OPENNESS AND ECONOMIC GROWTH: EMPIRICAL EVIDENCE ON THE RELATIONSHIP BETWEEN OUTPUT, INWARD FDI, AND TRADE

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Abstract

The relationship between openness and economic growth in developed and developing countries has been of continuing interest in both the theoretical and empirical literature. In this paper, we employ a vector autoregressive (VAR) model and error correction techniques to test for the existence and nature of the causal relationship between output level, inward FDI and exports across a cross-section of both developed and developing countries using data from 1960–2001. Our main objective is to analyze the extent and sources of international linkages between openness and economic performance. The evidence supports bi-directional causality between exports growth and economic growth; the economic growth and FDI relationship has mixed results.

Introduction

The relationship between export growth, foreign direct investment (FDI), and economic growth in both developed and developing countries is a question that continues to be of considerable theoretical and empirical interest. Cross-country trade and capital flows, and interpreting the importance of these activities towards economic growth lie at the heart of the debate on economic development policy since the early literature on import-substitution to the current literature on openness and economic growth.

Recent literature has highlighted the role of both exports and FDI on economic growth. On the one hand, the export led growth (ELG) hypothesis states that exports are the main determinants of overall growth. At the heart of the ELG model are beliefs that (a) the export sector generates positive externalities on non-export sectors in the economy through more efficient management and production techniques (Feder, 1983); (b) export expansion increases productiv-

ity by creating scale economies (Helpman and Krugman, 1985; Krugman 1997); (c) exports help to alleviate foreign exchange constraints and thus provide greater access to international markets (Esfahani, 1991). Endogenous growth theory extends this analysis by emphasizing the role of exports on technological innovation and dynamic learning (Romer, 1986; Lucas, 1988; Grossman and Helpmann, 1995; Alisana and Rodrick, 1999).

On the other hand, empirical evidence in the last few decades indicates that FDI flows have been growing at a pace far exceeding the volume of international trade. Between 1975 and 1995, the aggregate stock of FDI rose from 4.5% to 9.7% of world GDP, with sales of foreign affiliates of multinational enterprises substantially exceeding the value of world exports (Barrell and Pain, 1997). The effect of FDI on economic growth appears to have become quite explicit with multinational enterprises acting as the primary vehicle for the international transfer of technology (OECD, 1991). Blomström and Persson (1983) and Blomström (1986) find that FDI has created significant positive spillover effects on the labor productivity of domestic firms. It is argued that FDI plays a central role in the technological progress of recipient countries through the generation of productivity spillovers (Borensztein, De Gregorio, and Lee, 1998; Lim 2001).

However, empirical work from both the ELG literature and the FDI and growth literature when studied in isolation show mixed results. This is mainly, due to the omission of a relevant mechanism through which openness or the re-structuring of an economy promotes growth. Liberalization, in particular, is expected to increase not only trade but also FDI. If a complementary relationship between FDI and exports exists, then foreign investment may increase the volume of exports in specific and international trade in general. Direct investment may encourage export promotion, import substitution, or greater trade in intermediate inputs, especially between parent and affiliate producers (Goldberg and Klein, 1998). Along the same lines, Blomström, Globerman and Kokko (2000) argue that the beneficial impact of FDI is only enhanced in an environment characterized by an open trade and investment regime and macroeconomic stability. In this environment, FDI can play a key role in improving the capacity of the host country to respond to the opportunities offered by global economic integration. In the absence of such an environment, FDI may impede rather than promote growth by enhancing the private rate of return to investment for foreign firms while exerting little impact on social rates of return in the recipient economy (Balasubramanyam, Salisu and Sapsford, 1996).

Early studies supporting the ELG hypothesis such as those by Balassa (1978), Heller and Porter (1978) and Tyler (1981) examined the simple correlation coefficient between export growth and economic growth, and based their conclusions based upon the high degree of correlation between the two variables. Other studies, characterized by Voivades (1973), Feder (1983), Balassa (1985), Ram (1987), Sprout and Weaver (1993) and Ukpolo (1994) find support for ELG based upon growth and output regressions drawn from a growth accounting framework. These

studies make the 'a priori' assumption that export growth causes output growth without considering the direction of the causal relationship. A third group of studies has emphasized the issue of causality between export growth and economic growth. In this approach, exemplified by Jung and Marshall (1985), Darrat (1987), and Serletis (1992), the Granger or Sims causality test is applied to growth and export data to test the ELG hypothesis. The causality tests are only valid if the original time series underlying the analysis are cointegrated.

For a complete study on economic growth, the focus has to be not only on ELG but FDI as well. Therefore, the objective of this paper is to investigate the causal relationship between export growth, inward FDI and economic growth (measured as output growth) in developed and developing countries using the cointegration and error-correction models. These techniques, as successfully applied in studies by Serletis (1992), Bahmani-Oskooee and Alse (1993), Dutt and Ghosh (1996), Rahman and Mustafa (1998), Islam (1998), Cuadros, Orts and Alguacil (2001) and Trevino, Daniels, Arbelaez, and Upadhyaya (2002), demonstrate their econometric robustness and their ability to root out spurious relationships.

So far, only a few studies have used this methodology to study the causality relation between export growth, economic growth, and FDI in both developed and developing countries. Given the small number of studies conducted using this methodology, it is expected that this paper will contribute to this expanding body of literature.

The rest of the paper is organized as follows. Section 2 explains the methodology of the cointegration and error-correction models and a description of the data sources. Section 3 contains the empirical results and comparison of our results with previous studies. Finally, Section 4 provides a discussion about the implication of the results and some summary conclusions.

Methodology and Data

Methodology

This paper uses the cointegration and error-correction models, to test the causal relationship between FDI, exports, and economic growth. We start by considering the three-variable vector autoregressive (VAR) model comprised of foreign direct investment (), exports (), and gross domestic product (), all expressed in natural logs. As shown in equation (1), all variables are systematically and endogenously considered at first.

$$
\begin{bmatrix} FDI_t \\ EXP_t \\ GDP_t \end{bmatrix} = A_0 + A_1 \begin{bmatrix} FDI_{t-1} \\ EXP_{t-1} \\ GDP_{t-1} \end{bmatrix} + A_2 \begin{bmatrix} FDI_{t-2} \\ EXP_{t-2} \\ GDP_{t-2} \end{bmatrix} + \ldots + A_s \begin{bmatrix} FDI_{t-s} \\ EXP_{t-s} \\ GDP_{t-s} \end{bmatrix} + \varepsilon_t \quad (1)
$$

where A_0 is a vector of constant terms, are all matrices of parameters (i = 1, 2, ..., s), and $\varepsilon_t \sim IN\,(0,1)$.

In order to analyze the causal relationship it is necessary to first check whether the variables are stationary. According to Granger (1988), standard tests for causality are valid only if there exits cointegration. Therefore, a necessary precondition to causality testing is to check the cointegrating properties of the variables under consideration. The cointegration and error-correction methodology is briefly outlined below.

Testing for cointegration among the three variables, real FDI, real exports, and real GDP (expressed in logarithmic form), is accomplished in two steps. First, following Engle and Granger (1987), the time series properties of each variable are examined by unit root tests. In this step, it is tested whether FDI, exports, and GDP are integrated of order zero, or in other words, that the three series are stationary. This is accomplished by performing the augmented Dickey-Fuller (ADF) test. The ADF test is based on the regression equation with the inclusion of a constant and a trend of the form

$$\Delta X_t = \beta_0 + \mu t + \theta_1 X_{t-1} + \sum_{j=1}^{p} \beta_j \Delta X_{t-j} + \varepsilon_t \qquad (2)$$

where $\Delta X_t = X_t - X_{t-1}$ and X is the variable under consideration, p is the number of lags in the dependent variable (chosen so as to induce a white noise term), and ε_t is the stochastic error term. The stationarity of the variable is tested using the null hypothesis of $|\theta_1| = 1$ against the alternative hypothesis of $|\theta_1| < 1$. If the null hypothesis cannot be rejected, it implies that the time series is non-stationary at that level and therefore it requires taking first or higher order differencing of the level data to establish stationarity. The optimum lag length (p) in the ADF regression is selected using the minimum final prediction error (FPE) criterion developed by Akaike and then the results were confirmed by the Schwarz criterion.

Having tested the stationarity of each time series, the next step is to search for cointegration between ln*FDI*, ln*EXP*, and ln*GDP*. This step investigates whether the stochastic trends in ln*FDI*, ln*EXP*, and ln*GDP* that contained unit roots have a long-run relationship. In order to show that exports and economic growth have any type of causality, it is necessary to demonstrate that they are cointegrated in the Granger sense. This is accomplished by using the Johansen-Juselius cointegration technique (Johansen and Juselius, 1990). Since the Johansen cointegration test is now well known it is not discussed here.

Engle and Granger (1987) have shown that if variables such as ln*FDI*, ln*EXP*, and ln*GDP* are integrated of order one, $I(1)$, and the stochastic error terms are both integrated of order zero, $I(0)$, then ln*FDI*, ln*EXP*, and ln*GDP* are said to be cointegrated. When the variables are found to be both integrated of degree $I(1)$, and cointegrated, then either unidirectional or bi-directional Granger causality must exist in at least the $I(0)$ variables. If the variables are cointegrated then there must exist an error-correction representation that may take the following form:

$$\Delta \ln FDI_t = \gamma_0 + f\upsilon_{t-1} + \sum_{i=1}^{k} \gamma_{1i}\Delta \ln FDI_{t-1} + \sum_{i=1}^{k} \gamma_{2i}\Delta \ln EXP_{t-1} + \sum_{i=1}^{k} \gamma_{3i}\Delta \ln GDP_{t-1} + \varepsilon_{1t} \quad (3)$$

$$\Delta \ln EXP_t = \theta_0 + g\delta_{t-1} + \sum_{i=1}^{k} \theta_{1i}\Delta \ln EXP_{t-1} + \sum_{i=1}^{k} \theta_{2i}\Delta \ln GDP_{t-1} + \sum_{i=1}^{k} \theta_{3i}\Delta \ln FDI_{t-1} + \varepsilon_{2t} \quad (4)$$

$$\Delta \ln GDP_t = \pi_0 + h\rho_{t-1} + \sum_{i=1}^{k} \pi_{1i}\Delta \ln GDP_{t-1} + \sum_{i=1}^{k} \pi_{2i}\Delta \ln EXP_{t-1} + \sum_{i=1}^{k} \pi_{3i}\Delta \ln FDI_{t-1} + \varepsilon_{3t} \quad (5)$$

where υ_{t-1}, δ_{t-1}, and ρ_{t-1} are the error-correction terms. The inclusion of error-correction terms in equations (3), (4) and (5) introduces an additional channel through which Granger causality can be detected. However, in the absence of cointegration, a vector auto regression (VAR) in first-differences form can be constructed. In this case, the error-correction terms will be eliminated from equations (3), (4) and (5). If the series are cointegrated, then the error-correction models given in equations (3), (4) and (5) are valid and the coefficients f, g, and h are expected to capture the adjustments of $\Delta \ln FDI_t$, $\Delta \ln EXP_t$ and $\Delta \ln GDP_t$ towards long-run equilibrium, while $\Delta \ln FDI_{t-1}$, $\Delta \ln EXP_{t-1}$, and $\Delta \ln GDP_{t-1}$ and are expected to capture the short-run dynamics of the model.

Data

Annual data for the period 1960-2001 are used for estimation. Data on inward FDI, exports, and gross domestic product (GDP) for the selected developed and developing countries are from several issues of the UNCTAD, *World Investment Report*, and International Monetary Fund's *International Financial Statistics Yearbook*. The sample of countries consists of Brazil, Canada, Chile, Mexico, and United States. The choice of countries and span of data reflects data availability. Nominal figures of foreign direct investment, exports, and GDP were deflated by the GDP deflator (1990=100) for each country to express them in real terms. The GDP deflator was collected from the International Monetary Fund's *International Financial Statistics Yearbook*.

Empirical Results

In the light of econometric methodology presented in the previous section, the cointegrating properties of the variables involved are examined and the empirical results are discussed in this section. Table 1 presents the results of unit root tests obtained using the augmented Dickey-Fuller test. The results support the presence of unit roots in all of the series for all countries. This is confirmed by the fact that the null hypothesis that the series are non-stationary is not rejected at the levels for all variables. However, the null hypothesis is rejected in favor of the alternative hypothesis that the series are stationary when the first difference of the variables is taken. Thus, their first difference

is found to be stationary and hence, are all integrated of order one. In all cases, the null hypothesis that the series has unit roots cannot be rejected. The tests of unit roots support the unit root hypothesis at the 1%, 5% or 10% levels of significance for all data series.

Having confirmed the existence of unit roots for all the data series, the next step involves applying the Johansen-Juselius cointegration test to check whether the three variables are cointegrated for each of the five countries. The optimum lag lengths are determined using the Akaike final prediction error (FPE) criterion. The results of Johansen-Juselius cointegration tests are presented in Table 2. The Johansen-Juselius cointegration test provides evidence for the existence of one cointegration vector implying that the three variables are cointegrated in these five cases. Thus, the results of Johansen-Juselius cointegration test imply a long-run association between real exports, real FDI, and real GDP. Therefore, equations (3), (4) and (5) have been estimated for these five countries including the error-correction terms.

The empirical results of the estimated error-correction models are presented in Table 3. Beyond the analysis of the long-run relationship among the three variables in the system for each country, the short-run dynamics is also explored performing multivariate Granger causality tests for the vector error-correction model. The F-statistics and probability (in parentheses) for the Granger causality tests are presented in columns 2-4 in Table 3. It also includes the t-statistics for error-correction terms for each of the three equations. For each variable in the system, at least one channel of Granger causality is active, either in the short-run through the joint tests of the lagged-differences or in the long run through statistically significant ECT.

Our results are consistent with past time-series work with regards to the export-growth relationship. However, the results for FDI-growth and FDI-Exports relationships are mixed (Table 4). In each of the five countries considered, there is evidence for the ELG hypothesis in the short-run, although only Canada provides evidence for ELG in the long run. In the cases of Canada and Mexico, there is evidence for short-run growth-led exports Granger causality. In fact, both Canada and Mexico show bi-directional causality between exports and growth. The evidence regarding the positive impact of FDI on growth is limited. FDI plays a significant role in Brazil, Mexico, and the United States. In the cases of Canada and Chile, the F-statistic on the lagged-FDI variable is not statistically significant. However, Chile and Brazil show growth led FDI. This is consistent with the fact that only since the mid-eighties have these countries attempted to improve their economies by stabilizing and opening up their economies to the world. Brazil is the only country in the sample that showed bi-directional causality for FDI and growth.

Similar to Goldberg and Klein (1998) and Rodrik (1999) our analysis shows mixed results with regard to a complementary relationship between FDI and trade. Only the USA displayed bi-directional causality between FDI and trade.

Table 1
Augmented Dickey-Fuller Unit Root Test

Country	Level					
	ln*EXP*		ln*GDP*		ln*FDI*	
	ADF_1	ADF_2	ADF_1	ADF_2	ADF_1	ADF_2
Brazil	-0.1209	-1.4922	-0.8987	-1.9952	-0.6923	-1.7541
Canada	-2.2528	-1.8608	-2.5698	-1.6612	-1.5515	-2.2133
Chile	-0.6840	-2.0577	-0.0561	-2.5097	-2.0557	-2.2679
Mexico	-0.7783	-1.8174	-0.2364	-2.0089	-0.3787	-2.1714
United States	-1.3562	-2.7512	-1.0569	-2.7381	-0.7934	2.0634

Country	First Difference					
	Δln*EXP*		Δln*GDP*		Δln*FDI*	
	ADF_1	ADF_2	ADF_1	ADF_2	ADF_1	ADF_2
Brazil	-2.6416*	-3.2112*	-3.4621**	-4.0748**	-2.8572*	-4.9763***
Canada	-3.9361***	-5.0946***	-2.8029*	-3.9252**	-4.3171***	-7.6965***
Chile	-4.1105***	-4.4926***	-3.5015**	-3.4508*	-4.4627***	-7.3178***
Mexico	-2.7181*	-3.2041*	-3.0718**	-3.2082*	-3.9286***	-3.8777**
United States	-3.9069***	-4.6362***	-3.1874**	-3.8792**	-4.0381***	-4.6104***

Notes:

ADF_1 tests $H_0 : \theta_1 = 0$ in $\Delta \ln X_t = \beta_0 + \theta_1 \ln X_{t-1} + \sum_{j=1}^{m} \beta_j \Delta \ln X_{t-j} + \varepsilon_t$ (6)

ADF_2 tests $H_0 : \theta_2 = 0$ in $\Delta \ln X_t = \varphi_0 + \varphi_1 \ln X_{t-1} + \sum_{j=1}^{m} \varphi_j \Delta \ln X_{t-j} + \varsigma_t$ (7)

*, **, and *** denote statistical significance at the 10% 5%, and 1% levels, respectively. The critical values of ADF_1 statistics as reported in Engle and Yoo (1987), for 50 observations are -3.58, -2.93, and -2.60 at 1%, 5%, and 10% levels of significance respectively. The critical values of ADF_2 statistics as reported in Engle and Yoo (1987), for 50 observations are -4.15, -3.50, and -3.18 at 1%, 5%, and 10% levels of significance respectively.

In the cases of Brazil and Mexico there are indications of a positive causal relationship for Export led FDI. However, for Canada and Chile there is no evidence of causality.

The findings of this study are consistent with the findings of selected studies (Goldberg and Klein, 1998; Rodrik, 1999; Cuadros, Orts, and Alguacil, 2001). However, since the coverage of countries varies from study to study no direct comparison can be made. In general, the differences in outcomes of these studies could be due to a number of reasons including different time periods, different sample intervals and different methodologies.

Table 2
Johansen Multivariate Cointegration Tests

Trace Test

Null Hypothesis	Brazil	Canada	Chile	Mexico	United States
$r = 0$	31.01	30.94	44.54	33.05	35.32
$r \geq 1$	12.91	11.07	12.03	9.59	16.73
$r \leq 2$	0.16	0.28	0.02	0.10	0.87

Maximum Eigenvalues Test

Null Hypothesis	Brazil	Canada	Chile	Mexico	United States
18.10	19.87	32.51	23.46	18.59	
12.75	10.79	12.01	9.49	15.86	
0.16	0.28	0.02	0.10	0.87	

Cointegration Equations Normalized on ln*EXP*$_t$

Null Hypothesis	Brazil	Canada	Chile	Mexico	United States
Constant	-2.7645	-6.0122	-1.2124	-5.1818	-2.8392
ln*GDP*$_t$	0.1032 (0.389)	1.1797 (0.189)	0.7831 (0.024)	4.4062 (2.042)	0.8779 (0.310)
ln*FDI*$_t$	0.8628 (0.497)	0.2474 (0.097)	0.2611 (0.060)	5.4206 (2.931)	0.1904 (0.069)
Log Likelihood	65.44	105.43	125.78	58.76	115.69

Note: The 5% critical values $r = 0$, $r \geq 1$, and $r \leq 2$ are 29.68, 15.41, and 3.76, respectively. Figures in parentheses are standard errors.

Summary and Conclusions

The cointegration and error-correction modeling techniques used in this paper have revealed that there is a bi-directional causality between export growth and economic growth in two of the five countries considered, FDI and economic growth and exports growth and FDI for just one country each. While there is evidence for export-led growth in all countries, the evidence for FDI led exports and economic growth or economic growth led FDI or exports is mixed.

For the central question of this paper, whether FDI increases exports or vice versa, results are not consistent. The results in both developed and developing countries when studied separately have been mixed, indicating that the reasons

Table 3
Results of Error Correction Models

Brazil	Source of causation (short run)			EC_{t-1}	
Dep. Variable	ΔEXP	ΔGDP	ΔFDI	Coefficient	t-value
ΔEXP	-	4.9136 (0.426)	4.7632 (0.442)	-0.1647**	-2.3587
ΔGDP	21.8269 (0.000)	-	7.9080 (0.047)	-0.0595	-0.6666
ΔFDI	16.8877 (0.004)	12.2614 (0.031)	-	-0.5085***	-2.9966

Canada	Source of causation (short run)			EC_{t-1}	
Dep. Variable	ΔEXP	ΔGDP	ΔFDI	Coefficient	t-value
ΔEXP	-	34.8140 (0.000)	8.3517 (0.137)	-0.1672**	-2.3858
ΔGDP	47.3521 (0.000)	-	2.5499 (0.2794)	-0.1226**	-2.3612
ΔFDI	6.6171 (0.250)	6.9968 (0.220)	-	-2.7663***	-3.1242

Chile	Source of causation (short run)			EC_{t-1}	
Dep. Variable	ΔEXP	ΔGDP	ΔFDI	Coefficient	t-value
ΔEXP	-	3.3778 (0.582)	1.4044 (0.923)	-0.2069*	-1.8380
ΔGDP	7.8829 (0.049)	-	5.2077 (0.391)	-0.2485	-0.2160
ΔFDI	2.9948 (0.559)	17.0230 (0.004)	-	-0.5529*	-1.8680

Mexico	Source of causation (short run)			EC_{t-1}	
Dep. Variable	ΔEXP	ΔGDP	ΔFDI	Coefficient	t-value
ΔEXP	-	21.3171 (0.000)	4.5136 (0.478)	-0.0507	-0.7972
ΔGDP	17.7278 (0.003)	-	11.7008 (0.039)	-0.0485	-0.7398
ΔFDI	10.4815 (0.062)	6.8381 (0.232)	-	-0.1843**	-2.4650

United States	Source of causation (short run)			EC_{t-1}	
Dep. Variable	ΔEXP	ΔGDP	ΔFDI	Coefficient	t-value
ΔEXP	-	5.2552 (0.385)	13.7511 (0.017)	-0.3710**	-2.5276
ΔGDP	9.6034 (0.022)	-	6.3666 (0.094)	-0.0464	-1.2472
ΔFDI	16.1757 (0.006)	7.2796 (0.201)	-	-2.0845***	-3.0745

Notes: EC denotes the error-correction term. *, ** and *** indicate the statistical significance at the 10%, 5% and 1% levels of significance respectively. Figures in parentheses are p-values.

Table 4
Comparative Evaluation of Major Findings (Short-Run Causality)

Country	BDC-EG	ELG	GLE	BDC-FG	FLG	GLF	BDC-EF	ELF	FLE
Brazil		✓		✓	✓	✓		✓	
Canada	✓	✓	✓						
Chile		✓				✓			
Mexico	✓	✓	✓		✓			✓	
USA		✓			✓		✓	✓	✓

Notes: BDC-EG denotes bi-directional causality for exports and growth, ELG denotes export-led growth, and GLE denotes growth-led exports. BDC-FG denotes bi-directional causality for FDI and growth, FLG denotes FDI-led growth and GLF denotes growth-led FDI. Similarly, BDC-EF denotes bi-directional causality for exports and FDI, ELF denotes export-led FDI, and FLE denotes FDI-led Exports.

✓ denotes the presence of causality and blank spaces indicate no evidence of causality.

for the historical levels of development between nations should be observed elsewhere. New evidence from Trevino et al. (2002), shows that FDI is a function of current account balance, inflation, real exchange rate, market size, capital market liberalization and privatization values. Therefore, the weak results between FDI and exports are plausible. However, observing export led FDI for Brazil, Mexico and USA would confirm that most multinational firms of the USA invest in these countries as export-oriented investment. In so doing, FDI has served to integrate national markets into the regional and world economy far more effectively than could have been achieved by traditional trade flows.

The liberalization process in Brazil, Chile and Mexico has increased not only trade but FDI flows as well. This is particularly true in the Latin American region, a major recipient of FDI. Therefore, due to the increasing importance of FDI, focusing only on trade as a proxy for openness may be misleading. Also at a time when the countries of the Western Hemisphere are all set to form a trade block in the name of FTAA (Free Trade Area of the Americas) analyzing both the ELG hypothesis and the FDI-growth hypothesis for both the developed and developing countries, especially those that have been the main recipient countries of FDI in the Western Hemisphere, makes this study all the more interesting.

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