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Foreign Direct Investment, Financial Development and Economic Growth

NIELS HERMES and ROBERT LENSINK

This article argues that the development of the financial system of the recipient country is an important precondition for FDI to have a positive impact on economic growth. A more developed financial system positively contributes to the process of technological diffusion associated with FDI. The article empirically investigates the role the development of the financial system plays in enhancing the positive relationship between FDI and economic growth. The empirical investigation presented in the article strongly suggests that this is the case. Of the 67 countries in data set, 37 have a sufficiently developed financial system in order to let FDI contribute positively to economic growth. Most of these countries are in Latin America and Asia.

I. INTRODUCTION

The contribution of foreign direct investment (FDI) to economic growth has been debated quite extensively in the literature. This debate has focused on the channels through which FDI may help to raise growth in recipient countries. In particular, it has been discussed to what extent FDI may enhance technological change through spillover effects of knowledge and new capital goods, that is, the process of technological diffusion. In this discussion, some have argued that the contribution FDI can make is strongly dependent on the circumstances in the recipient countries. However, empirical studies investigating the relationship between FDI and economic growth on the one hand, and the role played by the circumstances FDI is confronted with whenever it enters a recipient country on the other hand, are scarce.[1]

This article argues that the development of the financial system of the recipient country is an important precondition for FDI to have a positive

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impact on economic growth. The financial system enhances the efficient allocation of resources and in this sense it improves the absorptive capacity of a country with respect to FDI inflows. In particular, a more developed system may contribute to the process of technological diffusion associated with FDI. The main contribution of this article is to investigate empirically the role the development of the financial system plays in enhancing the positive relationship between FDI and economic growth.

The article is structured as follows. Section II provides a description of the discussion of the contribution FDI can make to increased economic growth. The section emphasises the importance of technological diffusion and the role of FDI. In particular, it focuses on the contribution the financial system can make in this respect, using a simple theoretical model. Section III discusses the data and the empirical methodology. Sections IV–VI discuss the outcomes of the empirical investigation. Finally, section VII provides a summary and concluding remarks.

II. FDI, THE FINANCIAL SYSTEM, AND ECONOMIC GROWTH: A THEORETICAL FRAMEWORK

Review of the Literature on FDI and Growth

There is a huge literature emphasising the positive impact FDI may have on economic growth.[2] Next to the direct increase of capital formation of the recipient economy, FDI may also help increasing growth by introducing new technologies, such as new production processes and techniques, managerial skills, ideas, and new varieties of capital goods. In the new growth literature the importance of technological change for economic growth has been emphasised [*Grossman and Helpman, 1991; Barro and Sala-i-Martin, 1995*]. The growth rate of less developed countries (LDCs) is perceived to be highly dependent on the extent to which these countries can adopt and implement new technologies available in developed countries (DCs). By adapting new technologies and ideas (that is, technological diffusion) they may catch up to the levels of technology in DCs.

One important channel through which adoption and implementation of new technologies and ideas by LDCs may take place is FDI. The new technologies they introduce in these countries may spillover from subsidiaries of multinationals to domestic firms [*Findlay, 1978*]. The use of new technologies may be important in contributing to higher productivity of capital and labour in the host country. The spillover may take place through demonstration and/or imitation (domestic firms imitate new technologies of foreign firms), competition (entrance of foreign firms leads to pressure on domestic firms to adjust their activities and to introduce new technologies), linkages (spillovers through transactions between multinationals and

domestic firms), and/or training (domestic firms upgrade the skills of their employees to enable them to work with the new technologies) [*Kinoshita, 1998: 2–4; Sjöholm, 1999a: 560*].

The next question is about the conditions in the host country that are important to maximise the technology spillovers discussed above. In the literature it has been emphasised by some that the spillover effect can only be successful given certain characteristics of the environment in the host country. These characteristics together determine the absorption capacity of technology spillovers of the host country. Thus, FDI can only contribute to economic growth through spillovers when there is a sufficient absorptive capacity in the host country.

Several country studies have been carried out, providing diverging results on the role of FDI spillovers with respect to stimulating economic growth. These studies deal with the productivity effects of FDI spillovers on firms or plants using micro level data. Whereas positive effects from spillovers have been found for, for example, Mexico [*Blomström and Persson, 1983; Blomström and Wolff, 1994; Kokko, 1994*], Uruguay [*Kokko, Tansini, and Zejan, 1996*] and Indonesia [*Sjöholm, 1999b*], no spillovers were traced in studies for Morocco [*Haddad and Harrison, 1993*] and Venezuela [*Aitken and Harrison, 1999*]. These diverging results may underline the crucial role of certain host country characteristics necessary to let FDI contribute positively to economic growth through spillovers. They emphasise the difference in absorptive capacity between countries to adopt FDI.[3]

Some authors argue that the adoption of new technologies and management skills requires inputs from the labour force. High-level capital goods need to be combined with labour that is able to understand and work with the new technology. Therefore, technological spillover is possible only when there is a certain minimum, or 'threshold' level of human capital available in the host country [*Borensztein, et al., 1998*]. This suggests that FDI and human capital are complementary in the process of technological diffusion. Other authors argue that the process of technological spillovers may be more efficient in the presence of well-functioning markets. Under these circumstances, the environment in which FDI operates ensures competition and reduces market distortions, enhancing the exchange of knowledge among firms [*Bhagwati, 1978; Ozawa, 1992; Balasubramanyam et al., 1996*]. Some authors stress that the establishment of property rights – in particular intellectual property rights – is crucial to attract high technology FDI [*Smarzynska, 1999*]. If intellectual property rights are only weakly protected in a country, foreign firms will undertake low technology investments, which reduces the opportunities for spillover effects and improvements of productivity of domestic firms.

FDI and the Domestic Financial System

The previous discussion shows there may be several characteristics that may indeed be important to promote the use of absorptive capacity of a country with respect to maximising technology spillovers from foreign firms. Yet, this article argues that one crucial characteristic of the environment in the host country has not been mentioned in the literature, that is, the development of the domestic financial system. 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.[4]

The model assumes that technical progress is represented through the variety of capital goods available. There are three types of agents in the model: final goods producers, innovators and consumers. Every producer of final goods rents N varieties of capital good from specialised firms that produce a type of capital good (the innovators). The producer has monopoly rights over the production and sale of the capital goods. The purchase price P_j of the capital good is set by optimising the present value of the returns from inventing (and producing in several periods), $V(t)$. This leads to a fixed mark-up over production costs. Barro and Sala-i-Martin [*1995: 218*], assuming free entry of inventors, show that in equilibrium with positive R&D (at cost price) and increasing N, the (constant) rate of return (interest rate, r) is given by:

$$r = (1/\eta)LA^{1/(1-\alpha)}\left(\frac{1-\alpha}{\alpha}\right)\alpha^{2/(1-\alpha)} \qquad (1)$$

where α measures capital's share of income (that is, the coefficient in Cobb-Douglas production function) and L is labour input. FDI is introduced in the model by assuming that there are fixed maintenance costs, equal to 1, and fixed set up costs (R&D costs, η). The costs of discovering a new variety of a good (costs of innovation) are assumed to be the same for all goods. In line with Borensztein *et al.* [*1998*] the costs of R&D depend on FDI: more FDI leads to a decline in the costs of innovation. This reflects the idea that it is cheaper to imitate than to innovate [*Borensztein et al. 1998*], and that the possibility to imitate increases if more goods are produced in other countries (that is, when FDI is higher). So, the costs of discovering a new good can be modelled as (using FDI = F): $\eta = f(F)$, where $\partial\eta/\partial F < 0$.

The impact of the financial sector enters the model via A, the level of technology. It is well known that the financial sector may improve economic growth by enhancing the average level of technology (see below). So, A is a function of the development of the financial sector (H), $A = h(H)$, where $\partial A/\partial H > 0$. This implies that:

$$r = \left(\frac{L}{f(F)}\right)h(H)^{1/(1-\alpha)}\left(\frac{1-\alpha}{\alpha}\right)\alpha^{2/(1-\alpha)} \tag{2}$$

To introduce the link to economic growth we close the model by considering behaviour of households. Households maximise a standard inter-temporal utility function, subject to the budget constraint. This gives the well-known Euler condition for the growth rate of consumption, $g_C = (1/\theta)(r - \rho)$, where $-\theta$ is the elasticity of marginal utility and ρ is the discount rate. In the steady state the growth rate of consumption equals the growth rate of output, g.

Using the expression for r from (2) we finally get:

$$g = (1/\theta)\left[\left(\frac{L}{f(F)}\right)h(H)^{1/(1-\alpha)}\left(\frac{1-\alpha}{\alpha}\right)\alpha^{2/(1-\alpha)} - \rho\right] \tag{3}$$

It is now easy to see that an increase in FDI leads to an increase in the growth rate of output (g) and that the effect of FDI depends on the development of the financial sector. An increase in FDI lowers set-up costs (for technology adaptation) and raises the return on assets (r). This leads to an increase in saving and so a higher growth rate in consumption and output. This effect will be greater the higher the level of technology in a country, that is, the better the financial system is developed.

A crucial assumption in the above model is that the domestic financial system influences growth through the level of technology. We need to specify further this link, however. First of all, the financial system influences the allocative efficiency of financial resources over investment projects. Thus, the financial system may contribute to economic growth through two main channels (next to providing and maintaining a generally accepted means of exchange). On the one hand, it mobilises savings; this increases the volume of resources available to finance investment. On the other hand, it screens and monitors investment projects (that is, lowering information acquisition costs); this contributes to increasing the efficiency of the projects carried out (see, for example, Greenwood and Jovanovic [*1990*]; Levine [*1991*]; Saint-Paul [*1992*]).[5] The more developed the domestic financial system, the better it will be able to mobilise savings, and screen and monitor investment projects, which will contribute to higher economic growth.

Second, investment related to upgrade existing or adopt new technologies is more risky than other investment projects. The financial system in general, and specific financial institutions in particular, may help to reduce these risks, thereby stimulating domestic entrepreneurs to actually

undertake the upgrading of existing technology or to adopt new technologies introduced by foreign firms. Thus, financial institutions positively affect the speed of technological innovation, thereby enhancing economic growth [*Huang and Xu, 1999*]. This argument also holds for technological innovation that results from one or more of the channels of technology spillovers from FDI as described above. The more developed the domestic financial system, the better it will be able to reduce risks associated with investment in upgrading old and/or new technologies.

Third, when we reconsider the different channels through which technology spillover may take place, it becomes clear that in many cases domestic firms will need to invest when upgrading their own technology or adopting new technologies, based either on a demonstration effect, a competition effect, and/or a linkage effect. The same holds in case they aim at upgrading the skills of their employees (the training effect). These investments should be financed, however. The development of the domestic financial system at least partly determines to what extent domestic firms may be able to realise their investment plans in case external finance from banks or stock markets is needed.

Finally, the development of the domestic financial system may also determine to what extent foreign firms will be able to borrow in order to extend their innovative activities in the host country, which would further increase the scope for technological spillovers to domestic firms. FDI as measured by the financial flow data may be only part of the FDI to developing countries, as some of the investment is financed through debt and/or equity raised in financial markets in the host countries [*Borensztein et al., 1998: 134*]. Thus, the availability and quality of domestic financial markets also may influence FDI and its impact on the diffusion of technology in the host country. This diffusion process may be more efficient once financial markets in the host country are better developed, since this allows the subsidiary of a MNC to elaborate on the investment once it has entered the host country.

Thus, in conclusion, FDI and domestic financial markets are complementary with respect to enhancing the process of technological diffusion, thereby increasing the rate of economic growth. This hypothesis can be tested empirically, which will be the subject of the next two sections.

III. DATA AND METHODOLOGY OF EMPIRICAL INVESTIGATION

The data set used in this article applies to the 1970–95 period and contains 67 LDCs (see Appendix II for a complete list of the countries). For this set of countries data is available for all variables used in this study, which means that the estimations have been carried out with a balanced data set.

Table 1 provides basic descriptive statistics for the dependent variable, that is, the per capita growth rate (*PCGROWTH*) and the crucial variable in this study, that is, gross FDI inflows as a percentage of GDP *(FDI*). Both variables (and all other variables in this study) are average values for the 1970–95 period.

The table shows that *PCGROWTH* and *FDI* are not normally distributed. The distribution of these variables is skewed. With respect to *PCGROWTH*, 30 countries have an average growth rate varying between zero and two per cent, for 13 countries the growth rate is between two and four, for five the growth rate is above four per cent, and for 19 countries the growth rate is negative. For 42 countries FDI as a percentage of GDP is between zero and one, for 17 countries it is between one and two, for five countries between two and three, and for three countries between four and five. The largest recipients of FDI as a percentage of GDP are Swaziland, Trinidad and Tobago and Malaysia.

The methodology of the empirical investigation follows the voluminous growth regression literature, which was stimulated by the seminal paper of Barro [*1991*]. Unfortunately, theory does not provide clear guidance concerning the set of variables that should be included in the growth equation. Depending on the aim of the study and the insights and beliefs of the author(s), different explanatory variables have been included and found to be significant in the literature. Recently, some studies have shown that only a few variables have a robust effect on economic growth (see, for example, Levine and Renelt [*1992*] and King and Levine [*1993a*]), implying the importance of stability tests. Sala-i-Martin [*1997a; 1997b*] provides a useful method to test for the robustness of different variables in explaining economic growth. The empirical analysis in this article closely follows his approach. In particular, the regression analysis for the cross-section of 67 countries is specified as follows:

$$PCGROWTH = \alpha_i + \beta_{i,j} I + \beta_{mj} M + \beta_{z,j} Z + e \qquad (4)$$

TABLE 1

DESCRIPTIVE STATISTICS FOR PER CAPITA GROWTH AND FDI

	PCGROWTH	*FDI*
Mean	0.938	0.998
Median	0.529	0.693
Maximum	6.832	4.698
Minimum	–3.134	0.003
Standard Deviation	1.923	0.989
Skewness	0.719	1.824
Kurtosis	4.120	6.686

where *I, M* and *Z* are vectors of variables and *e* is an error term. *I* is a vector of variables that are 'generally accepted' to be important to explain economic growth. *M* is a vector of variables containing the variables of interest in this study. In this study these variables are the log of the FDI to GDP ratio (*LFDI*), and *LFDI* interacted with the log of the private sector bank loans to GDP ratio (*LCREDP*). *LCREDP* is chosen here as a measure of financial development (see below). The vector of *Z* variables contains a limited number of variables from a large set of variables that have been used in the literature to explain per capita economic growth. These variables are used as control variables in the estimations.[6]

The vector of *I* variables contains variables that, according to Levine and Renelt [*1992*], and King and Levine [*1993a*], have a robust effect on economic growth. These variables are: the log of the initial level of the secondary enrolment rate *(LSECENR),* the log of the initial level of GDP per capita (*LGDPPC*), the variable proxying for financial market development over the 1970–95 period (*LCREDP*) and the log of the investment share in GDP (*LINVGDP*). Table 2 presents the correlation matrix for the *I* variables, *PCGROWTH* and *LFDI.*

The choice of the *I* variables needs some further explanation:

(1) *LSECENR* measures human development;
(2) The introduction of *LGDPPC* reflects the process of catch up;
(3) With respect to the choice of the financial development variable, we note that several variables have been suggested in the literature to measure financial development, depending on the specific characteristics of the financial system of interest. These variables focus on the size, the efficiency and/or the relative importance of different financial intermediaries in the total financial system. The problem is that for several of these variables data are only available for a limited number of countries. Therefore in the analysis the log of credit to the private sector as a percentage of GDP (*LCREDP*) is used to measure financial development, since for this variable data are available for all

TABLE 2

CORRELATION MATRIX

	PCGROWTH	*LFDI*	*LSECENR*	*LINVGDP*	*LCREDP*	*LGDPPC*
PCGROWTH	1					
LFDI	0.21	1				
LSECENR	0.43	0.30	1			
LINVGDP	0.58	0.29	0.27	1		
LCREDP	0.48	0.38	0.53	0.52	1	
LGDPPC	–0.10	0.37	0.52	0.18	0.45	1

countries in the data set. Moreover, this variable is used in several other studies (see, for example, Demirgüç-Kunt and Levine [*1996*]);[7]

(4) With respect to *LINVGDP*, regression models are estimated including and excluding this variable in the vector of *I* variables. The reason for this is that the interpretation of a significant coefficient for a certain variable *x* depends on whether or not *LINVGDP* is included in the regression model. If *LINVGDP* is included and the coefficient of variable *x* is significant, this is interpreted as *x* affecting growth via the 'level of efficiency'. If *LINVGDP* is not included, it is unclear whether variable *x* affects growth via investment or via efficiency. This distinction is of importance to obtain more information with respect to how exactly *FDI* is related to economic growth.

IV. RESULTS OF THE EMPIRICAL INVESTIGATION

The analysis starts by estimating a number of base equations, that is, the *Z* variables are not yet included in the regression models. The results of these estimations are presented in Table 3 (without *LINVGDP*) and Table 4 (with *LINVGDP*). Column [1] in both tables shows the relevance of including the different *I* variables as determinants of GDP per capita growth. The tables show that *LGDPPC, LSECENR, LCREDP* and *LINVGDP* have a significant impact on economic growth. In column [2] *LFDI* is added to this equation. This variable does not have a significantly positive direct effect on economic growth. This may be interpreted as a confirmation of the view that without additional requirements FDI does not enhance economic growth of a country.

As explained above, the aim of this article is to empirically investigate the hypothesis that FDI and domestic financial markets are complementary with respect to enhancing the process of technological diffusion, thereby increasing the rate of economic growth. Therefore, the empirical analysis focuses on the variables *LFDI* and the interactive term *LFDI*LCREDP*, which represent the vector of *M* variables as specified in equation (1). The model presented in column [3] of Tables 3 and 4 directly tests the central hypothesis of this article. The outcomes in the tables show that the interactive term *LFDI*LCREDP* is positive and significantly related to the dependent variable *PCGROWTH*, whereas *LFDI* alone is significantly negative.[8] This supports the view that FDI only has a positive effect on economic growth if the development of the domestic financial system has reached a certain minimum level. Thus, we find preliminary support for the central hypothesis of this article.

It may be argued that the results presented in column [3] of Tables 3 and 4 are due to high multi-collinearity between *LSECENR* and *LCREDP* (see

TABLE 3

FDI AND ECONOMIC GROWTH

	[1]	[2]	[3]	[4]
LGDPPC	–1.182***	–1.238***	–1.180***	–1.247***
	(–5.15)	(–5.29)	(–5.20)	(–4.98)
LSECENR	0.891***	0.882***	0.740***	0.964***
	(4.47)	(4.45)	(3.75)	(4.09)
LCREDP	1.562***	1.471***	1.827***	1.620***
	(4.12)	(3.97)	(4.59)	(4.02)
LFDI		0.156	–1.587**	–1.574***
		(1.11)	(–2.60)	(–2.68)
*LFDI*LSECENR*				0.215*
				(1.69)
*LFDI*LCREDP*			0.621***	0.429*
			(2.85)	(1.86)
C	1.376	2.127	0.943	1.386
	(1.01)	(1.47)	(0.60)	(0.85)
R^2	0.46	0.46	0.51	0.51
F	19.94	15.32	14.53	12.46

Note: See Appendix A for abbreviations used. Dependent variable: *PCGROWTH.* Amount of observations in all regressions: 67. Values in parentheses are White heteroskedastic adjusted t-values. * denotes significance at the ten per cent level; ** denotes significance at the five per cent level; *** denotes significance at the one per cent level. R^2 is the adjusted R^2. F is the F-statistic.

TABLE 4

FDI AND ECONOMIC GROWTH: EFFECTS VIA EFFICIENCY

	[1]	[2]	[3]	[4]
LGDPPC	–1.117***	–1.148***	–1.081***	–1.113***
	(–6.83)	(–6.33)	(–7.14)	(–6.86)
LSECENR	0.868***	0.863***	0.706***	0.805***
	(5.40)	(5.43)	(4.64)	(4.03)
LINVGDP	2.539***	2.488***	2.594***	2.536***
	(5.56)	(5.55)	(5.60)	(5.25)
LCREDP	0.843**	0.807**	1.171***	1.095***
	(2.46)	(2.40)	(3.23)	(2.86)
LFDI		0.085	–1.839***	–1.828***
		(0.65)	(–3.23)	(–3.28)
*LFDI*LSECENR*				0.095
				(0.807)
*LFDI*LCREDP*			0.685***	0.599***
			(3.45)	(2.91)
C	–4.437***	–3.910***	–5.473***	–5.125***
	(–3.07)	(–2.48)	(–3.44)	(–3.04)
R^2	0.59	0.58	0.64	0.63
F	24.43	19.47	20.40	17.36

Note: See note to Table 3.

Table 2). This would mean that the results found are in fact due to the level of human development in a country (that is, the hypothesis forwarded by Borensztein *et al.* [*1998*]),[9] rather than due to the level of financial development. To further investigate this issue we estimate a model incorporating *LFDI*, *LFDI*LCREDP*, and *LFDI*LSECENR*. This model is presented in column [4] of both tables. If we concentrate on the results for the model including *LINVGDP* (Table 4), the results of the estimation show that *LFDI*LCREDP* remains significant; however, *LFDI*LSECENR* becomes insignificant. These results can be interpreted as follows.

First, it again confirms the hypothesis that a certain level of financial market development is an important prerequisite for FDI to have a positive effect on economic growth. Second, it suggests that the importance of a certain level of human capital as a prerequisite for the growth effects of FDI (the argument made by Borensztein *et al.* [*1998*]) is at least partly explained by the existence of a well-developed financial sector. Moreover, the fact that the variable *LFDI*LCREDP* remains significant in the models where *LINVGDP* is included suggests that FDI affects economic growth mainly via the level of efficiency.[10]

What do the results of the analysis presented in Tables 3 and 4 imply for the countries in the data set? Based on the results of our empirical analysis we are able to determine the threshold value of *LCREDP* above which *LFDI* starts to have a positive effect on growth. In order to be able to this, we differentiate the model presented in column [3] of both tables with respect to *LFDI*. We get:

$$\Delta(PCGROWTH)/\Delta\, LFDI = -1.587+0.621*LCREDP$$

(model without *LINVGDP*); and

$$\Delta(PCGROWTH)/\Delta\, LFDI = -1.839+0.685*LCREDP$$

(model with *LINVGDP*).

The threshold level of *LCREDP* above which *LFDI* has a positive effect on economic growth can be calculated by setting the first derivative of the above equations equal to zero. The threshold levels then equal: (1.587/0.621) = 2.56 and (1.839/0.685) = 2.68. Since *LCREDP* is the logarithm of credit to the private sector as a percentage of GDP, the results imply that *LFDI* (and hence also *FDI*) will have a positive effect on growth in countries where credit to the private sector as a percentage of GDP is above 12.9 (when *LINVGDP* is excluded from the basic model) and 14.6 (when *LINVGDP* is included). In other words, *CREDP* should be larger than 12 per cent in order for FDI to have a positive effect on growth. In our data set 37 out 67 countries (or 55 per cent) satisfy this threshold value for *CREDP*. Table 5 presents the countries for which the domestic financial

TABLE 5

RELATIONSHIP BETWEEN FDI AND GROWTH AND THE ROLE OF THE LEVEL OF DEVELOPMENT OF THE DOMESTIC FINANCIAL SYSTEM

No positive effect of *LCREDP* on relationship between *LFDI* and *PCGROWTH*
AFRICA: Algeria; Benin; Burkina Faso; Burundi; Cameroon; Cape Verde; Central African Rep.; Chad; Gabon; Gambia; Guinea-Bissau; Cote d'Ivoire; Kenya; Lesotho; Madagascar; Mali; Mauritania; Niger; Nigeria; Rwanda; Senegal; Sierra Leone; Somalia; Sudan; Togo; Zimbabwe
LATIN AMERICA: Guatemala; Haiti
ASIA AND OTHER COUNTRIES: Nepal; Papua New Guinea
Positive effect of *LCREDP* on relationship between *LFDI* and *PCGROWTH*
AFRICA: Egypt; Ghana; Morocco; Swaziland; Tunisia; Zambia
LATIN AMERICA: Barbados; Costa Rica; Dominican Rep.; El Salvador; Honduras; Jamaica; Mexico; Nicaragua; Panama; Trinidad and Tobago; Argentina; Bolivia; Chile; Colombia; Ecuador; Paraguay; Peru; Uruguay; Venezuela
ASIA AND OTHER COUNTRIES: Bangladesh; China; India; Malaysia; Pakistan; Philippines; Sri Lanka; Syria; Thailand; Hungary; Malta; Fiji

system has reached a sufficient level of development, that is, for these countries FDI contributes positively to economic growth. The table shows that for most sub-Saharan African countries it appears to be the case that the level of development of their domestic financial system is insufficient, so that FDI probably will not have a positive impact on their economic growth.

V. FURTHER ANALYSIS OF THE RELATIONSHIP BETWEEN FDI, FINANCIAL DEVELOPMENT AND ECONOMIC GROWTH

The relationship between FDI, financial development and growth may be further investigated in several directions. We will discuss a number of these directions below.[11]

First, we investigate whether the results found in column [3] of Tables 3 and 4 also hold when using alternative indicators of financial development. As was already discussed several variables have been used in the literature to measure financial development. One alternative used extensively is the log of the average money and quasi money to GDP ratio (*LMGDP*).[12] We

use this variable and present the results of the analysis in Table 6, columns [1] and [2] (with and without *INVGDP*). The estimation results first of all show that *LMGDP* is positively and significantly related to growth. Moreover, the interactive term *LFDI*LMGDP* has a positive and significant coefficient, but only when *INVGDP* is included. These results seem to support the view that FDI only has a positive effect on economic growth if the development of the domestic financial system has reached a certain minimum level. More precisely, it suggests that FDI affects economic growth mainly via the level of efficiency.[13]

We also investigate whether the results we find in Tables 3 and 4 are different for specific geographic regions. To analyse this we repeat the regression analysis of column [3] in Tables 3 and 4 and include region dummies for Africa (DUMAFR), Latin America (DUMLA) and Asia and other countries (DUMAS), and present the results in columns [3] and [4] of Table 6. The outcomes of the estimation show that the main results of Tables

TABLE 6

FDI AND ECONOMIC GROWTH: USING ALTERNATIVE MEASURES OF FINANCIAL DEVELOPMENT AND COUNTRY REGION DUMMIES

	[1]	[2]	[3]	[4]
LGDPPC	–0.9014***	–0.929***	–0.979***	–0.999***
	(–4.05)	(–4.98)	(–3.46)	(–5.52)
LSECENR	0.610***	0.676***	0.522*	0.424*
	(3.32)	(4.32)	(1.98)	(1.84)
LINVGDP		2.236***		2.587***
		(4.45)		(5.36)
LCREDP			1.648***	1.053***
			(4.79)	(3.17)
LMGDP	2.409***	1.615***		
	(5.75)	(3.72)		
LFDI	–0.721	–1.532*	–1.236***	–1.583***
	(–0.80)	(–1.74)	(–2.27)	(–2.90)
*LFDI*LMGDP*	0.277	0.498*		
	(1.04)	(1.94)		
*LFDI*LCREDP*			0.503***	0.596***
			(2.75)	(3.35)
C	–2.738*	–6.957***	2.046	–3.611**
	(–1.76)	(–3.93)	(1.05)	(–2.15)
DUMAFR			–1.463	–1.631
			(–1.38)	(–1.59)
DUMLA			–1.470	–1.159
			(–1.54)	(–1.22)
DUMAS			–0.491	–0.689
			(–0.45)	(–0.66)
R^2	0.55	0.64	0.52	0.65
F	17.30	20.39	10.07	14.80

Note: See note to Table 3.

3 and 4 remain unchanged. At the same time, none of the region dummies appears to have statistically significant coefficient. These results suggest that the findings as presented in column [3] of Tables 3 and 4 are not different for specific country regions.

Finally, we analyse whether our results remain the same when we average the variables over five-year periods, instead of over 25 years as we did in the analyses presented in column [3] of Tables 3 and 4. For this analysis we create a panel data set of four five-year periods (1975–79, 1980–84, 1985–89 and 1990–95). Because of missing data for some of the variables, we do the estimations with an unbalanced panel data set. We use three different estimation techniques: estimations with a common constant, with fixed effects and with random effects. The results of the estimations are shown in Table 7. The results in columns [1] and [4] refer to the estimations with a common constant; columns [2] and [5] refer the estimations with fixed effects; and columns [3] and [6] show the outcomes for the estimations with random effects.

In general, the results we find using the panel data set are similar to our results shown previously. This is especially true for estimations with a common constant and with random effects. The estimations with fixed effects are less satisfactory, since some of the control variables appear not to be significant; yet, even these estimations show a statistically significant positive relation between *LFDI*LCREDP* and growth. Thus, also when we use a panel data set, the analysis appears to confirm the central hypothesis of this article on the relationship between FDI, financial development and growth.[14]

VI. FURTHER STABILITY ANALYSIS

In this section we further investigate the robustness of the results, by conducting a stability analysis in line with Sala-i-Martin [*1997a, 1997b*]. This stability analysis tests whether the coefficients for *LFDI* and the interactive term *LFDI*LCREDP* remain robust after adding a vector *Z* of a limited number of control variables to the models presented in Tables 3 and 4. We define a group of 14 variables from which the additional control variables are taken. These variables are shown to be important for explaining economic growth in several other studies. Since we aim at using a fully balanced data set in our analysis, other possibly relevant variables were not taken into account due to lack of observations.

The additional variables we take into account in our analysis are *AIDGDP* (development aid as a percentage of GDP), *BANKL* (bank and trade related lending as a percentage of GDP), *BMP* (black market premium), *CIVLIB* (index of civil liberties), *DEBTGDP* (the external debt

TABLE 7

FDI AND ECONOMIC GROWTH: PANEL DATA ESTIMATIONS

	[1]	[2]	[3]	[4]	[5]	[6]
LGDPPC	–0.828**	–8.877***	–0.909**	–1.007***	–9.600***	–1.135***
	(–2.50)	(–7.44)	(–2.34)	(–3.20)	(–8.23)	(–3.11)
LSECENR	1.028***	–0.771	0.779*	0.919***	–0.280	0.840**
	(2.84)	(–1.39)	(1.90)	(2.71)	(–0.54)	(2.19)
LINVGDP				2.275***	1.676*	2.262***
				(3.85)	(1.79)	(3.93)
LCREDP	1.581***	0.656*	1.146***	1.253***	0.605	0.935**
	(4.68)	(1.67)	(2.84)	(3.71)	(1.46)	(2.37)
LFDI	–1.443***	0.0419	–0.745	–1.112**	0.018	–0.597
	(–3.09)	(0.069)	(–1.23)	(–2.37)	(0.03)	(–1.02)
*LFDI*LCREDP*	0.566***	0.333*	0.399**	0.450***	0.342*	0.325*
	(3.47)	(1.67)	(1.99)	(2.77)	(1.65)	(1.67)
C	–1.696		1.195	–5.924***		–3.637
	(–0.99)		(0.55)	(–2.77)		(–1.60)
N	226	226	226	224	224	224
R^2	0.14	0.47	0.39	0.21	0.49	0.33
F	8.51	66.43		11.04	55.79	

Note: Dependent variable: *PCGROWTH.* Values in parentheses are White heteroskedastic adjusted t-values. * denotes significance at the ten per cent level; ** denotes significance at the five per cent level; *** denotes significance at the one per cent level. The results in columns [1] and [4] refer to the estimations with a common constant; columns [2] and [5] refer the estimations with fixed effects; and columns [3] and [6] show the outcomes for the estimations with random effects. N is the number of observations. R^2 is the adjusted R^2. In case of the estimations with random effects R^2 refers to unweighted statistics including random effects. F is the F-statistic. For the estimations with random effects the F-statistic is not given.

to GDP ratio), *DEBTS* (total external debt service as a percentage of GDP), *EINFL* (uncertainty with respect to inflation), *EGOVC* (uncertainty with respect to government expenditures), *EXPGDP* (exports of goods and services as a percentage of GDP), *GOVCGDP* (government consumption as a percentage of GDP), *INFL* (the annual inflation rate), *PRIGHTS* (index of political rights), *STDINFL* (the standard deviation of the annual inflation rate), and *TRADE* (exports plus imports to GDP).[15] In all estimates discussed below, these variables have been transformed into logarithmic form.

The stability test starts by determining all possible combinations of a limited number of the above-presented set of 14 variables. We have chosen to perform the stability test by adding combinations of three, respectively four control variables to the models discussed above. Next, we carry out regression analysis including all variables presented in column [3] from Table 3, respectively Table 4, as well as all possible combinations of three (respectively four) control variables. This means that in case of three additional variables we estimate 14!/(11! 3!) = 364 different specifications

of the model presented in column [3] of Tables 3 and 4 (that is, with and without *LINVGDP*). In case we use four additional variables the amount of different specifications equals 14!/(10!4!) = 1,001.

After having estimated all different equation specifications, the next step of the stability test is to look at the distribution of the coefficients of the individual equations, and calculate the fraction of the cumulative distribution function lying on each side of zero. By assuming that the distribution of the estimates of the coefficients is normal and calculating the mean and the standard deviation of this distribution, the cumulative distribution function (*CDF*) can be computed.

More precisely, if β_j is the coefficient for a variable in the specification j of the estimated model and σ_j is the standard error of the coefficient β_j, we proxy the mean and the standard deviation of the distribution by:

$$\overline{\beta} = \frac{\Sigma \beta_j}{n}$$

$$\overline{\sigma} = \frac{\Sigma \sigma_j}{n} \quad .$$

The number of estimated equations is 364 (in case we add combinations of three *Z* variables), respectively 1,001 (when we add combinations of four *Z* variables). In Table 8 the mean estimate is presented in the column entitled *COEF* and the mean standard deviation is given in the column entitled *STERR*.

Next, we calculate the fraction of the cumulative distribution function lying on the right or left-hand side of zero, using a table for the (cumulative) normal distribution. The test statistic we use is defined as the mean over the standard deviation of the distribution. The column entitled *CDF* in Table 8 denotes the larger of the two areas. Finally, as an additional stability test, the last column of the table presents the percentage of all regressions for which the variable of interest (that is, *LFDI* or *LFDI*LCREDP*) is significant at the 95 per cent level.

The results presented in Table 8 show that the coefficients for *LFDI* and the interactive term *LFDI*LCREDP* are very robust. In the models including *LINVGDP* as an additional *I* variable t-values for *LFDI* and *LFDI*LCREDP* are significant at the 95 per cent level in all cases. These results strongly suggest that FDI enhances economic growth only if domestic financial markets are well-developed, thus supporting the main hypothesis investigated in this article.

TABLE 8
STABILITY TEST

	NUMBER	R^2	*COEF*	*STERR*	*CDF*	*PERC*
Without *LINVGDP* in the base model						
LFDI	364	0.57	–1.348	0.544	0.993	1.000
*LFDI*LCREDP*	364	0.57	0.534	0.194	0.997	0.997
LFDI	1,001	0.58	–1.310	0.535	0.993	0.921
*LFDI*LCREDP*	1,001	0.58	0.519	0.192	0.997	0.983
With *LINVGDP* in the base model						
LFDI	364	0.72	–1.620	0.505	1.000	1.000
*LFDI*LCREDP*	364	0.72	0.615	0.173	1.000	1.000
LFDI	1,001	0.73	–1.528	0.500	1.000	1.000
*LFDI*LCREDP*	1,001	0.73	0.603	0.172	1.000	1.000

Note: *NUMBER* denotes the number of equations tested. R^2 is the adjusted R^2. *CDF* is the cumulative distribution function. *COEF* is the mean estimate of the coefficient of the variable of interest (*i.e. LFDI* or *LFDI*LCREDP*). *STERR* is the mean standard deviation of the variable of interest. *PERC* is the percentage of all regressions for which the variable of interest is significant at the 95 per cent level.

VII. CONCLUSIONS

FDI may help to raise economic growth in recipient countries. Yet, the contribution FDI can make may strongly depend on the circumstances in the recipient countries. Few empirical studies have investigated the relationship between FDI and economic growth and the role played by the circumstances FDI is confronted with whenever it enters a recipient country. These studies focused on the role of human capital available in and the export-orientedness of the recipient country. The original contribution this article makes is that it argues that the development of the financial system of the recipient country is an important precondition for FDI to have a positive impact on economic growth. A more developed financial system positively contributes to the process of technological diffusion associated with FDI.

The article empirically investigates the role the development of the financial system plays in enhancing the positive relationship between FDI and economic growth. The empirical investigation presented in the article strongly suggests that this is the case. Of the 67 countries in data set, 37 have a sufficiently developed financial system in order to let FDI contribute positively to economic growth. Most of these countries are in Latin America and Asia. Almost all other countries in our data set are in sub-Saharan Africa. These countries have very weak financial systems and consequently FDI does not contribute positively to growth.

The results of the empirical investigation in this article provide a number of policy-relevant conclusions. First, the results contradict the widely

accepted view that an increase in FDI may important to enhance economic growth of LDCs. This is only true after these countries have improved their domestic financial systems. Second, the analysis in this article may contribute to the discussion on the order of economic liberalisation in LDCs. The outcomes of the empirical investigation suggest that these countries should first reform their domestic financial system before liberalising the capital account to allow for enlarged FDI inflows.

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NOTES

1. Exceptions are Balasubramanyam *et al.* [*1996*], Borensztein *et al.* [*1998*] and Lichtenberg and van Pottelsberghe de la Potterie [*1998*].
2. For an overview of the literature on the relationship between FDI and economic growth, see De Mello [*1997*] and World Bank [*2001*].
3. Görg and Strobl [*2001*] suggest that the econometric methodology used also has an important impact on the results found. In particular, they report that studies using cross-section data may overstate the spillover effects of FDI, since these studies do not take into account other time-invariant or firm-specific effects. Yet, these effects may have an impact on the spillover effects of FDI on productivity.
4. This model is based on Chapters 6 and 7 in Barro and Sala-i-Martin [*1995*].
5. See Levine [*1997*] or Berthelémy and Varoudakis [*1996*] for good surveys on the role of the domestic financial system and its relationship to economic growth.
6. The list of *Z* variables used in this study will be discussed in the next section. See also Appendix I.
7. Below, we will also discuss the results of an analysis in which we have used the log of the average money and quasi money to GDP ratio *(LMGDP)*.
8. Borensztein *et al.* [*1998*] also find a statistically significant negative relationship between the linear term of FDI and GDP per capita growth. Lensink and Morrissey [*2001*] find a positive relationship between both variables, but they use a data set for developed and less developed countries. When we redo their analysis by using only data for LDCs, we find that there is no statistically significant relationship between FDI and growth (see also our results in column [2] of Tables 3 and 4).
9. Lensink and Morrissey [*2001*] show that the results presented by Borensztein *et al.* [*1998*] are not statistically robust.
10. We have also explored the relationship between *LFDI* and *LFDI* interacted with a financial development variable as exogenous variables and total investment as a share of GDP as the endogenous variable. In line with Borensztein *et al.* [*1998*] it appears that *LFDI* and *LFDI* interacted with financial market development do not have a robust effect on investment levels. This confirms that FDI mainly affects growth via the level of efficiency.
11. Two anonymous referees suggested us to investigate the relationship between FDI, financial development and growth in the directions discussed below. We thank them for these suggestions.
12. See, for example, the seminal studies by King and Levine on the relationship between financial development and economic growth [*King and Levine, 1993a, 1993b*]. For an overview of the (empirical) literature on financial development, see Levine [*1997*].
13. We acknowledge that there are more variables to measure financial development. In particular, the two variables we have used here (*LCREDP* and *LMGDP*) focus only on the banking sector. Ideally, we would have liked to also use variables that focus on other financial markets, for example, stock market variables. Yet, using such variables would have led to a substantial reduction of the number of countries in our data set due to lack of long-term time series data.

14. We also investigated whether the relationship between FDI and financial development is non-linear. In particular, we included two new interactive terms *LFDI*LCREDP*^{2} and *LFDI*LCREDP*^{3} separately into the regression models presented in column [3] of Tables 3 and 4 (that is, with and without including *LINVGDP*). The results from this analysis suggest that, using a specification in which the linear interactive term is also included, none of the interactive terms have statistically significant coefficients. The results of this analysis are available upon request from the authors.
15. See Appendix I for the exact specification and data sources of these variables.

REFERENCES

Aitken, B.J. and A.E. Harrison, 1999, 'Do Domestic Firms Benefit from Direct Foreign Investment? Evidence from Venezuela', *American Economic Review*, Vol.89, No.3, pp.605–18.

Balasubramanyam, V.N., Salisu, M. and D. Sapsford, 1996, 'Foreign Direct Investment and Growth in EP and IS Countries', *The Economic Journal*, Vol.106, No.1, pp.92–105.

Barro, R.J., 1991, 'Economic Growth in a Cross-Section of Countries', *Quarterly Journal of Economics*, Vol.106, No.2, pp.407–43.

Barro, R.J. and J.W. Lee 1994, *Data Set for a Panel of 138 Countries*, Cambridge, MA: NBER.

Barro, R.J. and X. Sala-I-Martin, 1995, *Economic Growth*, Cambridge, MA: McGraw-Hill.

Berthelemy, J.C. and A. Varoudakis, 1996, 'Models of Financial Development and Growth: A Survey of Recent Literature', in N. Hermes and R. Lensink (eds.), *Financial Development and Economic Growth: Theory and Experiences from Developing Countries*, London: Routledge, pp.7–34.

Bhagwati, J.N., 1978, 'Anatomy and Consequences of Exchange Rate Regimes', *Studies in International Economic Relations*, 10, New York: NBER.

Blomström, M. and H. Persson 1983, 'Foreign Investment and Spillover Efficiency in an Underdeveloped Economy: Evidence from the Mexican Manufacturing Industry', *World Development*, Vol.11, No.6, pp.493–501.

Blomström, M. and E.N. Wolff, 1994, 'Multinational Corporations and Productivity Convergence in Mexico', in W. Baumol, R. Nelson and E.N. Wolff (eds.), *Convergence of Productivity: Cross-National Studies and Historical Evidence*, Oxford: Oxford University Press.

Bo, H., 1999, 'Empirics of the Investment-Uncertainty Relationship', unpublished manuscript, Groningen: University of Groningen.

Borensztein, E., De Gregorio, J. and J.W. Lee, 1998, 'How Does Foreign Direct Investment Affect Economic Growth?' *Journal of International Economics*, Vol.45, No.1, pp.115–35.

De Mello, Jr., L.R., 1997, 'Foreign Direct Investment in Developing Countries and Growth: A Selective Survey', *The Journal of Development Studies*, Vol.34, No.1, pp.1–34.

Demirgüç-Kunt, A. and R. Levine, 1996, 'Stock Market Development and Financial Intermediaries: Stylized Facts', *The World Bank Economic Review*, Vol.10, No.2, pp.291–321.

Findlay, R., 1978, 'Relative Backwardness, Direct Foreign Investment and the Transfer of Technology: A Simple Dynamic Model', *Quarterly Journal of Economics*, Vol.92, No.1, pp.1–16.

Görg, H. and E., Strobl 2001, 'Multinational Companies and Productivity Spillovers: A Meta-Analysis', *The Economic Journal*, Vol.111, No.475, pp.F723–39.

Greenwood, J. and B. Jovanovic, 1990, 'Financial Development, Growth, and the Distribution of Income', *Journal of Political Economy*, Vol.98, No.5, pp.1076–107.

Grossman, G.M. and E. Helpman, 1991, *Innovation and Growth in the Global Economy*, Cambridge, MA: MIT Press.

Haddad, M. and A. Harrison, 1993, 'Are There Positive Spillovers from Direct Foreign Investment? Evidence from Panel Data for Morocco', *Journal of Development Economics*, Vol.42, No.1, pp.51–74.

Huang, H. and C. Xu, 1999, 'Institutions, Innovations and Growth', *American Economic Review*, Vol.89, No.2, pp.438–43.

King, R.G. and R. Levine, 1993a, 'Finance and Growth: Schumpeter Might be Right', *Quarterly Journal of Economics*, Vol.108, No.3, pp.717–37.

King, R.G. and R. Levine, 1993b, 'Finance, Entrepreneurship, and Growth: Theory and Evidence', *Journal of Monetary Economics*, Vol.32, No.3, pp.513–42.

Kinoshita, Y., 1998, 'Technology Spillovers Through Foreign Direct Investment', unpublished working paper, Prague: CERGE-EI.

Kokko, A., 1994, 'Technology, Market Characteristics, and Spillovers', *Journal of Development Economics*, Vol.43, No.2, pp.279–93.

Kokko, A., Tansini, R. and M.C. Zejan, 1996, 'Local Technological Capability and Productivity Spillovers from FDI in the Uruguayan Manufacturing Sector', *The Journal of Development Studies*, Vol.32, No.4, pp.602–11.

Lensink, R. and O. Morrissey, 2001, 'Foreign Direct Investment: Flows, Volatility and Growth in Developing Countries', SOM research report 01E16, Groningen: SOM Research School, University of Groningen.

Levine, R., 1997, 'Financial Development and Economic Growth: Views and Agenda', *Journal of Economic Literature*, Vol.35, No.2, pp.688–726.

Levine, R., 1991, 'Stock Markets, Growth, and Tax Policy', *Journal of Finance*, Vol.46, No.4, pp.1445–65.

Levine, R. and D. Renelt 1992, 'A Sensitivity Analysis of Cross-Country Growth Regressions', *American Economic Review*, Vol.82, No.4, pp.942–63.

Lichtenberg, F.R. and B. van Pottelsberghe de la Potterie, 1998, 'International R&D Spillovers', *European Economic Review*, Vol.42, No.8, pp.1483–91.

Ozawa, T., 1992, 'Cross-Investments between Japan and the EC: Income Similarity, Technological Congruity and Economies of Scope', in J. Cantwell (ed.), *Multinational Investment in Modern Europe: Strategic Interaction in the Integrated Community*, Aldershot: Edward Elgar, pp.13–45.

Saint-Paul, G., 1992, 'Technological Choice, Financial Markets and Economic Development', *European Economic Review*, Vol.36, No.4, pp.763–81.

Sala-i-Martin, X., 1997a, 'I Just Ran Two Million Regressions', *American Economic Review*, Vol.87, No.2, pp.178–83.

Sala-i-Martin, X., 1997b, 'I Just Ran Four Million Regressions', unpublished manuscript, Colombia University and Universitat Pompeu Fabra.

Sjöholm, F., 1999a, 'Productivity Growth in Indonesia: The Role of Regional Characteristics and Direct Foreign Investment', *Economic Development and Cultural Change*, Vol.47, No.3, pp.559–84.

Sjöholm, F., 1999b, 'Technology Gap, Competition and Spillovers from Direct Foreign Investment: Evidence from Establishment Data', *The Journal of Development Studies*, Vol.36, No.1, pp.53–73.

Smarzynska, B.K., 1999, 'Composition of Foreign Direct Investment and Protection of Intellectual Property Rights in Transition Economies', unpublished working paper, New Haven, CT: Yale University.

World Bank, 1997, *World Development Indicators 1997*, Washington, DC: World Bank.

World Bank, 2001, *Global Development Finance 2001*, Washington, DC: World Bank.

APPENDIX I

LIST OF VARIABLES USED IN THE ANALYSIS

AIDGDP = development aid as a percentage of GDP
BANKL = bank and trade related lending as a percentage of GDP
BMP = black market premium, calculated as (black market rate/official rate)-1
CIVLIB = index of civil liberties
CREDP = credit to the private sector as a percentage of GDP
DEBTGDP = the external debt to GDP ratio
DEBTS = total external debt service as a percentage of GDP
DUMAFR = dummy for African countries
DUMAS = dummy for Asian (and other) countries
DUMLA = dummy for Latin American countries
EINFL = uncertainty with respect to inflation
EGOVC = uncertainty with respect to government expenditures
EXPGDP = exports of goods and services as a percentage of GDP
FDI = foreign direct investment as a percentage of GDP
GDPPC = GDP per capita in 1970
GOVCGDP = government consumption as a percentage of GDP
INFL = the annual inflation rate
INVGDP = average investment to GDP ratio over 1970–95 period
MGDP = average money and quasi money to GDP ratio over the 1970–95 period
PCGROWTH = average real per capita growth rate over 1970–95 period.
PRIGHTS = index of political rights
SECENR = secondary school enrolment rate in 1970
STDINFL = the standard deviation of the annual inflation rate, calculated from the inflation figures
TRADE = exports plus imports to GDP; measure of the degree of openness

The source for all variables is World Bank [*1997*], which is available on CD-ROM, except for *BMP, CIVLIB* and *PRIGHTS*. These variables are obtained from the data set created by Barro and Lee [*1994*]. Moreover, *EINFL* and *EXPGDP* have been calculated by the authors (see below). The variables from Barro and Lee [*1994*] refer to averages for the 1970–90 period. Unless otherwise stated, all other variables refer to averages over 1970–95 period. For all variables logarithmic transformations are used.

We need to explain how the uncertainty variables *EINFL* and *EGOVC* have been constructed. Both variables are constructed by using the standard deviation of the unpredictable part of *INFL* and *GOVC*; see Bo [*1999*] for a survey of different methods to measure uncertainty. We first specify and estimate a forecasting equation to determine the expected part of *INFL* and *GOVC*. The standard deviation of the unexpected part of *INFL* and *GOVC* (that is, the residuals from the forecasting equation) is used as a measure of uncertainty. We have used a second-order autoregressive process, extended with a time trend, as the forecasting equation:

$$P_t = a_1 + a_2T + a_3FDI_{t-1} + a_4FDI_{t-2} + e_t,$$

where P_t is the variable under consideration, T is a time trend, a_1 is an intercept, a_3 and a_4 are the autoregressive parameters and e_t is an error term. We estimate the above equation for all countries in the data set. By calculating the standard deviation of the residuals for the entire sample period for each individual country, we obtain the variables *EINFL* and *EGOVC*.

APPENDIX II

COUNTRIES IN THE DATA SET

Africa:

Algeria, Benin; Burkina Faso; Burundi; Cameroon; Cape Verde; Central African Rep.; Chad; Egypt; Gabon; Gambia; Ghana; Guinea-Bissau; Côte d'Ivoire; Kenya; Lesotho; Madagascar; Mali; Mauritania; Morocco; Niger; Nigeria; Rwanda; Senegal; Sierra Leone; Somalia; Sudan; Swaziland; Togo; Tunisia; Zambia; Zimbabwe.

Latin America:

Barbados; Costa Rica; Dominican Rep.; El Salvador; Guatemala; Haiti; Honduras; Jamaica; Mexico; Nicaragua; Panama; Trinidad and Tobago; Argentina; Bolivia; Chile; Colombia; Ecuador; Paraguay; Peru; Uruguay; Venezuela.

Asia and others

Bangladesh; China; India; Malaysia; Nepal; Pakistan; Philippines; Sri Lanka; Syria; Thailand; Hungary; Malta; Fiji; and Papua New Guinea.