used to investigate the impact of FDI on growth. Foreign direct investment, domestic investment, and economic policy were the other independent variables, while GDP was used as dependent variable. The econometric framework of cointegration and error correction methods were used to capture the short-run and long-run relationship. Their results indicated that there was no significant relationship between GDP and FDI during the study period. However, there may be some indirect effects, as indicated by the view of civil society that there is a positive impact of FDI on opportunities for domestic business and economic activities.

The empirical studies reviewed above use different econometrics techniques and methodologies to test the causal relationship between FDI and economic growth in host countries and create variation in test results. No consensus has yet been reached on the steady state as well as dynamic effects of FDI on growth. While some studies argue that the impact of FDI on growth is highly heterogeneous across countries with relatively open economies showing statistically significant results, the other studies maintains to test the causality between FDI and economic growth. However, most studies don't pay any serious attention to the possibility of a bi-directional link between the two variables in reference.

3. Data and the Method of Estimation

This study is mainly based on the secondary data from Central Bank of Sri Lanka. It should mention here that the study will use time series quarterly data Gross Domestic Product (GDP), Domestic Investment (DIN), Foreign Direct Investment (FDI) and Exports (EX) in real terms covering the sample period from 1978-1 to 2005-4. Annual data covering the 27 observations are very small sample for a regression analysis and therefore, quarterly data have been interpolated from the annual data to avoid the small sample of the study[3]. It has taken log values for all data series and then used these log values for estimation of the equations in this study.

For the model to investigate the impact of FDI on growth, we use a simple production function but add several slight difference variables.

Multiple regression analysis based on time series data is used to test the relationship between economic growth (GDP growth rate) and the explanatory variables: Foreign Direct Investment (FDI) along with Domestic Investment (DIN), and Exports (EX). Because of the non availability of sufficient data, employment was excluded as an explanatory variable in the model. Accordingly, in this study it derives the following growth equation:

$$GDP = \hat{a}_0 + \hat{a}_1\, INV + \hat{a}_2\, FDI + \hat{a}_3\, EX + U_t \qquad (1)$$

Where

GDP = Gross Domestic Products

DIN = Domestic Investment

FDI = Foreign Direct Investment

EX = Exports

Ut = Stochastic error term

Specifying the production function in log-linear form (with an error term, U_t), the following equation can be written:

$$GDPt = \hat{a}_0 + \hat{a}_1\, LINVt + \hat{a}_2\, LFDIt + \hat{a}_3\, LEXt + Ut \qquad (2)$$

The first step of the estimation process was to examine the time series properties of the data series. We look at trends in each data series and test for stationary and the order of integration. In fact most economic variables are non-stationary in their level form. These non-stationary time series may result to have spurious regressions.

Although a simple least squares regression of integrated variables may be spurious, one or more linear combinations of the series may exist that result in a stationary residual. For this purpose we can employ the following forms of Dickey-Fuller and the Augmented Dickey-Fuller (ADF) test where each form differs in the assumed deterministic components in the series[4] (Dickey and Fuller, 1979, 1981). To allow for the various possibilities, the DF test is estimated in the different forms, that is under three different null hypothesis.

$$\Delta Y_t = \acute{a} Y_{t-1} + U_t \qquad (3)$$

$$\Delta Y_t = \hat{a}_1 + \acute{a} Y_{t-1} + U_t \qquad (4)$$

$$\Delta Y_t = \hat{a}_1 + \hat{a}_2 t + \acute{a} Y_{t-1} + U_t \qquad (5)$$

Where, ΔY_t = First deference of Y variable

Y_{t-1} = One period lag of Y variable

= Stochastic error term,

Where, t is the time or trend variable. In each case, the null hypothesis is that $\acute{a} = 0$, that is there is a unit root- the time series is nonstationary.

As the error term U_t is autocorrelated, we use the following equation with lagged difference term instead of equation (5)

$$\Delta Y_t = \hat{a}_1 + \hat{a}_2 t + \acute{a} Y_{t-1} + \ddot{a}i \sum_{i=1}^{n} \Delta Y_{t-i} + U_t \qquad (6)$$

Where U_t is an error term and where $\Delta Y_{t-1} = (Y_{t-1} - Y_{t-2})$, $\Delta Y_{t-2} = (Y_{t-2} - Y_{t-3})$,

Where, U_t is an error term and where $\Delta Y_{t-1} = (Y_{t-1} - Y_{t-2})$, $\Delta Y_{t-2} = Y_{t-2} - Y_{t-3})$, etc. The number of lagged difference terms to include is often determined empirically, the idea being to include enough terms so that the error term in equation (6) is serially uncorrelated.

In ADF we still test whether $\acute{a} = 0$ or not and the ADF test follows the same asymptotic distribution as the DF statistics, so same critical values can be used[5],

In economic analysis, the relationship between the variables plays significant role. In the short-run, the variables may drift apart. But in the long-run they converge to equilibrium. The cointegration analysis provides an analytical instrument in this process. As defined by Engle and Granger (1987), the stationarity of a variable determine the degree of integration of the variables[6]. After selecting the order of integration, next step involves testing the cointegration rank. Cointegration means the stationarity of linear combinations of non-stationary variables (Johansen and Juselius, 1990 and 1994)

Here, it will form a Vector Autoregressive Regression (VAR) system. This step involves a testing for the appropriate lag length of the system[7], including residual diagnostic tests. It will specify the VAR model as a four variable system with a maximum of two lags. The model includes the GDP (Gross Domestic Product), Foreign Direct Investment (FDI), Domestic Investment (DIN) and Exports (EX). Various procedures have been suggested for determining the appropriate lag length in a dynamic model in the literature. The procedure employed here include: the Akaike Information Criterion (AIC), and Schwartz's Criterion (SC).[8] Above mentioned two criteria were used in order to decide the appropriate lag length for this study.

Basic structure of VAR is as follows:

$$Z_t = \begin{Bmatrix} Z_1 \\ Z_2 \\ Z_3 \\ Z_4 \end{Bmatrix} = \begin{matrix} GDP \\ FDI \\ DIN \\ EX \end{matrix}$$

Where,

GDP=Gross Domestic Product
FDI=Foreign Direct Investment
DIN=Domestic Investment
EX=Exports.

$$\Delta Z_t \phi_{t-i} + \sum_{i=1} t_i Z_{t-i} + Z_{t-1} \prod \Delta + U_t \qquad (7)$$

This model gives the short-run and long- run dynamics of a group of integrated variables, where Z_t is a vector of I (1) variables, U_t is a vector of white noise residuals, and ? is a constant vector. The adjustments to disequilibrium are captured over *n* lagged periods in the coefficient matrix t_i?. This part of the Error Correction Model (ECM) represents a traditional vector autoregression of the differenced variables. The ?' Z_{t-1} terms represent long run equilibrium or cointegrating relationship, and the coefficient matrix can be decomposed into ?â' matrix[9]. A procedure developed by Johansen (1991) provides a means to investigate the cointegrating relationship between integrated series. The valuable contribution of the concepts of unit root, cointegration, etc. is to force us to find out if the regression residuals are stationary. As Granger notes, "A test for cointegration can be thought of as pre-test to avoid spurious regression situation"(Granger, 1986).

The Johansen test (1991) is used to determine the cointegrating rank[10]. For a long-run relationship to exist, at least the first column must contain non-zero elements. If more than one linear combination occurs, it can normalize and combine them to investigate pair-wise effects between the variables. This cointegrating relationship represents the foundation of a complete dynamic error correction model. For this analysis, the ECM and cointegrating relationship allows us to compare the immediate and overall effects and then, the model will show how fast adjustments occur. Next we interpret the cointegrating relations and test the weak exogeneity. Based on these results a vector error correction model (VECM) of the endogenous variables can be specified[11].

In general, at least three steps are necessary to employ the VECM approach. At first, it tests the three performance variables for non-stationarity. Secondly, if variables are integrated of the same order, it will check for the presence of cointegrating relationship. Thirdly, if there is a cointegration, it distils the lagged error term from the estimated cointegrating vector and incorporates the lagged error terms in the VECM process.

4. Causal Relationship between the variables (GDP, FDI, DIN and EX)

This section examines the causal relationship among the variables GDP, FDI, DIN and EX by using an econometric methodology to study the direction of causality. Although regression analysis deals with the dependence of one variable on other variables, it does not necessarily imply the causation. In other words, the existence of a relationship between variables does not prove causality or direction of influence. But in regressions involving time series data, the situation may be somewhat different. More generally since the future cannot predict the past if variable X granger causes variable Y, then changes in X should precede changes in Y. Therefore, in a regression of Y on other variables (including its own past values) if we include past or lagged values of X and it significantly improves the prediction of Y, then we can say that X (Grange) causes Y. A similar definition applies if Y (Granger) causes X. The steps involved in implementing the Granger causality test are discussed in the following section (Granger, 1969).

4.1 The Granger Causality Test

If we consider the Granger causality between X and Y, there is a question in macroeconomics: Is it X that "causes" Y (X'!Y) or is it Y that causes X (Y'!X), where the arrow points to the direction of causality. The Granger causality test assumes that the information relevant to the prediction of the respective variables, X and Y, is contained solely in the time series data on these variables.

The test is based on estimating the following pair of regressions.

$$X_t = \sum_{i=1}^{n} \text{Óái}Yt_{-i} + \sum_{j=1}^{n} \text{Óâj}Xt_{-j} + u_{1t} \quad (8)$$

$$Y_t = \sum_{i=1}^{n} \text{Öë}_i Y_{t-i} + \sum_{j=1}^{n} \text{Óäj}Xt_{-j} + u_{2t} \quad (9)$$

where, it is assumed that the disturbances U_{1t} and U_{2t} are uncorrelated. If we consider two variables it is called bilateral causality. It can extend multivariable causality through the technique of Vector Autoregression (VAR).

Equation 8 postulates that current X is related to past values of itself as well as that of Y and equation 9 postulates a similar behaviour for Y. These regressions can be cast in growth forms, X and Y where the variables indicate its growth rate. Accordingly, four cases can be distinguished

1) Unidirectional causality from Y to X is indicated if the estimated coefficients on the lagged Y in equation 8 are statistically different from zero as a group (i.e., $\text{Óá}_i \neq \Delta\ 0$) and the set of estimated coefficients on the lagged X in equation 9 is not statistically different from zero(i.e., $\Delta\text{ä}_i = 0$).
2) Conversely, unidirectional causality from X to Y exists if the set of lagged Y coefficients in equation 8 is not statistically different from zero (i.e., $\Delta\text{á}_i = 0$) and the set of the lagged X coefficients in equation 9 is statistically different from zero (i.e., $\text{Óä}_i \neq \Delta\ 0$).
3) Feedback, or bilateral causality, is suggested when the sets of Y and X coefficients are statistically significantly different from zero in both regressions

4) Finally, independence is suggested when the sets of Y and X coefficients are not statistically significant in both regressions (Gujarati, 2003:697).

Before handling the Granger causality test there are some important assumptions that have to be mentioned, as follows:

1) It is assumed that the two variables X and Y are stationary. Sometimes taking the first differences of the variables makes them stationary, if they are not already stationary in the level form.
2) The number of lagged terms to be introduced in the causality test is another important thing. As mentioned in the case of distributed lag models[12], it will have to use the Akaike Information Criterion (AIC) and Schwartz's Criterion (SC) to make the choice.
3) We will have to assume that the error terms in the causality test are uncorrelated.

5. The Result of the Granger Causality Test

In testing the causality between variables the Engle Granger Causality test (Granger, 1969, 1988) is used as the technique of estimation for time series data covering the quarterly periods from 1978-1 to 2005-4.

First of all the variables were differenced I (1) in order to remove non–stationarity of variables .before employ them in the Granger Causality Test. This is because the fact that spurious result would be yielded if variables may have both stochastic and deterministic trends. As noted above, the Granger causality test depends critically on the number of lag terms in produced in the model.

It presents the results of the F test using the 5 lags in each variable. The test is conducted up to 8 lags but there is no statistically discernable relationship between variables after the lag 6. This reinforces the point made earlier that the outcome of the granger test is sensitive to the number of lags introduced in the model. The null hypothesis in each case is that the variable under consideration does not Granger cause the other variable **(see Table 1).**

According to the Granger causality test it is evident that Sri Lanka exhibits uni-directional Granger cause between FDI and GDP growth.

In other words, GDP in Sri Lanka is not Granger caused by FDI but causality runs more from GDP'!FDI at the 5% significance level in 1 and 2 lags and 10 % significance level in 5 lag in the model. Accordingly, unidirectional causality between GDP and FDI shows that GDP growth may serve as a determinant for FDI flows, but there is no reverse causation from FDI to GDP. This is more consistent with the findings of empirical studies cited in the literature: Choe (2003), Chakraborty and Basu (2002), Reagle et. al (2003) which, found a causality runs from GDP to FDI.

Theoretically, it can suggest that government policies since 1977 aimed at enhancing economic growth may make the economy attractive to FDI flows (through the effect of economic development.). In this study, Sri Lanka's case seems to support this theory directing the causality from GDP growth to FDI growth.

Table: 1

Granger Causality Test

Direction of Causality	F Statistics	Probability	Number of Lags	Decision
FDI→GDP	0.03384	0.85439	1	Accept
GDP→FDI	6.70132**	0.01096	1	Reject
FDI→GDP	0.21120	0.93167	4	Accept
GDP→FDI	3.42617**	0.01146	4	Reject
FDI→GDP	1.10375	0.36358	5	Accept
GDP→FDI	2.01247*	0.08368	5	Reject (at 10%)
EX→GDP	0.43996	0.50855	1	Accept
GDP→EX	6.62022**	0.01144	1	Reject
EX→GDP	1.02887	0.36098	2	Accept
GDP→EX	5.93852**	0.00360	2	Reject
EX→GDP	1.05515	0.37164	3	Accept
GDP→EX	5.25654**	0.00206	3	Reject
EX→GDP	0.95210	0.43740	4	Accept
GDP→EX	4.33832**	0.00283	4	Reject
DIN→GDP	0.34970	0.55552	1	Accept
GDP→DIN	8.11558**	0.00526	1	Reject
DIN→GDP	0.31410	0.73113	2	Accept
GDP→DIN	4.86494**	0.00954	2	Reject
DIN→GDP	0.21735	0.88417	3	Accept
GDP→DIN	3.94906**	0.01039	3	Reject
DIN→GDP	0.14377	0.96535	4	Accept
GDP→DIN	3.31541**	0.01358	4	Reject

EX→FDI	7.62954**	0.00675	1	Reject
FDI→EX	0.46104	0.49859	1	Accept
EX→FDI	3.05773*	0.02018	4	Reject
FDI→EX	0.19890	0.93840	4	Accept
DIN→FDI	3.89480**	0.05099	1	Reject
FDI→DIN	0.03795	0.84591	1	Accept
DIN→FDI	3.49755**	0.01027	4	Reject
FDI→DIN	0.76385	0.55128	4	Accept
DIN→FDI	2.66696**	0.02659	5	Reject
FDI→DIN	4.24697**	0.00157	5	Reject
DIN→EX	0.65750	0.41923	1	Accept
EX→DIN	8.83025**	0.00365	1	Reject
DIN→EX	0.61698	0.54152	2	Accept
EX→DIN	4.43395**	0.01417	2	Reject
DIN→EX	0.55347	0.64697	3	Accept
EX→DIN	3.34390**	0.02214	3	Reject
DIN→EX	0.47496	0.75401	4	Accept
EX→DIN	2.71024**	0.03435	4	Reject

Source: *Computed results*

*** Denotes rejection of null hypothesis at least than 5 per cent level of significance*

It can be interpreted that FDI flows to Sri Lanka were encouraged by the potential of better economic conditions coupled with Sri Lanka's more accommodative liberalization policies undertaken during the last three decades. However, the causality tests from FDI inflows to GDP growth fail to establish any significance relationship in this study.

Besides, it is important to recognize the distinction between the short run and long run contribution of FDI to economic growth. Although it was not able to find Granger causality from FDI to economic growth in the short run, this does not mean that FDI would not have any active role in the economic growth in Sri Lanka. What the results simply indicate is that the effects of FDI flows in to the country may affect in the long term rather than in the short term. It is a very valid argument particularly because the contribution of FDI to economic growth is generally believed to come from technology spillovers, increase in capital and labour productive effects which are manifested over time. Therefore, FDI promotes gross capital accumulation as well as that a higher ratio of FDI in gross capital formation creates positive effects on GDP growth.

While the literature has heeded the importance of FDI to growth and development, it also realizes that economic growth could be an important factor in attracting FDI flows. The importance of economic growth to attracting FDI is closely linked to the fact that FDI tends to be an important component of investing firm's strategic decisions. Brewer (1993) suggests three hypothesis in explaining strategic FDI projects namely "efficiency seeking hypothesis", "resource seeking hypothesis" and market seeking or market size hypothesis". The importance of economic growth in determining FDI flows can be explained by the market size hypothesis.

The Granger causality tests show a statistically significant causal relationship between GDP and Exports to one direction. That is GDP'!EX at the 5% significance level up to 4 lags. Since 1977, Sri Lanka's export sector has been shown considerable structural changes due to the export promotion and trade liberalization policies of the government. It directed to attract more FDI into the country contributing to increase particularly manufacturing production leading to exports.

There is a possibility that the bi-directional causality may not be due to the interaction between exports and GDP only but because there is a third force moving both variables in the same direction. For example, policies that foster economic growth tend to be responsible for increasing the exports in the country. Another possibility is that economic policies may be fostering just GDP growth in the economy and this economic growth tends to increase exports and vice versa. In the first situation, GDP and export growth may have no relation with each other except that they are influenced by same policies, while in the second case, economic policies may be affecting GDP growth directly and indirectly through economic growth. In such a situation GDP and Exports have an effect on each other.

Besides, it is found that a uni-directional causal relationship running from GDP to DIN. up to 4 lags. Theoretically, it provides evidence that in the long run DIN affects GDP growth and GDP growth itself exerts a major influence to the extent of investment rate like egg and hen relationship. Investment today as much as in the past remains crucial to economic growth and growth lead to high investment rate as highlighted by the acceleration principle in the future. Capital formation in a country

mainly depends on investment rate, which consisted of both domestic and foreign investment. Especially, FDI creates capital spillover effects by increasing domestic investment, which contributes to capital accumulation for economic growth. However, existence of Granger causality between DIN and GDP for both directions will depend much on the policy measures of the government which helps to increase savings and investment.

The result of the Granger causality test between FDI and Exports suggests that the direction of causality is uni-directional. It is evident only in lag 1 and lag 4 causality running EX'!FDI at the 5% significance level. There is no reverse causation from FDI to Exports. Accordingly, it shows that high growth rate of exports attracts the high inflow of export oriented FDI. Therefore, the Granger causality with FDI with the export variable provides insight into how export influences on the causal links to FDI and then to GDP growth.

Granger causality between FDI and DIN describes an uni-directional causality from DIN to FDI at the 5% significance level in lag 1 and 4. According to the various empirical studies, the most notable advantage of FDI inflows to the recipient country is that it helps to increase the level of total investment and growth by filling the investment-savings gap in the recipient countries. FDI inject new capital into the country and thus spur economic growth and investment. Thus, it also shows reverse Granger causation from FDI to DIN at lags 5.

Considering the granger causality between investment and exports, up to 4 lags it shows an uni-directional causality from EX'!DIN at the 5% significance level. However, it seems to predict that high investment rate forced by attraction of FDI directed to increase exports and causality ran from EX to DIN. Sri Lanka introduced various policy measures to increase both domestic investment and foreign direct investment since 1977. As a result, increased investment rate particularly in the manufacturing sector resulted in improving the exports and increased exports showed causation to investment rate in the long run.

To conclude the discussion of Granger causality, it is important to mention that the question we are examining is whether statistically one can detect the direction of causality when temporally there is a lead-lag relationship between two variables. If causality is established, it suggests that one can use a variable to better predict the other variable than simply the past history of that other variable. The Granger causality test discussed above generally point to that the outcome is connected to the number of lags introduced in the model. However, Granger causality alone cannot be used as a basis to conclude that one variable causes the other. While it is a possibility, it should be noted that the results simply indicate the predictive ability of past values of one variable in determining the present values of another variable. While it is possible that indeed the variables are reinforcing and causing each other to grow, it may also possible that a third force (i.e. economic policies) is driving both variables together.

6. Conclusion

This study analyzed the causal relationship between FDI and economic growth in Sri Lanka using quarterly time series data in real terms from 1978-1 to 2005-4. The production function approach has been used as the theoretical framework for undertaking empirical work to test whether there are any relationship between FDI and economic growth along with other two variables domestic investment and exports. In the empirical investigation unit root test, cointegration analysis, error correction modeling approaches and causality test have been applied. It is confirmed that according to the causality test, the direction of causation is not towards from FDI to GDP growth but the direction goes from GDP growth to FDI. Besides, unidirectional causality could be observed from GDP to Exports, GDP to DIN, EX to FDI, EX to DIN and bidirectional causality for DIN and FDI. However, according to the results of this analysis, it is evident that Sri Lanka exhibits uni-directional Granger causation between FDI and GDP growth. In other words, GDP in Sri Lanka is not Granger caused by FDI but causality runs more from GDP'!FDI. It provides government with guidelines for their future economic policy making in attracting FDI and stimulating economic growth.

Notes:

1. The countries in his study included Indonesia, Malaysia, Philippines and Thailand representing Southeast Asia; Chile, Ecuador, Mexico and Venezuela representing Latin America; and Ghana, Kenya, Nigeria and Zambia representing Sub-Saharan Africa.
2. The countries represented in the study included Hong Kong, Japan, the Philippines, Taiwan and Thailand

3. For example the procedure adopted to obtain 1998 quarterly data on GDP was as follows:

   1997 1st quarter = (3x1997+1x1998)/16
   2nd quarter = (2x1997+2x1998)/16
   3rd quarter = (1x1997+3x1998)/16
   4th quarter = (1998x4)/16 (Hemachandra, 2005).

4. According to the literature, there are two types of unit root tests, namely Augmented Dickey-Fuller (ADF) unit root tests and the Phillip-Perron (PP) Unit Root Tests. These tests have a similar background. The Dickey Fuller or Augmented Dickey Fuller (ADF) test (Dickey & Fuller, 1979) is widely used in testing whether a data series has a unit root.
5. The actual estimation procedure is as follows: Estimate the equation by OLS, divide the estimated coefficient of Y_{t-1} in each case by its standard error to compute the (t) tau statistic and refer to the DF tables. If the computed absolute value of the tau statistic (t) exceeds the DF or MacKinnon critical tau values of Dickey and Fuller (1979) or MacKinnon (1991), we reject the hypothesis that á = 0, in which case the time series is stationary. On the other hand, if the computed (t) does not exceed the critical tau value, we do not reject the null hypothesis, in which case the time series is nonstationary (Gujarati, 2004).
6. If X_t is differentiated *d* times in order to achieve stationarity, it can say that it is integrated of order *d* and can be shown as X_t~I(d). If there are at least two variables which have same degree of integration (d), there can be found a linear combination, which can be shown as $Þ_t=X_t-ãY_t$ Engle and Granger (1987) have shown that the linear combination is integrated at any order less than *d* then these variables are cointegrated. The residual from the OLS regression is usually taken as a proxy for the linear combination ($Þ_t$) in empirical analysis. For example the variables in the regression equation, which have the same integration degree:I (1), will be cointegrated and have a steady state relationship, if and only if the residual of the OLS regression has the integration degree of I (0).
7. In economics the dependence of a variable Y (the dependent variable) on another variable (s) X (the explanatory variable) is rarely instantaneous. Very often, Y responds to X with a lapse of time. Such a lapse of time is called a lag
8. Akaike (1973) Information Criterion (AIC) ; AIC(p) = Ln (e'e /T)+ (2P/T)
   Schwartz's criterion (SC); SC(p) = AIC(p) +(P/T) (lnT -2)

   P = Number of Lags
   T = Time = n = sample size
   e'e = Residuals some of squire

9. This matrix must have lower than full rank, otherwise it can be shown that Z_t is entirely a function of the residuals and therefore must be stationary.
10. In general, if Y is I(d) and X is also I(d), where d is the same value, these two series can be cointegrated. Cointegration means that despite being individually nonstationary, a linear combination of two or more time series can be stationary. Cointegration of two or more time series suggests that there is a long-run, or equilibrium, relationship between them. As a proper test for cointegration trace test was used.

    The CI rank: the trace statistic; Trace = -T Ó ln (1-λ_i) Ói = r+1 ..k

Which allows for the test of H (r) : the rank of ? is r, Against the alternative that the rank of ? is k.

The results of the trace test are:

1. The hypothesis that $r = 0$ is rejected if sample value > critical value
2. The hypothesis that $r\, d\Delta\, \text{rank}(1,2..)$ is not rejected if sample value < critical value A large value of the trace statistic is evidence against H (r): that is, with $r = 0$, a value of the trace statistic greater than the appropriate critical value allows us to reject $r = 0$ in favor of $r > 0$. The test may then be repeated for $r = 1$, and so on.

11. The vector error correction estimation has two attractive features. First, it includes theory consistent cointegrating relation(s) and corrects short run deviation from steady-state relations so that all variables in the function(s) can enter to the long-run time path(s). Second, it incorporates short-run dynamics that represent the nature of the economic variables.
12. Suppose a person receives a salary increase of Rs 2000 as an annual pay. People usually do not hurry to spend all the salary increase immediately. Suppose the income recipient may decide to increase consumption expenditure by Rs. 800 in the first year following the salary increase in income, by another Rs. 600 in the next year, and by another Rs 400 in the following year, saving the remainder.

By the end of the third year, the person's annual consumption expenditure will be increased by Rs. 1800 and consumption function can be derived as follows.

$$Y_t = \text{constant} + 0.4\,X_t + 0.3\,X_{t-1} + 0.2\,X_{t-2} + Ut$$

Where, Y is consumption expenditure and X is income. The above equation shows that the effect of an increase in income of Rs. 2000 is spread or distributed, over a period of 3 years. Such models are called distributed-lag models (Gujarati, 2003:657).

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