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FDI, FINANCIAL DEVELOPMENT, AND ECONOMIC GROWTH: INTERNATIONAL EVIDENCE

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Previous studies have recognized that the benefits from foreign direct investment (FDI) to recipient countries can only be realized when those countries have reached a certain level of financial development. However, the dynamic interrelationships among FDI, financial development, and real output, including the long-run equilibrium as well as causality, have not been analyzed. This paper overcomes this major shortcoming by applying recent advances in panel cointegration and panel error correction models for a set of 37 countries using annual data for the period 1970-2002. For the first time, we explore the directions of causality among FDI, financial development, and economic growth and obtain solid, convincing evidence of a fairly strong long-run relationship. Furthermore, the financial development indicators have a larger effect on economic growth than does FDI. From the panel causality tests, while the evidence of a short-run relationship is weak, that of a long-run relationship among the variables is unequivocal. Overall, the findings underscore the potential gains associated with FDI when coupled with financial development in an increasingly global economy.

JEL classifications codes: F23, O16, O40
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I. Introduction

That there is a clear-cut connection between foreign direct investment (FDI) and economic growth has yet to be confirmed through empirical research. On the one

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hand, far too many studies have only focused on FDI at the expense of financial development. On the other hand, many studies have explored whether the level of financial development encourages growth while ignoring FDI. For the most part, previous studies have not taken into account the interactions between FDI and financial development, though some very recent research studies pertaining to the connections among FDI, financial development, and economic growth have made great strides.

It is well known that FDI and domestic financial markets are important sources of capital investment funds for manufacturers, and because the substitutable or complementary relations between them are very important, this paper mainly focuses on the analysis of their interactive relations as well as their relation to economic growth. Levine (1997) drew attention to many other extremely effective functions of a developed financial system: exerting corporate control; mobilizing savings; reducing risk; allocating resources; monitoring managers; and facilitating the exchange of goods and services. Provided these functions are being carried out, it should be possible to alter an economy's growth rate by affecting either the growth rate of capital stock or the rate of technological innovation.

Theoretically, FDI may enhance technological change through the spillover effects of knowledge and new capital goods, but underlying the magnitude of FDI's contribution is the overall business climate in recipient countries (Chamarbagwala et al., 2000). The FDI-growth hypothesis contends that a positive relationship between FDI inflow and growth can be expected, provided that recipient countries have attained a relatively high level of development in their financial system (Alfaro et al., 2004; Durham, 2004). In addition to the direct capital financing FDI generates, it plays an important role in modernizing a national economy and in stimulating growth. For these very reasons, most countries' governments have prioritized the issue and exert every effort to come up with new ways to attract more and more FDI.

It cannot be ignored that FDI still has other positive effects, among which are the introduction of new processes, managerial skills, technological transfers and know-how in the domestic market, international production networks, employee training, and international financial integration (Barro and Sala-i-Martin, 1997; Grossman and Helpman, 1991). De Mello (1997) reports two main channels through which FDI may enhance growth. First, through capital spillovers, FDI facilitates the adoption of new technology in the production process. Second, FDI may stimulate the transfer of knowledge both in terms of labor training and acquisition of skills and by introducing alternative management practices and better organizational capabilities.

However, despite the popularity of the FDI-growth nexus, empirical evidence has been mixed. Following De Mello (1999), Alfaro et al. (2004) is credited with being the first to make the claim that FDI has a definitive positive impact on economic growth. As for the power of the growth factor equation, growth regressions have been carried out by both Borensztein et al. (1998) and Carkovic and Levine (2005), but neither find much, if any, support for the position that FDI has a positive exogenous effect on economic growth - a finding which shows that the endogeneity of FDI inflow has no robust impact on growth.

Edison et al. (2002) argue that a more developed financial system is better able to effectively absorb capital inflows, especially if these flows are fungible. Thus, financial development might help explain possible divergent outcomes across countries with different incomes. Hermes and Lensink (2003) indicate that the importance of the domestic financial system as a precondition for the positive growth effects of FDI can be illustrated with a simple model of technological change. FDI and domestic financial markets are complementary in terms of enhancing the process of technological diffusion; to be sure, this in turn increases the rate of economic growth. Along similar lines, Alfaro et al. (2004) put forth the view that although most FDI is in the form of capital from abroad, it is essential to recognize that the spillovers for the receiving economy are most likely highly dependent on the extent of the development of the internal financial market. It is true that some local firms might be able to finance new endeavors with internal financing, but when it comes to firms that require technological knowledge, the greater the gap is between current practices and the latest technology, the greater is the need for external financing. Alfaro et al. (2006) propose a mechanism that emphasizes the role of local financial markets in enabling FDI to stimulate growth through the creation of backward linkages. When financial markets reach a certain level of development, the host country benefits from the backward linkages between foreign and domestic firms with positive spillovers to the rest of the economy.

Most previous papers to date have used cross-sectional data models (Alfaro et al., 2004; Durham, 2004) or traditional static panel data models (fixed effect and random effect models; Hermes and Lensink, 2003), which have a weakness in the sense that they do not account for much of the dynamics regardless of whether they are time-averaged or not (Sarantis and Stewart, 2001). Furthermore, non-stationary data cannot be analyzed using the traditional panel data approach.[1] To cite an

[1] To conduct the traditional static fixed effect or random effect model, the variable is a stationary series (see Green, 2000), but the non-stationary variable, as with real GDP in our model, has to be transferred as the first difference term (or the growth rate), and then again we estimate the regression via the traditional fixed effect or random effect model. However, this induces the possibility that we will omit the long-run cointegrated or long-run causality among variables. Thus, we use the panel cointegration and panel vector error correction models.

example, though Choong et al. (2004) adopt time series data and an error-correction model, their empirical results conceivably also suffer from the "small sample" problem.[2] To resolve this shortcoming in previous studies, we do not attempt to estimate a structural model or to identify growth determinants, nor do we re-examine an empirical linkage (the FDI-growth nexus).

Although recent studies in the literature recognize that the extent of the contribution of FDI to recipient countries is strictly determined by the local financial development of recipient countries, the dynamic interrelationships among FDI, financial development, and real output, including the long-run equilibrium as well as causality, have never been empirically investigated. This paper for the first time undertakes the challenge to investigate the relationship among FDI, finance development, and economic growth in a panel framework, and in order to do so we modify Odedokun's (1996) model. Applying panel cointegration techniques and panel error correction models allow us to take into consideration the presence of heterogeneity in the estimated parameters and dynamics across countries.

There are several unique features of this research. First, taking an international perspective and using a panel data approach, we empirically investigate long-run co-movements and the causal relationships among FDI, financial development, and economic growth in a multivariate model. Second, we test the empirical data by implementing the heterogeneous panel cointegration tests developed by Pedroni (1999, 2004), which allow for different individual effects with regard to cross-sectional interdependency. Third, it is noteworthy that since there are more than two variables in the empirical model we estimate, the restriction that only a single variable can be used as a unity cointegrated vector with a residual base is far too rigorous. Thus, we employ the newly-developed heterogeneous dynamic panel data approach, as first advanced by Larsson et al. (2001), which allows for multiple cointegrated relations and improves upon the power performance of the estimations. Fourth, we estimate the long-run relationships using the dynamic OLS (DOLS; Kao and Chiang, 2000) technique for heterogeneous cointegrated panels. Fifth, since the causal relationship between FDI and growth and that between financial development and growth may run in either or both directions – whether or not they are transitory or permanent – the estimations of the vector error correction model (VECM) which we use to test the statistical causality hypothesis are more reliable than those from a single equation model. We also apply a panel VECM to distinguish between short-run and long-run causalities.

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[2] Campbell and Perron (1991) indicate that short-time spans of individual datasets weaken the power of the unit root, cointegration and causality tests.

This paper is organized as follows: Section II provides a brief discussion of the panel unit root test and the panel cointegration procedures. Section III provides the empirical results and the robustness test. Finally, Section IV summarizes our conclusions.

II. Methodology

A. The panel unit root tests

Interest in investigating the unit root of panel data has recently intensified, and in this regard, Abuaf and Jorion (1990) point out that the power of unit root tests may increase by using cross-sectional information. Expanding on the work of Levin and Lin (1992), Levin et al. (2002; henceforth LLC) propose a panel-based ADF test that restricts parameters γ_i by keeping them identical across cross-sectional regions as follows:[3]

$$\Delta y_{it} = \alpha_i + \gamma_i y_{it-1} + \sum_{j=1}^{k} \alpha_j \Delta y_{it-j} + e_{it}, \tag{1}$$

where $t=1,\ldots,T$ time periods and $i=1,\ldots N$ members in the panel. LLC (2002) test the null hypothesis of $\gamma_i = \gamma = 0$ for all i, against the alternative $\gamma_1 = \gamma_2 \ldots = \gamma < 0$ for all i, with the test based on the statistic $t_\gamma = \hat{\gamma} / s.e.(\hat{\gamma})$. One drawback, however, is that γ is restricted since it is kept identical across regions under both the null and alternative hypotheses.

For the above reasons, Im *et al*. (2003 henceforth IPS) relax the assumption of the identical first-order autoregressive coefficients of the LLC test and allow γ to vary across regions under the alternative hypothesis. IPS test the null hypothesis of $\gamma_i = 0$ for all i, against the alternative $\gamma_i < 0$ for all i. This, the so-called IPS test, is based on the mean-group approach which uses the average of the $t_{\gamma i}$ statistics to obtain the following $\bar{Z}$ statistics:

$$\bar{Z} = \sqrt{N}\left(\bar{t} - E(\bar{t})\right) \Big/ \sqrt{Var(\bar{t})}, \tag{2}$$

where $E(\bar{t})$ and $Var(\bar{t})$ are respectively the mean and variance of each $t_{\gamma i}$ statistic;

[3] LLC (2002) conduct Monte Carlo simulation experiments on panel-based unit root tests which are more powerful than individual unit root tests.

$\bar{t} = (1/N)\sum_{i=1}^{N} t_{\gamma_i}$, and they are generated by simulations and are tabulated by the IPS (2003). Here, $\bar{Z}$ converges to a standard normal distribution. Based on the Monte Carlo simulation experiment results, IPS demonstrate that their test has more favorable finite sample properties than does the LLC test.

Hadri (2000) is responsible for changing the direction of this, stating that the null should be reversed, thereby making it a stationary hypothesis in order to obtain a stronger, more powerful test. Hadri's (2000) Lagrange multiplier (LM) statistics can be written as:

$$LM = (1/N)\sum_{i=1}^{N}((1/T^2)\sum_{t=1}^{T} S_{it}^2 / \hat{\sigma}_\varepsilon^2), \quad S_{it} = \sum_{j=1}^{t} \hat{e}_{ij}, \tag{3}$$

where $\hat{\sigma}_\varepsilon^2$ is the consistent Newey and West (1987) estimate of the long-run variance of the disturbance terms, while S_{it} are the cumulative sum of the residuals. Hadri (2000) implements heterogeneous and serially-correlated errors in order to increase power. In our research we use the above three panel unit root tests to determine whether the panel data in our model are stationary or not.

B. Pedroni's panel cointegration tests

Pedroni (1999) considers the following time series panel regression:

$$y_{it} = \alpha_i + \delta_i t + X_{it}\beta_i + e_{it}, \tag{4}$$

where y_{it} and X_{it} are the observable variables with the dimensions $(N^*T) \times 1$ and $(N^*T) \times M$, respectively, N refers to the number of individual countries in the panel, T refers to the number of observations over time, and M refers to the number of regression variables. The parameters α_i and $\delta_i\, t$ allow for the possibility of countries-specific fixed effects and deterministic trends, respectively. The slope coefficient β_i is also permitted to vary by individual, such that the cointegrating vectors may be heterogeneous across members of the panel (Pedroni, 2004). Pedroni (1999) develops the asymptotic and finite-sample properties of the testing statistics to examine the null hypothesis of non-cointegration in a panel. The tests allow for heterogeneity among individual members of the panel, including heterogeneity in both the long-run cointegrated vectors and in the dynamics, because there is no reason to believe that all parameters are the same across countries.

Pedroni (1999) proposes two types of tests. The first type of test is based on the within-dimension approach, which includes four statistics: the panel v-statistic, the panel ρ-statistic, the panel PP-statistic, and the panel ADF-statistic. These statistics pool the autoregressive coefficients across different members for the unit root tests on the estimated residuals. Pedroni's (1999) second type of test is based on the between-dimension approach and includes three statistics: the group ρ-statistic, the group PP-statistic, and the group ADF-statistic. These statistics are based on estimators that simply average the individually-estimated coefficients for each member.[4] In equation (4) above, $\hat{e}_{it}$ is the estimated residual, while the other terms are adequately defined in detail in Pedroni (1999). Asymptotically, all seven tests are distributed as standard normal. This requires a standardization based on the moments of the underlying Brownian motion function. The panel v-statistic is a one-sided test where large positive values flatly reject the null of no cointegration. The remaining statistics diverge to negative infinitely, which means that large negative values reject the null. The critical values are also tabulated in Pedroni (1999).

In the presence of the unit root variables, the effects of super-consistency may not dominate the endogeneity effects of the regressors if OLS is employed. To deal with the endogeneity bias in regressors, we consider the DOLS estimation method. The DOLS method introduces a parametric bias correction, while the fully-modified OLS (FMOLS; Pedroni, 2000) uses non-parametric correction terms in the estimation to eliminate endogeneity bias. However, Kao and Chiang (2000) show that the DOLS estimator outperforms the FMOLS estimator in the estimation of cointegrated panel regressions.

C. Likelihood-based cointegration tests in heterogeneous panels

Larsson and Lyhagen (1999) propose a likelihood-based panel test of the cointegrated rank and a general likelihood-based framework for inference in panel-VAR models with cointegration restrictions that allow for multiple cointegrated vectors.[5] The likelihood-based panel test for cointegration rank in heterogeneous panel models is based on the average of individual rank trace statistics. Thus, the assumption of a unique cointegrating vector and the problem of normalization are relaxed when this approach is used.

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[4] Detailed explanations of the panel v-statistics, the panel ρ-statistics, the panel PP-statistics, and the panel ADF-statistic as well as the group ρ-statistic, the group PP-statistic, and the group ADF-statistic are provided in Pedroni (1999).

[5] Larsson et al. (2001) assume that each group in a panel can be characterized by the heterogeneous VAR model.

Following the seminal literature of Larsson and Lyhagen (1999) and Larsson et al. (2001), if we consider a panel dataset that consists of a sample of N countries observed over T time periods and the observed p-vector for group i at time t is given by $G_{it}' = (g_{i1t},...,g_{ipt})'$, then each group in the panel can be characterized by the following heterogeneous VAR(k_i) model:[6]

$$G_{it} = \sum_{k=1}^{k_i} \Pi_{ik} G_{i,t-k} + \varepsilon_{it}, \tag{5}$$

where k represents lag length, $i = 1,...N$; $t = 1,...,T$; and ; $j = 1,...,p$, while ε_{it} is assumed to be normally distributed as $Np(0,\Omega_i)$. Thus, the heterogeneous VECM is:

$$\Delta G_{it} = \Pi_i \Delta G_{i,t-1} + \sum_{k=1}^{k_{i-1}} \Psi_{ik} \Delta G_{i,t-k} + \varepsilon_{it}, \tag{6}$$

where Π_i is of the order ($p \times p$).

We now consider a reduced rank specification of the panel system where the matrix Π_i ranges in rank from 0 to p, which is specified as $\Pi_i = \alpha_i\beta_i'$; the model is heterogeneous, and the panel groups are modeled individually as:

$$\Delta G_{it} = \alpha_i\beta_i' \Delta G_{i,t-1} + v_i + \sum_{k=1}^{k_{i-1}} \Psi_{ik} \Delta G_{i,t-k} + \varepsilon_{it}, \quad i = 1,...,N, \quad t = 1,...,T \tag{7}$$

where v_i contains the deterministic components. The first hypothesis we consider is that all of the N groups in the panel have the same number of co-integrating relationships among the p variables. We consider the following rank hypothesis:

$$H_0 : rank(\Pi_i) = r_i < r \text{ for all } i = 1,...,N \tag{8}$$

against the full rank alternatives for all countries:

$$H_1 : rank(\Pi_i) = p \text{ for all } i = 1,...,N. \tag{9}$$

After defining the $\overline{LR}_{NT}$ statistic as the average of the N individual trace statistics, Larsson et al. (2001) then define the panel cointegrated rank test as follows:

[6] Gutierrez (2003) points out that in Larsson et al. (2001), the LR-bar panel test requires panels with a large time series dimension, i.e., for small T, the test is size-distorted and shows low power.

$$Z_{L\bar{R}}\{H(r) \mid H(p)\} = \frac{\sqrt{N}(L\bar{R}_{NT}\{H(r) \mid H(p)\} - E(Z_k))}{\sqrt{Var(Z_k)}}, \tag{10}$$

where $E(Z_k)$ is the mean, and $Var(Z_k)$ is the variance of the asymptotic trace statistics. The asymptotic distribution of the trace statistics can be found in Larsson and Lyhagen (1999). Larsson et al. (2001) report the values for the moments of Z_k, and these can be used to calculate the test statistics. The panel trace statistics are asymptotic normal (0, 1) as N and T approach infinity, such that $\sqrt{N}T^{-1}$ goes to zero (Ericsson and Irandoust 2004).

III. Empirical results

A. The data and variables

The panel cointegration estimators are specifically designed to address the econometric problems that are a direct consequence of allowing for heterogeneity among individual members of the panel, including heterogeneity in both the long-run cointegration vectors and in the dynamics, such as the growth regressions. Our estimations are for the period 1970-2002 and cover 37 countries.[7] We obtain all of the datasets from the *World Development Indicators* (WDI 2004) published by the World Bank. Except those for the variable *FDI*,[8] we transform all of the data series to their logarithmic form. For this set of countries, the data are available for all of the variables we use in this paper, which means that we carry out the estimations with a balanced dataset. We use two different financial development variables, *LIAB* and *LEND*. A definition of each term follows: [9]

FDI: Foreign direct investment, net inflow (% of GDP)

LIAB: Liquid liabilities as % of GDP.[10]

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[7] This is in line with Rousseau and Wachtel (2000) who have 47 countries in their database; we do not use 10 of those countries owing to a paucity of data.

[8] Because FDI/GDP is minor in some sample countries, taking a natural logarithm usually transfers it as a negative value. Thus, as in Durham (2004) and Alfaro et al. (2004), FDI is not transformed in logs. However, in keeping with the literature, we use the logarithm of the financial development variables.

[9] Limited by the desirability of the data length, we do not take other financial variables in the stock and bond markets.

[10] This is a typical measure of "financial depth" and thus of the overall size of the financial intermediate sector (King and Levine, 1993a; Shen and Lee, 2006).

LEND: Domestic credit provided by the banking sector to the private sector (% of GDP).[11]

LGDP: Real gross domestic product (constant 1995 U.S.$)

The highest *FDI* is noted in Singapore (9.49%), followed by Trinidad and Tobago (5.38%) and Malaysia (3.87%). The lowest *FDI*, in ascending order, is in Japan (0.05%), India (0.21%), and Turkey (0.35%). On the financial development variable, the highest *LIAB* ratios are found in Japan (160.18%), followed by Switzerland (137.32%) and Singapore (99.72%), whereas the lowest ratios, in ascending order, are in Niger (12.99%), Argentina (23.01%), and Peru (23.98%). *LEND* shows slightly different results, with the three highest values for Malaysia (598.96%), Japan (162.19%), and Switzerland (135.80%), while the three lowest are Niger (10.53%), Peru (17.06%), and Turkey (18.54%). Finally, the United States, Japan, and Italy have the highest *LGDP* – US$5941.9, US$4098.5, and US$917.4 billion, respectively. By contrast, Niger, Mauritius, and Jamaica have the lowest.

B. The empirical results

Panel cointegration tests results

Table 1 presents the results from the panel unit root tests. At the 5% significance level, no matter if there is a time effect or not, the IPS and Hadri statistics provide strong evidence that the four series – *LGDP*, *FDI*, *LIAB*, and *LEND* – have a unit root, while just two statistics reject the unit root in the LLC test. A similar test also shows that all of the variables are of the I(1) process. Using these results, we proceed to test *LGDP*, *FDI*, and *LIAB* (or *LEND*) for cointegration to determine if there is a long-run relationship to control for in the econometric specifications (Model 1 and Model 2).

We further modify Odedokun's (1996) model as *Output = f (FDI, Financial Development)* and attempt to untangle the relationships in the FDI-finance-growth nexus. To conduct empirical tests on the effect of financial development on economic growth, Odedokun (1996) proposes a theoretical framework based on the conventional neo-classical, one-sector, aggregate production function in which financial development constitutes an input. Odedokun's (1996) study employs time-series data for 71 developing countries and examines whether the effect of financial

[11] This measure of financial development is more than simply a measure of the size of the financial sector. *LEND* isolates the credit issued to the private sector as opposed to the credit issued to governments, governmental agencies, and public enterprises (King and Levine, 1993a, b).

Table 1. Results of the panel unit root tests

Variables	LLC		IPS		Hadri	
	No time effects	Time fixed effects	No time effects	Time fixed effects	No time effects	Time fixed effects
LGDP	-4.468**	3.617	2.452	3.500	20.507**	10.080**
FDI	2.390	-0.537	2.102	-0.157	10.468**	12.600**
LIAB	-1.968**	1.263	0.563	2.051	16.274**	12.533**
LEND	-0.868	1.903	0.960	3.955	14.020**	11.902**
Δ *LGDP*	-12.999**	-12.996**	-13.430**	-12.844**	3.386**	4.945**
Δ *FDI*	-22.536**	-22.899**	-22.273**	-25.412**	1.665	10.724**
Δ *LIAB*	-14.675**	-13.986**	-13.532**	-13.167**	2.454	6.150**
Δ *LEND*	-7.874**	-9.730**	-8.031**	-8.177**	2.579	3.899**

Notes: Δ denotes the first differences. All variables are in natural logarithms. ** rejects the null of the unit root in the LLC and IPS tests at the 5% level or rejects the null of stationary in the Hadri test at the 5% level. The method used for selecting the lag length is the Modified Schwarz Information Criterion (MSIC). This is one among several criteria discussed by Bai and Ng (2002). The MSIC is found to perform well in finite sample situations. Like the standard information criteria, a smaller MSIC indicates a better fit of model to data.

development on economic growth varies across different regional groups of countries as well as across countries with different levels of economic development. This model has also been broadly used in the study of other related topics (see Lee and Wong, 2005 and Odedokun, 1998).

We estimate the following equation:

$$LGDP_{it} = \alpha_i + \beta_i FDI_{it} + c_i FIN_{it} + \varepsilon_{it}, \tag{11}$$

and this allows for cointegrating vectors of differing magnitudes between countries as well as with country (α_i) fixed-effects. *FIN* denotes the level of financial development and is proxied by *LIAB* or *LEND*. Table 2 contains the estimates from the panel cointegration tests in which the dependent variable is the measure of *LGDP*, though they are different from the financial development indicators. First, for the models with *LGDP*, *FDI*, and *LIAB* (Model 1) in Table 2, except for the panel variance and the group ρ statistics, the other statistics significantly reject the null of no cointegration. For the models with *LGDP*, *FDI*, and *LEND* (Model 2), except for the group ρ statistics, the results are similar since all other statistics also significantly reject the null of no cointegration. Thus, it can be seen that either (*LGDP*, *FDI*, and *LIAB*) or (*LGDP*, *FDI*, and *LEND*) move together in the long run.

Table 2. Results of the panel cointegration tests

	Model 1: (*LGDP*, *FDI*, *LIAB*)	Model 2: (*LGDP*, *FDI*, *LEND*)
Panel variance	-0.413	1.777**
Panel ρ	-3.338**	-2.243**
Panel PP	-7.950**	-6.450**
Panel ADF	-5.978**	-6.763**
Group ρ	2.204	1.726
Group PP	-1.708**	-2.667**
Group ADF	-2.568**	-3.257**

Notes: under the null hypothesis, all the statistics are distributed as standard normal distributions. The finite sample distribution for the seven statistics has been tabulated in Pedroni (2004). The variance ratio test is right-sided, while the others are left-sided. ** denotes that rejects the null of no cointegration at the 5% level.

While it is interesting to know that there are one or more long-run relationships in the three non-stationary variables, it is of more interest to discover the nature of these relationships. Tables 3 and 4 report the individual country-by-country and panel cointegration test results using the Larsson et al. (2001) method. The lags we select are determined by minimizing the Schwarz Bayesian information criteria (SBC), and there appears to be a reasonable fit in terms of the test statistics for normality and autocorrelation. The individual trace test favors a cointegrated vector of zero, one, or two. In fact, the most common rank in the panel is r = 0. However, the Larsson et al. (2001) panel test suggests the presence of at least two cointegrated vectors in Models 1 and 2, respectively, for the three variables in 37 selected countries. Dickey et al. (1994, page 22) have shown that the existence of more than one cointegration vector indicates that estimated equations are stationary in more than one direction and hence they are more stable. Compared with the Pedroni tests, Larsson et al.'s (2001) test provides stronger evidence of panel cointegration. Thus, based on the results of panel cointegrated test, our study overall identifies the long-run stability relation among financial development, *FDI*, and *LGDP*.[12]

[12] From theory, it seems likely that there is a long-run relationship between *FDI* and *LGDP*. We do not report details of the cointegrating vector between *FDI* and *LGDP* as this is not of relevance to the study.

Table 3. Results of Larsson et al.'s (2001) panel cointegration test (Model 1)

Country	Lag	LM(1)	$r = 0$	$r = 1$	$r = 2$	Rank
Argentina	1	6.35	16.78	6.99	1.03	0
Australia	1	11.40	40.66	17.53	0.06	2
Brazil	1	10.92	28.48	8.20	2.35	1
Canada	1	10.09	26.48	8.11	1.98	0
Chile	1	10.96	13.96	5.61	1.91	0
Colombia	1	8.92	42.35	12.32	0.13	1
Cote d'Ivoire	1	5.96	21.89	7.32	2.46	0
Denmark	1	5.97	21.72	8.54	1.92	0
Finland	1	7.34	19.68	7.61	0.32	0
India	1	1.72	32.43	5.11	0.03	1
Indonesia	1	9.33	28.34	8.97	0.08	1
Israel	1	12.96	29.27	11.43	4.39	1
Italy	2	1.70	24.48	8.38	0.77	0
Jamaica	1	15.96	21.98	6.82	0.88	0
Japan	1	8.20	21.42	6.99	0.12	0
Jordan	1	13.18	30.12	11.88	1.76	1
Kenya	1	9.56	20.52	8.18	3.17	0
Malaysia	1	10.55	31.53	11.39	0.37	1
Mauritius	1	10.72	26.24	11.89	0.05	0
México	1	2.70	19.68	4.22	0.29	0
Morocco	2	3.74	21.10	9.04	0.27	0
New Zealand	1	7.24	17.31	7.96	2.53	0
Nigeria	1	4.14	20.85	4.07	0.72	0
Norway	1	12.92	19.86	10.08	0.07	0
Pakistan	1	13.57	44.55	13.26	0.38	1
Peru	1	6.79	15.91	7.53	2.28	0
Philippines	1	12.65	22.43	4.45	0.10	0
Singapore	1	8.80	21.87	10.36	2.54	0
Sri Lanka	1	8.78	49.71	21.23	0.89	2
Sweden	1	5.86	19.86	7.91	1.20	0
Switzerland	1	7.23	23.41	5.18	1.85	0
Thailand	1	2.65	18.02	6.30	0.13	0
Trinidad/Tobago	1	15.94	45.73	7.49	1.46	1
Turkey	1	8.80	36.57	14.25	1.19	2
United States	2	9.25	24.45	4.23	0.01	0
Venezuela	1	10.90	14.50	4.79	1.19	0
Zimbabwe	1	9.07	19.37	9.37	1.19	1
Panel test $Z_{\overline{LR}}(H(r)/H(3))$			13.869	5.529	0.132	2

Notes: The null hypothesis is that there are no more than r cointegrating relationships; the panel rank test critical value is 1.645. Trace test critical values at 95% significance level are 26.70 ($r = 0$), 13.55 ($r = 1$), and 4.54 ($r = 2$); the 5% finite-sample critical values constructed from asymptotic critical values in MacKinnon et al. (1999) using the Cheung and Lai (1993) method; critical values for E(Zk) and Var(Zk) from Larsson et al.(2001, Table 1). LM(1) is the Lagrange-multiplier test for residual autocorrelation of order 1.

Table 4. Results of Larsson et al.'s (2001) panel cointegration test (Model 2)

Country	Lag	LM(1)	r = 0	r = 1	r = 2	Rank
Argentina	1	6.30	14.71	7.5	1.34	0
Australia	1	14.39	44.46	18.21	0.11	2
Brazil	2	11.88	40.07	9.25	2.09	1
Canada	1	11.48	28.75	9.21	0.10	1
Chile	1	10.31	13.19	7.22	3.02	0
Colombia	2	12.18	15.18	6.09	2.86	0
Cote d'Ivoire	1	16.00	25.04	4.70	0.02	0
Denmark	1	12.80	29.98	13.89	0.73	2
Finland	2	12.04	24.55	9.75	1.52	0
India	1	11.62	32.46	5.36	0.45	1
Indonesia	2	8.54	24.98	8.46	0.03	0
Israel	1	8.99	26.71	11.49	3.42	1
Italy	1	8.30	27.28	9.86	3.19	1
Jamaica	1	12.62	25.89	7.59	0.64	0
Japan	1	9.49	17.48	5.86	2.06	0
Jordan	1	8.27	33.23	8.29	1.12	1
Kenya	1	3.71	21.39	6.62	0.67	0
Malaysia	1	8.23	22.75	8.05	0.92	0
Mauritius	2	12.33	24.96	5.48	0.03	0
México	1	10.29	21.03	3.84	0.95	0
Morocco	2	3.38	26.46	12.10	3.02	0
New Zealand	1	7.09	22.36	8.91	2.54	0
Nigeria	1	13.02	23.84	2.58	0.56	0
Norway	1	12.76	16.76	7.88	1.92	0
Pakistan	1	12.99	33.01	9.89	0.44	1
Peru	1	9.13	18.00	8.97	2.08	0
Philippines	1	10.80	21.52	10.71	0.81	0
Singapore	1	8.69	21.6	10.49	1.78	0
Sri Lanka	1	7.19	37.58	16.12	2.59	2
Sweden	2	5.78	42.49	11.28	2.27	1
Switzerland	1	9.36	21.79	8.33	1.63	0
Thailand	2	10.33	23.12	9.88	3.36	0
Trinidad/Tobago	1	13.46	43.44	7.83	1.93	1
Turkey	1	14.05	34.75	12.71	0.25	2
United States	2	12.93	37.26	11.93	0.66	2
Venezuela	1	3.05	11.95	3.85	0.05	0
Zimbabwe	1	4.96	16.28	5.28	0.34	0
Panel test $Z_{\overline{LR}}(H(r)/H(3))$			13.651	5.079	1.042	2

Notes: The null hypothesis is that there are no more than r cointegrating relationships; the panel rank test critical value is 1.645. Trace test critical values at 95% significance level are 26.70 (r = 0), 13.55 (r = 1), and 4.54 (r = 2); the 5% finite-sample critical values constructed from asymptotic critical values in MacKinnon et al. (1999) using the Cheung and Lai (1993) method; critical values for E(Zk) and Var(Zk) from Larsson et al.(2001, Table 1). LM(1) is the Lagrange-multiplier test for residual autocorrelation of order 1.

Panel long-run estimates

To deal with the endogeneity bias in regressors, we further consider the bias-corrected estimation methods. Tables 5 provides the results of the country-by-country and the panel DOLS for the two models:[13] (*LGDP*,*FDI*, *LIAB*) and (*LGDP*,*FDI*, *LEND*). As shown at the bottom of Table 5, for (*LGDP*,*FDI*, *LIAB*) the panel parameters are 0.14 and 0.55, and there are no time dummies for *FDI* or *LIAB*. Furthermore, as the coefficients are statistically significant at the 5% level, the effect is positive. On a per country basis of Model 1, *FDI* has a significantly positive impact on *LGDP* in 20 of the 37 countries. In 22 of the 37 countries, *LIAB* has a significantly positive effect on *LGDP* at the 10% level. However, when the financial development variable is *LEND*, as shown in the right-hand side (Model 2) of Table 5, in 29 of the 37 countries the null - that *FDI* has no effect on *LGDP* - must be rejected. Furthermore, in 24 of the 37 countries, *LEND* has a significantly positive effect on *LGDP* at the 10% level. Therefore, strictly based on our examination above, it is unambiguous that there is a cointegrated relationship among *FDI*, *LGDP*, and *LEND* in our sample countries. For *FDI* and *LEND*, the panel parameters are 0.22 and 0.61, respectively. This shows that a 1% increase in *FDI* increases *LGDP* by around 0.2%, and the corresponding increase from a 1% increases in financial development is around 0.6%. Added to this, Tables 5 illustrates that both of the financial development indicators have a greater impact on *LGDP* than does *FDI*. This phenomenon underscores the potential gains associated with *FDI* and financial development in an increasingly global economy. The results also suggest that *FDI* promotes growth through two channels: one where it directly causes economic growth, and indirectly where it promotes financial market development which then spurs growth. More specifically, the results support the *FDI* -finance-growth nexus in the long run.

Panel causality test results

Once these variables are cointegrated, the next step is to implement the causality tests. We use a panel-based error correction model to identify the nature of the long-run relationship using the two-step procedure of Engle and Granger (1987). In the first step, we estimate the long-run model for equation (11) in order to obtain the estimated residual ε_{it-1} (the error correction term; ECM hereafter). In

[13] We do not report the estimated results of FMOLS we use here in order to conserve space, but all results are available upon request.

Table 5. Results of dynamic OLS estimates (dependent variable: LGDP)

Country	Model 1		Model 2	
	FDI	*LIAB*	*FDI*	*LEND*
Argentina	0.15 (10.64)**	0.01 (0.30)	0.18 (15.90)**	0.07 (1.72)*
Australia	-0.14 (-0.97)	1.07 (9.35)**	-0.10 (-1.23)	0.6 (10.98)**
Brazil	-0.02 (-0.18)	0.01 (0.05)	0.28 (2.44)**	1.28 (2.05)**
Canada	0.18 (10.28)**	0.07 (0.55)	0.02 (1.16)	1.08 (11.67)**
Chile	0.30 (6.01)**	0.32 (1.34)	0.18 (13.07)**	0.03 (0.36)
Colombia	-0.03 (-0.76)	-1.72 (-3.96)**	0.28 (14.09)**	1.27 (5.33)**
Côte d'Ivoire	0.04 (5.87)**	0.56 (11.20)**	0.17 (1.68)*	0.20 (0.78)
Denmark	0.06 (0.64)	0.81 (7.29)**	0.03 (1.53)	-0.40 (-2.17)**
Finland	0.81 (6.48)**	1.22 (8.51)**	0.09 (26.51)**	0.59 (15.44)**
India	-0.15 (-3.32)**	1.06 (30.14)**	1.42 (18.63)**	0.59 (5.8)**
Indonesia	0.1 (0.96)	0.04 (0.12)	-0.10 (-3.68)**	0.48 (11.07)**
Israel	-0.01 (-0.06)	-1.36 (-12.44)**	0.20 (1.81)*	0.59 (1.76)*
Italy	0.05 (8.03)**	-0.01 (-0.07)	0.22 (0.28)	-0.58 (-1.57)
Jamaica	0.34 (1.25)	1.42 (19.17)**	0.05 (7.7)**	0.20 (1.41)
Japan	0.15 (12.58)**	1.36 (19.67)**	0.36 (3.29)**	1.08 (45.26)**
Jordan	-0.18 (-1.55)	1.68 (7.67)**	0.08 (4.29)**	1.42 (9.50)**
Kenya	0.10 (1.45)	1.39 (6.81)**	-0.01 (-0.06)	1.57 (6.06)**
Malaysia	0.01 (0.17)	1.73 (11.81)**	0.08 (2.85)**	0.81 (15.4)**
Mauritius	0.26 (6.67)**	-0.58 (-1.92)*	0.04 (5.06)**	1.00 (113.78)**
Mexico	-0.18 (-5.58)**	1.80 (17.52)**	0.28 (15.96)**	-0.39 (-8.27)**
Morocco	0.01 (0.65)	0.63 (5.74)**	0.44 (3.65)**	-0.42 (-1.83)**
New Zealand	0.11 (3.09)**	0.10 (1.56)	-0.08 (-2.18)**	0.33 (5.73)**
Nigeria	0.22 (6.06)**	2.35 (4.97)**	0.10 (2.20)**	-0.12 (-3.17)**
Norway	1.44 (5.19)**	-1.43 (-0.88)	0.11 (11.86)**	0.97 (22.15)**
Pakistan	0.03 (1.93)*	0.67 (3.50)**	0.98 (23.86)**	1.78 (11.52)*
Peru	-0.09 (-1.2)	0.81 (5.02)**	0.04 (2.01)**	0.29 (1.75)*
Philippines	0.16 (2.93)**	0.25 (0.38)	0.28 (8.61)**	-0.01 (-0.07)
Singapore	0.14 (0.66)	1.86 (3.08)**	0.05 (0.81)	2.86 (3.59)**
Sri Lanka	0.07 (2.38)**	-3.66 (-7.31)**	0.75 (6.30)**	0.06 (0.25)
Sweden	-0.04 (-6.37)**	1.84 (16.51)**	0.01 (0.53)	0.47 (12.17)**
Switzerland	-0.01 (-0.04)	1.67 (11.66)**	0.02 (8.29)**	0.93 (20.27)**
Thailand	0.02 (2.26)**	0.82 (7.33)**	0.03 (1.72)*	0.98 (39.52)**
Trinidad/Tobago	0.68 (1.89)*	0.85 (1.98)**	0.03 (4.80)**	0.80 (2.83)**
Turkey	0.54 (12.51)**	-0.67 (-1.27)	1.19 (4.58)**	0.97 (1.49)
United States	0.06 (2.61)**	-0.04 (-0.55)	0.27 (2.64)**	0.68 (2.49)**
Venezuela	0.12 (3.86)**	0.87 (3.25)**	0.06 (3.92)**	-0.05 (-1.17)
Zimbabwe	0.14 (15.96)**	0.55 (33.9)**	0.04 (0.59)	0.65 (3.02)**
Panel	0.14 (15.96)**	0.55 (33.89)**	0.22 (35.42)**	0.61 (61.48)**

Notes: t-value in parentheses. Asymptotic distribution of t statistic is standard normal as *T* and *N* go to infinity. ** and * indicate statistical significance at the 5% and 10% levels, respectively.

the second step, we estimate the Granger causality model with the dynamic error correction as follows:

$$\begin{aligned}\Delta LGDP_{it} &= \theta_{1i} + \lambda_1 \varepsilon_{it-1} + \sum_k \theta_{11k} \Delta LGDP_{it-k} + \sum_k \theta_{12k} \Delta FDI_{it-k} \\ &\quad + \sum_k \theta_{13k} \Delta FIN_{it-k} + u_{1it};\end{aligned} \tag{12}$$

$$\begin{aligned}\Delta FDI_{it} &= \theta_{2i} + \lambda_2 \varepsilon_{it-1} + \sum_k \theta_{21k} \Delta LGDP_{it-k} + \sum_k \theta_{22k} \Delta FDI_{it-k} \\ &\quad + \sum_k \theta_{23k} \Delta FIN_{it-k} + u_{2it}; \text{ and}\end{aligned} \tag{13}$$

$$\begin{aligned}\Delta FIN_{it} &= \theta_{3i} + \lambda_3 \varepsilon_{it-1} + \sum_k \theta_{31k} \Delta LGDP_{it-k} + \sum_k \theta_{32k} \Delta FDI_{it-k} \\ &\quad + \sum_k \theta_{33k} \Delta FIN_{it-k} + u_{3it}.\end{aligned} \tag{14}$$

All the variables here are as previously defined, Δ denotes the first difference of the variables, θ_{ji} ($j = 1,2,3$) represent fixed country effect, and k is the lag length. Term λ_j ($j = 1,2,3$) is the adjustment coefficient and u_j ($j = 1,2,3$) is the disturbance term assumed to be uncorrelated with mean zero. The short-run adjustment coefficients are constrained to be the same for all countries (Al-Iriani, 2006; Coiteux and Oliveier, 2000). We take the first-differences of equations (12)-(14) to eliminate the country-specific effects. Since this is a dynamic panel data model, we must use an instrumental variable estimator to deal with the correlation between the error term and the lagged dependent variables. As we have found that the lag length $k = 2$ is necessary to satisfy the classical assumptions concerning the error term, we use three and four periods as instruments for the lagged dependent variables.[14] To address this issue, we consider the Sargan test of over-identifying restrictions which examines the overall validity of the instruments by analyzing the sample analog of the moment conditions used in the estimation process (Edison et al., 2002).

The directions of causation can be identified by testing for the significance of the coefficient of each of the dependent variables in equations (12), (13), and (14). First, the short-run effects can be considered transitory. For short-run causality, we test $H_0 : \theta_{12k} = 0$ for *FDI* or $\theta_{13k} = 0$ for *FIN* for all k in equation (12); $H_0 : \theta_{21k} = 0$ for *LGDP* or $\theta_{23k} = 0$ for *FIN* for all k in equation (13); and $H_0 : \theta_{31k} = 0$ for *LGDP*

[14] It is well known that standard estimation techniques, like the Least Square Dummy Variable (LSDV), often yield biased and inconsistent estimations in the case of panel data. For this reason, we must use an instrumental variable estimator to deal with the correlations between the error terms and the lagged dependent variables (Christopoulos and Tsionas, 2004). For this examination, the testing procedures are started by using $k = 1$, until the error terms have no serial correlation and they are over-identified. Finally, we find that lag 2 ($k = 2$) can satisfy the classical assumptions of the error term.

or $\theta_{32k} = 0$ for *FDI* for all *k* in equation (14). Next, we test long-run causality by looking at the significance of the speed of adjustment λ which is the coefficient of the error correction term. The significance of λ indicates the long-run relationship of the cointegrated process, and so movements along this path can be considered permanent. For long-run causality, we test $H_0 : \lambda_1 = 0$ in equation (12); $H_0 : \lambda_2 = 0$ in equation (13); and $H_0 : \lambda_3 = 0$ in equation (14). Finally, it is desirable to investigate whether the two sources of causation are jointly significant. We conduct a joint test of ε_{it-1} and the respective interactive terms to check for strong causality. The joint test shows which variable(s) bear the burden of short-run adjustment to re-establish long-run equilibrium, following a shock to the system. If there is no causality in either direction, the neutrality hypothesis supports.

Table 6 shows the F-test results of our panel causality test for the two models, (*LGDP*, *FDI*, *LIAB*) and (*LGDP*, *FDI*, *LEND*) for both the long run and the short run. In the short run, *FDI* is not significant in the *LGDP* equation at the 5% level in the (*LGDP*, *FDI*, *LIAB*) model, and in fact it is the same as *LIAB* in the *FDI* equation; by contrast, a short-run causal relationship is clearly apparent in the *LIAB* equation. In short, any evidence of short-run relationships is, at most, weak. Against this, in the long run, all *LGDP*, *FDI* and *LIAB* equations are significant at the 5% level. When we change the financial development indicators to *LEND*, then we must focus on the (*LGDP*, *FDI*, *LEND*) model given in Table 6 which shows that uni-directional causality runs from *LGDP* to *FDI* and to *LEND* in the short run, but the reverse absolutely does not hold true. This implies that, in the short run, national income growth can be treated as a catalyst attracting FDI inflows and to promote financial development.

When the relationships among *LGDP*, *FDI*, and the financial development variable are in disequilibrium, the one period lagged error correction term $\varepsilon_{it-1} > 0$. If this assumption holds, then other conditions should be present, such that: $\Delta LGDP > 0$, $\Delta FDI > 0$, and $\Delta LIAB > 0$ ($\Delta LEND > 0$) in Table 6. We present the findings from the three error correction equations for Models 1 and 2, respectively. The coefficient of the error correction term ΔFDI (equation (13)) has the highest value of 0.4 and 0.6 for Models 1 and 2, respectively, indicating that as the short-run disequilibrium among the variables is adjusted to the long-run equilibrium, FDI plays a major role. When the relationships among the three variables are in disequilibrium in the short run, FDI and financial development can restore equilibrium to the economic system in the long run, but the speed of adjustment is the most rapid for FDI. Moreover, this also implies causality flowing from FDI to economic growth, but the estimated speed of adjustment is fast, with a 40-60% deviation from long-run equilibrium being eliminated in one period.

Table 6. Results of the panel causality tests

Dependent variable	Source of causation (independent variable)							
	Short run			Long run				ECM coefficients
Model 1 (*LGDP*, *FDI*, *LIAB*)								
	Δ *LGDP*	Δ *FDI*	Δ *LIAB*	ε_{it-1}	$\varepsilon_{it-1}/\Delta LGDP$	$\varepsilon_{it-1}/\Delta FDI$	$\varepsilon_{it-1}/\Delta LIAB$	Coefficient: ε_{it-1}
Δ *LGDP*	–	1.784	5.588**	39.576**	–	14.985**	19.496**	-0.023
Δ *FDI*	5.577**	–	0.229	18.095**	8.996**	–	6.398**	0.392
Δ *LIAB*	4.078**	3.626**	–	13.628**	6.717**	5.671**	–	0.035
Model 2 (*LGDP*, *FDI*, *LEND*)								
	Δ *LGDP*	Δ *FDI*	Δ *LEND*	ε_{it-1}	$\varepsilon_{it-1}/\Delta LGDP$	$\varepsilon_{it-1}/\Delta FDI$	$\varepsilon_{it-1}/\Delta LEND$	Coefficient: ε_{it-1}
Δ *LGDP*	–	2.015	1.253	22.800**	–	8.839**	7.649**	-0.015
Δ *FDI*	5.768**	–	1.436	39.426**	15.682**	–	13.458**	0.606
Δ *LEND*	34.507**	0.909	–	17.805**	26.551**	6.334**	–	0.045

Notes: Figures denote F-statistic values. ε_{it-1} indicates the estimated error-correction term. ** indicates statistical significance at the 5% level.

IV. Concluding remarks

There is a general consensus in the literature on FDI that the positive impact of FDI on growth depends on the local conditions and the absorptive capacity of the recipient country, such as financial development. Previous studies, however, have largely ignored the role played by financial development in examining the long-run relationship and causality between FDI and growth. Thus, after taking a global viewpoint based on the panel data approach, what is needed is to examine the long-run co-movements and the causal relationships among FDI, financial development, and economic growth in a multivariate model so as to jointly analyze the finance-growth hypothesis and the FDI-growth nexus. This paper overcomes some of the shortcomings in earlier studies by applying recent developments in a panel analysis and by using a small time frame to estimate panel cointegration and panel VECM tests with an annual dataset of 37 countries for 1970-2002.

By and large, the panel cointegration testing results of the Pedroni (1999) and Larsson et al. (2001) methods provide substantive evidence that there is a fairly strong long-run relationship among *FDI*, *LIAB* (or *LEND*), and *LGDP*. Apart from this, our panel DOLS estimates indicate that both of our financial development indicators have a larger effect on growth than does FDI. Moreover, from our panel causality tests, whereas evidence of a short-run relationship is weak, that of a long-run relationship among the variables is unequivocal. Important to note is that this is a clear sign of bi-directional causal linkages among FDI, financial development, and economic growth. More specifically, there is a bi-directional causal relationship between FDI and the financial development indicators in the long run, and this is indicative of a truly complementary relationship among all of the variables.

On the question of homology, as shown in Table 6, the long-run causal relation among the variables is very explicit, and there is a significant correlation among *FDI*, *LGDP*, and *LEND*. It is evident that the relationship between FDI and growth is endogenously influenced by the development of the domestic financial sector. In light of this implied FDI-led growth or growth-driven FDI, when the influence of financial development is taken into account, then it is incumbent upon policy makers to develop and improve the domestic financial system so that it can be more effective in channeling and transforming the advantages embodied in FDI inflows on growth (Choong et al., 2004). This signifies that the responsibility of the government should be redirected so that it focuses on developing the economy and on building and nurturing a good investment climate so as to attract foreign capital, thereby creating one perfect financial system in the short run. Naturally, with such a sound foundation, mutual relationships between FDI and growth can be observed and preserved in the long run.

Equally important, the bi-directional causal relationships between FDI and the financial development indictors in the long run complement each other (Hermes and Lensink, 2003). There are three important findings in the above results. First, when a country has a solid financial system as its foundation, it follows that it is in a better position to more effectively reap the benefits from FDI inflows. Next, the healthy development of the financial system is a drawing force for FDI. Moreover, it could be easier in the long run to attract even more FDI if a well-developed financial system is supplemented with an active economic policy.[15] With reference to previous papers on financial development, there is strong supporting evidence that a well-developed financial sector can represent a source of countless comparative advantages for a country, and that these advantages make it much easier for the country to absorb the positive impact of FDI, which in turn stimulates overall economic performance.

[15] Alfaro et al. (2004) argue that it is important to recognize that spillovers for a host economy might critically depend on the level of that economy's domestic financial development. They provide several different ways in which financial development matters.

It is also worth noting that countries in the throes of economic reform should have policies that include both fiscal and financial incentives to attract FDI as well as others that seek to improve the local regulatory environment and the cost of doing business. At the same time, a healthy development of a country's banking system is conducive to FDI. When FDI is associated with more competition, a larger technology gap arises between foreign and domestic firms, and more R&D expenditure results in increased productivity for all firms in the industry.

Achieving broad financial reform is admittedly not an easy task, as it depends on regulatory capacity, legal history, investment culture, and cooperation through various governments' policies; all the while, there must be a committed effort to dissolve resistance to reforms, establish good trade statues, and advance human capital. In the long term, it could well be easier for a country to attract more FDI if financial market development is supplemented with an effective economic policy, especially an international trade policy. There is considerable evidence that FDI is encouraged by enhancing multilateral economic trade contacts, export diversification, and by attracting international talent –that is, through increased participation in diversified international trade. As a result, an increase in FDI will likely produce a rise in domestic credit, and once this financial development indicator has crystallized to a desired level, the favorable effects of FDI on growth should be realized.

References

Abuaf, Niso, and Philippe Jorion (1990), Purchasing power parity in the long run, *Journal of Finance* **45**: 157–174.

Alfaro, Laura, Areendam Chanda, Sebnem Kalemli-Ozcan, and Selin Sayek (2004), FDI and economic growth: The role of local financial markets, *Journal of International Economics* **64**: 89–112.

Alfaro, Laura, Areendam Chanda, Sebnem Kalemli-Ozcan, and Selin Sayek (2006), How does foreign direct investment promote economic growth? Exploring the effects of financial markets on linkages, Working Paper12522, NBER.

Al-Iriani, Mahmoud A. (2006), Energy–GDP relationship revisited: An example from GCC countries using panel causality, *Energy Policy* **34**: 3342–3350.

Bai, Jushan, and Serena Ng (2002), Determining the number of factors in approximate factor models, *Econometrica* **70**: 191–221.

Barro, Robert, J.,and Xavier Sala-i-Martin (1997), Technology diffusion, convergence and growth, *Journal of Economic Growth* **2**: 1–26.

Beck, Thorsten, Ross Levine, and Norman Loayza (2000), Finance and the sources of growth, *Journal of Financial Economics* **58**: 261–300.

Borensztein, Eduardo, Jose De Gregorio, and Jong-Wha Lee (1998), How does foreign direct investment affect economic growth? *Journal of International Economics* **45**: 115–135.

Campbell, John Y., and Pierre Perron (1991), Pitfalls and opportunities: What macroeconomics should know about unit roots, in O. J. Blanchard, and S. Fischer, eds., *NBER macroeconomic annual*, Cambridge, MA, MIT Press.

Carkovic, Maria, V., and Ross Levine (2005), Does foreign direct investment accelerate economic growth?, in T. H. Moran, E. M. Graham and M. Blomström, eds., *Does Foreign Direct Investment Promote Development?*, Washington, D.C., Institute for International Economics.

Chamarbagwala, Rubiana, Sunder Ramaswamy, and Phanindra V. Wunnava (2000), The role of foreign capital in domestic manufacturing productivity: Empirical evidence from Asian economies, *Applied Economics* **32**: 393–398.

Choe, Jong, I. (2003), Do foreign direct investment and gross domestic investment promote economic growth?, *Review of Development Economics* **7**: 44-57.

Choong, Chee-Keong, Zulkornain Yusop, and Siew-Ohoo Soo (2004), Foreign direct investment, economic growth, and financial sector development, *ASEAN Economic Bulletin* **21**: 278–289.

Chowdhury, Abdur, and George Mavrotas (2006), FDI and growth: What causes what?, *World Economy* **29**: 9-19.

Christopoulos, Dimitris, K., and Efthymios G. Tsionas (2004), Financial development and economic growth: Evidence from panel unit root and cointegration tests, *Journal of Development Economics* **73**: 55–74.

Coiteux, Martin, and Simon Olivier (2000), The saving retention coefficient in the long run and in the short run: Evidence from panel data, *Journal of International Money and Finance* **19**: 535–548.

De Mello, Luiz R. (1997), Foreign direct investment in developing countries and growth: A selective survey, *Journal of Development Studies* **34**: 1–34.

De Mello, Luiz R. (1999), Foreign direct investment-led growth: Evidence from time series and panel data, *Oxford Economic Papers* **51**: 133–151.

Dickey, David, A., Dennis W. Jansen, and Daniel L. Thorton (1994), A primer on cointegration with an application to money and income in B.B. Rao, ed., *Cointegration for the Applied Economist*, Basingstoke, Macmillan Press.

Driffill, John, (2003), Growth and finance, *Manchester School* **71**: 363–380.

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

Edison, Hali, J., Ross Levine, Luca Ricci, and Torsten Slok (2002), International financial integration and economic growth, *Journal of International Money and Finance* **21**: 749–776.

Engle, Robert, F., and Clive W J Granger (1987), Cointegration and error correction: representation, estimation, and testing, *Econometrica* **55**: 257–276.

Ericsson, Johan, and Manuchehr Irandoust (2004), The productivity-bias hypothesis and the PPP theorem: New evidence from panel vector autoregressive models, *Japan and the World Economy* **16**: 121–138.

Grossman, G.ene, M., and Elhanan Helpman (1991), *Innovation and growth in the global economy*, Cambridge: MIT Press.

Gutierrez, Luciano (2003), On the power of panel cointegration tests: A Monte Carlo comparison, *Economics Letters* **80**: 105–111.

Hadri, Kaddour (2000), Testing for stationarity in heterogeneous panel data, *Econometrics Journal* **3**: 148–161.

Hermes, Niels, and Robert Lensink (2003), Foreign direct investment, financial development and economic growth, *Journal of Development Studies* **40**: 142–163.

Im, Kyung, So., M. Hashem Pesaran, and Yongcheol Shin (2003), Testing for unit roots in heterogeneous panels, *Journal of Econometrics* **115**: 53–74.

Kao, Chihwa (1999), Spurious regression and residual-based tests for cointegration in panel data, *Journal of Econometrics* **90**: 1–44.

Kao, Chihwa, and Min-Hsien Chiang (1999), International R&D spillovers: An application of estimation and inference in panel cointegration, *Oxford Bulletin of Economics and Statistics* **61**: 691–709.

Kao, Chihwa, and Min-Hsien Chiang (2000), On the estimation and inference of a cointegrated regression in panel data, *Advances of Econometrics* **15**: 7–51.

King, Robert, G., and Ross Levine (1993a), Finance and growth: Schumpeter might be right, *Quarterly Journal of Economics* **108**: 717–738.

King, Robert, G., and Ross Levine (1993b), Finance, entrepreneurship, and growth: Theory and evidence, *Journal of Monetary Economics* **32**: 513–542.

La Porta, Rafael, Florencio Lopez-De-Silanes, Andrei Shleifer, and Robert W. Vishny (1997), Legal determinants of external finance, *Journal of Finance* **52**: 1131–1150.

Larsson, Rolf, and Johan Lyhagen (1999), Likelihood-based inference in multivariate panel cointegration models, Working Paper Series in Economics and Finance 331, Stockholm School of Economics.

Larsson, Rolf, Johan Lyhagen, and Mickael Lothgren (2001), Likelihood-based cointegration tests in heterogeneous panels, *Econometrics Journal* **4**: 109–142.

Lee, Chien-Chiang, and Swee-Yoong Wong (2005), Inflationary threshold effects in the relationship between financial development and economic growth: Evidence from Taiwan and Japan, *Journal of Economics Development* **30**: 49-69.

Levin, Andrew, and Chien-Fu Lin (2002), Unit Root tests in panel data: Asymptotic and finite-sample properties, *Journal of Econometrics* **108**: 1–24.

Levine, Ross (1997), Financial development and economic growth: Views and agenda, *Journal of Economic Literature* **35**: 688–726.

Newey, Whitney, K., and Kenneth D. West (1987), A simple positive semi-definite: Heteroskedasticity and autocorrelation consistent covariance matrix, *Econometrica* **55**: 703–708.

Odedokun, Matthew, O. (1996), Alternative econometric approaches for analysing the role of the financial sector in economic growth: Time-series evidence from LDCs, *Journal of Development Economics* **50**: 119–146.

Odedokun, Matthew, O. (1998), Financial intermediation and economic growth in developing countries, *Journal of Economic Studies* **25**: 203-224.

Pedroni, Peter (1999), Critical values for cointegration tests in heterogeneous panels with multiple regressors, *Oxford Bulletin of Economics and Statistics* **61**: 653–670.

Pedroni, Peter (2000), Full modified OLS for heterogeneous cointegrated panels, in B. H. Baltagi, ed., *Nonstationary panel cointegration and dynamic panels* (vol. 15 of *Advances in Econometrics*), Amsterdam, Elsevier Science.

Pedroni, Peter (2004), Panel cointegration: Asymptotic and finite sample properties of pooled time series tests with an application to the PPP hypothesis, *Econometric Theory* **20**: 597–625.

Rousseau, Peter, L., and Paul Wachtel (2000), Equity markets and growth: Cross-country evidence on timing and outcomes, 1980–1995, *Journal of Banking and Finance* **24**: 1933-1957.

Sarantis, Nicholas, and Chris Stewart (2001), Saving behaviour in OECD countries: Evidence from panel cointegration tests, *Manchester School* **69**: 22–41.

Shen, Chung-Hua, and Chien-Chiang Lee (2006), Same financial development yet different economic growth – Why?, *Journal of Money, Credit and Banking* **38**: 1907-1944.

World Bank (2004), World Development Indicators on CD-ROM, Washington, DC, World Bank.