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Foreign Direct Investment and Economic Growth in Developing Countries:
How Relevant Are Host-country and Industry Characteristics?

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Abstract:

Conclusive evidence supporting the widely held view that developing countries should draw on foreign direct investment (FDI) to spur economic development is surprisingly hard to come by. We raise the proposition that results on the growth impact of FDI are ambiguous because highly aggregated FDI data, used in virtually all previous empirical studies, blur the differences between resource-seeking, market-seeking and efficiency-seeking FDI and ignore the compatibility of different types of FDI with economic conditions prevailing in the host country. Analysing US FDI stocks in major sectors and specific manufacturing industries in a large number of developing countries, we show that positive growth effects of FDI are anything but guaranteed. Rather, host-country and industry characteristics as well as the interplay between both sets of characteristics have an important say on the growth impact of FDI in developing countries.

Keywords: foreign direct investment stocks, resource-seeking, market-seeking and efficiency-seeking FDI, host-country characteristics, industry characteristics, economic growth effects

JEL classification: F21

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I. INTRODUCTION

Developing countries have strongly been recommended by international organizations and other external advisors to rely primarily on foreign direct investment (FDI) as a source of external finance. It is argued that FDI is superior to other types of capital inflows in stimulating economic growth for several reasons. In particular, FDI is supposed to be less volatile, and to offer not just capital but also access to modern technology and know-how.

However, empirical evidence supporting this policy advice is surprisingly hard to come by. Some studies do find a positive relationship between FDI inflows and economic growth in the host countries. Yet, the link between FDI inflows and growth is far from firmly established once endogeneity problems and the heterogeneity of host countries are taken into account. Moreover, if FDI stocks are considered instead of FDI inflows, previous studies typically fail to establish positive growth effects. Accordingly, Caves (1996: 237) reckons that "the relationship between a LDC's stock of foreign investment and its subsequent economic growth is a matter on which we totally lack trustworthy conclusions."

The major question we address in this paper is whether results on the growth impact of FDI are ambiguous because previous studies do not differentiate between different types of FDI and their suitability under different host-country conditions. Typically, the sectoral composition of FDI is ignored in the

empirical literature, even though the growth impact of FDI is likely to depend on industry characteristics.

We start by shortly surveying the relevant literature and discussing why host-country and industry characteristics may matter for the growth impact of FDI (Section II). Subsequently, we describe our empirical approach and the data used (Section III). The empirical analysis in Section IV is based on US FDI stocks in a large number of developing host countries and proceeds in several steps. After presenting some base-line regression results on the relationship between FDI and economic growth, we discuss in detail the relevance of host-country and industry characteristics. Finally, we combine both sets of characteristics in order to assess their interplay in shaping the growth impact of FDI. Section V summarizes and offers some conclusions.

II. WHERE DO WE STAND?

The standard procedure to test the impact of FDI on economic growth in developing countries is to run cross-country regressions in which the lagged growth rate of GDP per capita is related to the FDI-to-GDP ratio. The results of such empirical studies are mixed and depend on the explanatory FDI variable used. The estimated coefficients for the impact of FDI on economic growth range from significantly positive in the case of FDI flows (Ram and Zhang 2002), over insignificant if only the exogenous component of FDI flows is used

(Carkovic and Levine 2002), to significantly negative in the case of FDI stocks (Dutt 1997).

A growing strand of the literature attributes the lack of robust results to that the growth impact of FDI may depend on the characteristics of the developing country in which FDI takes place. It is argued that the host countries' capacity to absorb FDI productively is linked to their GDP per capita. Host countries with a better endowment of human capital are supposed to benefit more from FDI-induced technology transfers as spillovers from foreign affiliates to local enterprises are more likely. Openness to trade is considered important as foreign direct investors are said to increasingly pursue complex integration strategies which require the unrestricted import of intermediate goods at all stages of the production process (UNCTAD 1998: 111–116). The extent to which multinational enterprises transfer modern technology and know-how to their foreign affiliates may to depend on the host countries' institutional development, which captures factors such as the rule of law, the degree of corruption, the quality of public management, and the protection against property rights infringements and discretionary government interference.

And indeed, the empirical picture seems to become clearer once host-country characteristics are taken into account. Blomström et al. (1994) find that the positive impact of FDI on economic growth is confined to higher-income developing countries. According to De Mello (1997), the larger the

technological gap between the host and the home country of FDI, the smaller is the impact of FDI on economic growth. Borensztein et al. (1998) find that FDI enhances growth only in countries with a sufficiently qualified labor force.[1] Balasubramanyam et al. (1996) stress that openness to trade is essential for reaping positive growth effects of FDI. Regression analysis by Alfaro et al. (2001) suggests that FDI is associated with faster growth only in host countries with comparatively well developed financial markets.

In one way or another, these studies corroborate the hypothesis that developing countries must offer a supportive business environment and must have reached a minimum level of economic development before they can capture the growth-enhancing effects of FDI (OECD 2002:28). However, as all these results are based on FDI flows which are not corrected for potential endogeneity biases (i.e., higher economic growth causing higher FDI flows), the finding that host-country characteristics matter for the growth effects of FDI may also be sensitive to the choice of the explanatory FDI variable. As a matter of fact, Carkovic and Levine (2002) find that the exogenous component of FDI flows does not exert a significant independent influence on the growth rate of GDP per capita even if non-linearities caused by host-country characteristics are considered. To our knowledge, comparable empirical studies using FDI stocks as explanatory variable do not exist.

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1 This evidence is contested by a recent study of Ram and Zhang (2002).

Against this backdrop, it seems that the favorable perception of FDI among policymakers in developing countries and external advisors may easily be exaggerated. However, before coming to such a verdict, one should address another important shortcoming of almost all previous cross-country studies, namely the use of overall inward FDI positions as explanatory variable. As we argue in the following, such highly aggregated data cannot capture important aspects of the relationship between FDI and economic growth. This is why we differentiate between major sectors as well as between specific manufacturing industries in which FDI takes place.

Industry characteristics such as the technology intensity, factor requirements, linkages to local and foreign markets, and the degree of vertical integration of the foreign affiliates are likely to shape the growth impact of FDI in various ways. Industry characteristics may influence (a) the extent to which FDI supplements ("crowds in") or displaces ("crowds out") local investment, (b) the amount of technology and know-how transferred from parent companies to foreign affiliates, (c) the compatibility of technology transfers to the host countries' factor endowment and, hence, the degree to which local suppliers, competitors, and buyers can benefit through spillovers, (d) the amount of foreign exchange earnings generated through FDI-induced exports or lost through the repatriation of funds, (e) the extent to which foreign affiliates foster competition in the host countries by breaking up oligopolistic market structures, or stifle

competition through their market power, and (f) the degree to which the locational competition for FDI increases or decreases distortions in the host countries' economic policies.

These factors are closely linked to the different motives for FDI in developing countries. For instance, resource-seeking FDI in the primary sector tends to involve a large up-front transfer of capital, technology and know-how, and to generate high foreign exchange earnings. On the other hand, resource-seeking FDI is often concentrated in foreign-dominated enclaves with few linkages to the local product and labor markets. Furthermore, its macroeconomic benefits can easily be embezzled or squandered by corrupt local elites. Rather than enhancing economic growth, resource-seeking FDI in the primary sector might lead the country into some form of "Dutch Disease".

By contrast, efficiency-seeking FDI in some parts of manufacturing draws on the relative factor endowment and the local assets of host countries (UNCTAD 1998: Chapter IV). This type of FDI is more likely to bring in technology and know-how which is compatible to the host countries' level of development, and enables local suppliers and competitors to benefit from spillovers through adaptation and imitation. Additionally, the world-market orientation of efficiency-seeking FDI should generate foreign exchange earnings for the host countries. As a result, one would expect a relatively strong growth impact of

FDI in industries that attract efficiency-seeking FDI.

Market-seeking FDI in services and other parts of manufacturing can benefit host countries' consumers by introducing new products and services, by modernizing local production and marketing, and by increasing the level of competition in the host countries. However, fiercer competition may also lead to crowding out of local competitors, especially if foreign direct investors command over superior market power. Moreover, in the long run, the host countries' balances of payments are likely to deteriorate through the repatriation of funds since market-seeking FDI often does not generate export revenues, especially if the protection of local markets discriminates against exports. Hence, the growth impact of this type of FDI should be weaker than the growth impact of efficiency-seeking FDI.

Finally, it has been argued that the growth effects of FDI depend on the interplay between industry and host-country characteristics. Two opposing hypotheses are advanced in the literature. Building upon a standard Heckscher-Ohlin model structure and augmenting it by international technology flows, Kojima (1973) reckons that FDI in developing countries will be more growth-enhancing if it is undertaken in more labor intensive and less technology intensive industries. In these industries, the technological differences between the affiliates of foreign direct investors in developing countries and the local enterprises are considered relatively small. Therefore, technological spillovers to

local enterprises should be more likely.[2] By contrast, Dutt (1997) develops a Keynesian model with international transfers of capital and technology (but without local technological spillovers), from which he concludes that the impact of FDI on economic growth in developing countries should be greater if the inflow of FDI goes into technologically advanced industries. The rationale behind this proposition is that an increase in the capital stock in technologically less advanced industries lowers the export prices in developing host countries and, thus, leads to a deterioration of their terms of trade.

A first attempt to discriminate empirically between the two hypotheses was undertaken by Dutt (1997). In contrast to both models, he finds no difference in the growth impact of FDI between high-technology and low-technology industries. However, Dutt's empirical analysis is flawed in three respects. First, Dutt does not distinguish between resource-seeking FDI in the primary sector and FDI in manufacturing. In addition to six manufacturing industries, his high-technology group includes "coal and petroleum products". Second, Dutt's industry classification ignores that, irrespective of the technology intensity, the growth impact of FDI in manufacturing should differ depending on whether FDI is efficiency-seeking or market-seeking. Third, the classification of "metals" as a

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2 This proposition is consistent with the above cited empirical evidence of De Mello (1997).

high-technology industry is in conflict with the industry characteristics we portray below.

III. DATA AND APPROACH

A cross-country analysis of the role of industry characteristics and their interplay with host-country characteristics in shaping the growth impact of FDI requires sectorally disaggregated FDI data for a large number of host countries. For US foreign direct investors, such data are provided in the BEA (2003) online data base. Comparable data are not available for other foreign direct investors. Hence, we use the US outward FDI position in a host country as a proxy for its total inward FDI position. We prefer FDI stocks over FDI flows because they are available for a larger number of developing host countries and are less affected by potential endogeneity biases. The BEA (2003) online data base also offers information on the FDI-related economic activities of US foreign affiliates, which can be used to characterize the latter according to their technology intensity, factor requirements, linkages to local and foreign markets, and their degree of vertical integration with the parent company. Additionally, we use World Bank (2002) data on gross fixed capital formation, secondary school enrollment, and GDP per capita, as well as the Kaufmann et al. (2002)

index on institutional development and the Sachs and Warner (1995) index on openness to trade.[3]

The empirical analysis is carried out in several steps. We start by running standard regressions of lagged average annual growth rates of GDP per capita in the 1990s on the FDI-to-GDP ratio in 1990, calculated on the basis of total FDI stocks and FDI stocks in the manufacturing sector, respectively. As controlling variables, we use average gross fixed capital formation in the 1990s, log GDP per capita in 1990, and secondary school enrollment in 1990, as well as three regional dummies for Latin America & Caribbean, Africa & Middle East, and Asia. To check whether the growth impact of FDI differs between these regions, we also run modified regressions in which the FDI stocks are interacted with the regional dummies.

We then turn to the role of host-country characteristics in shaping the growth impact of FDI. To this end, we classify the host countries of US FDI into two groups with favorable and unfavorable characteristics[4] according to four alternative indicators: their GDP per capita in 1990, secondary school enrollment in 1990, the Kaufmann et al. (2002) index on institutional development, and the Sachs and Warner (1995) index on openness to trade in

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3 The definitions and data sources of the variables are given in the Appendix.

4 We restrict ourselves to two subgroups to maintain a sufficient high number of observations in each subgroup.

1990. Within each group, we differentiate further between host countries with low and high US FDI stocks. Based on this classification, we calculate the median lagged growth rates of GDP per capita for each subgroup, and explore the links between FDI and economic growth. In order to get first clues on whether the results differ between resource-seeking, efficiency-seeking and market-seeking FDI, we redo the analysis for US FDI stocks in petroleum, manufacturing, and services.[5]

We proceed by disaggregating the manufacturing sector into seven industries: food, chemicals, metals, machinery, electrical equipment, transport equipment, and others, for which the BEA (2003) online data base reports separate data. The manufacturing industries are characterized according to six indicators: (a) labor intensity, as given by the number of employees of US affiliates per million US$ of value added, (b) human capital intensity, measured by the compensation in 1000 US$ per person employed by US foreign affiliates, (c) R&D intensity, which indicates the R&D expenditures of US foreign affiliates in percent of value added, (d) amount of technology transfers, as given by the royalties and

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5 We use petroleum as a proxy for all primary-sector industries which receive resource-seeking FDI. This is because other primary-sector industries cannot be singled out from the BEA (2003) data base. Similar to the primary sector, BEA (2003) data do not allow for full coverage of the services sector. Some items (e.g., transportation and communication) are included in "other industries". Moreover, real estate and holding companies are subsumed under "finance". Hence, we consider the sum of the following three items to represent the services sector: "wholesale trade", "depository institutions", and "services". The latter includes, inter alia, business services, hotels, health services, motion pictures, and engineering, architectural and surveying services.

license fees paid by US foreign affiliates to their parent companies in percent of value added, (e) the export orientation, measured by total exports of US affiliates in percent of total sales, and (f) the degree of vertical integration, which reflects the sum of exports of US affiliates to, and imports of US affiliates from their parent companies in percent of sales of the affiliates. For each manufacturing industry, we then classify the observations in groups with low and high FDI-to-GDP ratios. The group-specific median growth rates of GDP per capita are then used to analyze whether the growth impact of FDI differs between manufacturing industries and how it is related to the above mentioned industry characteristics.

In the final step of the analysis, we analyze the interplay between industry and host-country characteristics. To this end, we repeat our analysis of the role of host-country characteritics in shaping the growth impact of FDI for food, chemicals, metals, machinery and electrical equipment, and link the results to the characteristics of these manufacturing industries.

IV. EMPIRICAL EVIDENCE

a) Base-line Regression Results

For a start, we run a simple regression which adds US FDI stocks in a large number of developing host countries to conventional growth determinants such

as gross fixed capital formation (GFCF), initial income (GDPPC) and human capital proxied by secondary school enrollment (SES). Equations (1) and (2) reported in Table 1 consider total FDI stocks as an explanatory variable, whereas equations (3) and (4) refer to FDI stocks in manufacturing only.

Table 1 — FDI Stocks and Economic Growth: Regression Results[a]

	Total		Manufacturing	
	(1)	(2)	(3)	(4)
GFCF	0.124 (0.03)	0.122 (0.04)	0.138 (0.03)	0.133 (0.04)
GDPPC	-0.594 (0.26)	-0.631 (0.27)	-0.223 (0.66)	-0.181 (0.75)
SES	0.029 (0.08)	0.029 (0.09)	0.025 (0.15)	0.026 (0.14)
FDI	-0.088 (0.38)		-0.261 (0.01)	
FDI-LA		-0.091 (0.50)		-0.292 (0.00)
FDI-AF		-0.311 (0.19)		-1.594 (0.30)
FDI-AS		-0.022 (0.88)		-0.087 (0.76)
NOBS	67	67	65	65
R^2	0.36	0.37	0.38	0.39

[a]For definitions and data sources of variables, see the Appendix. Constant term and regional dummies included, but not reported; p-value in parentheses.

Source: BEA (2003); World Bank (2002).

The results for the controlling variables are plausible. The coefficients of GFCF are fairly stable and highly significant in all four equations. The insignificantly negative coefficients of GDPPC are not surprising given that various empirical

analyses on the determinants of economic growth revealed, at best, mixed evidence regarding the convergence hypothesis, according to which countries with low initial per-capita income should grow faster than more advanced countries. The proxy for the human capital endowment of developing countries (SES) is positively related to economic growth, but the coefficients of SES remain insignificant when the FDI variable relates to manufacturing only in equations (3) and (4). The latter finding can be attributed to the shortcomings of SES, which does not capture the quality of schooling.

Turning to the impact of US FDI stocks on economic growth in developing host countries, we confirm earlier findings, e.g. by Dutt (1997), that the currently prevailing euphoria about FDI has little empirical substance, at least when stock data are used. The coefficient of total FDI in equation (1) is insignificant, and the coefficient of FDI in manufacturing in equation (3) is even significantly negative. The latter result indicates that crowding out and/or negative balance of payments effects are more pronounced in manufacturing than in other sectors.

Negative balance of payments effects are most likely where US direct investors had accumulated an optimal FDI stock by 1990 already so that profit remittances exceeded new FDI inflows. This can be expected for Latin America in particular, taking into account that US direct investors became engaged in major Latin American countries earlier than elsewhere. In addition, Agosin and Mayer (2000: 1) observed that "strong crowding out has been the norm in Latin

America."

It fits into this picture that, according to equations (2) and (4) in Table 1, the growth effects of US FDI stocks differ across major host country regions. While these differences remain insignificant when total FDI is considered, Latin America stands out when it comes to US FDI in manufacturing. It is only for this region that the negative coefficient of FDI in manufacturing is significant. As argued in the following, a detailed inspection of the role of host-country and industry characteristics in shaping the growth impact of FDI may shed more light on the base-line regression results.

b) The Relevance of Host-country Characteristics

Our sample countries differ considerably with regard to all four host-country characteristics. For example, GDP per capita ranges from less than 1000 US$ in various African host countries to more than 15000 US$ in Hong Kong and the United Arab Emirates. Secondary school enrollment, which proxies for educational attainment, is below 10 percent in Tanzania and Niger and above 80 percent in several Asian and Latin American countries. Institutional development is rated extremely poor in Zaire, Algeria and Haiti, and exceptionally strong in Hong Kong and Singapore. Moreover, for all characteristics, Table 2 shows that the two subgroups with favorable and unfavorable characteristics differ in two respects. First, the subgroups with

favorable characteristics recorded substantially higher GDP per capita growth in 1991–2000. Second, these subgroups hosted substantially higher US FDI stocks in 1990. However, the relevance of host-country characteristics for host countries' attractiveness for FDI varies considerably between sectors:

- The host-country characteristics considered here are irrelevant for FDI in the primary sector, which is proxied by US FDI in the petroleum industry. Unsurprisingly, the availability of natural resources such as oil appears to be the dominant motive for undertaking resource-seeking FDI.

- Countries with unfavorable characteristics hardly received market-seeking FDI in the services sector. The difference in the FDI-to-GDP ratio to countries with favorable characteristics is very similar, independently of which host-country characteristic is considered.

- For FDI in the manufacturing sector, the difference in locational attractiveness between host countries with favorable and unfavorable characteristics ranges from 0.8 percentage points in the case of schooling to 1.2 percentage points in the case of openness. The particularly wide margin in the latter case may indicate that, as suggested by UNCTAD (1996: 97), efficiency-seeking FDI plays an increasingly important role in manufacturing, and openness is crucial for host countries to attract this type of FDI.

Table 2 — Host-country Characteristics, FDI Stocks and Economic Growth[a]

Host-country characteristics		Economic growth[b] 1991-2000	FDI stock in 1990 (percent of GDP)[c]			
			total	petro-leum	manu-facturing	services
Per-capita GDP (PPP) in 1990	below median	0.8 (1.1)	0.97	0.41	0.19	0.04
	above median	2.0 (2.3)	2.67	0.45	1.22	0.44
Schooling (1990)	below median	0.5 (0.7)	1.20	0.24	0.34	0.07
	above median	2.1 (2.3)	2.54	0.44	1.15	0.38
Institutional devel-opment (1997/98)	below median	0.6 (0.3)	1.28	0.53	0.32	0.04
	above median	2.1 (2.3)	2.34	0.39	1.30	0.41
Openness (1990)	closed	0.6 (0.4)	1.68	0.50	0.45	0.06
	open	2.4 (2.4)	3.05	0.59	1.60	0.49

[a]For definitions and data sources of variables, see Appendix. – [b]Average of the annual growth rate of per-capita GDP for the respective subgroup of host countries (median in parentheses). – [c]Average for the respective subgroup of host countries.

Source: BEA (2003); World Bank (2002); Kaufmann et al. (2002); Sachs and Warner (1995).

The relevant question, of course, is whether high FDI stocks in host countries with favorable characteristics contributed to higher growth in these countries. The calculations reported in Table 3 provide some support to this proposition. In countries with unfavorable characteristics, higher total FDI stocks tend to be associated with lower subsequent growth. This negative relation may be because FDI crowded out domestic investment, a phenomenon that Agosin and Mayer (2000) observed in Latin America in particular. Furthermore, FDI may have

Table 3 — Economic Growth Rates for Country Subgroups (Median), According to Host-country Characteristics and FDI Stocks in Different Sectors[a]: Two FDI Groups[b]

Host-country characteristics		Total		Petroleum		Manufacturing				Services			
		FDI low	FDI high	FDI low	FDI high	FDI = 0	FDI >0	FDI low	FDI high	FDI = 0	FDI >0	FDI low	FDI high
Per-capita GDP (PPP)	below median	1.8 (17)	–0.3 (17)	1.7 (16)	1.4 (15)	1.2 (19)	0.4 (17)			0.1 (19)	1.6 (11)		
	above median	2.1 (20)	2.4 (20)	1.6 (14)	2.7 (14)			2.3 (17)	2.5 (16)			2.4 (13)	2.8 (13)
Schooling	below median	1.4 (17)	1.3 (17)	1.3 (15)	1.4 (14)	1.2 (18)	0.4 (17)			–0.1 (18)	1.4 (10)		
	above median	0.5 (18)	2.3 (18)	2.4 (13)	2.4 (13)			2.4 (17)	2.2 (17)			2.5 (12)	2.5 (12)
Institutional development	below median	1.4 (15)	–0.3 (15)	2.2 (13)	–0.2 (12)	–0.2 (15)	0.1 (17)			–0.2 (15)	1.4 (7)		
	above median	1.7 (19)	2.4 (18)	1.8 (13)	2.6 (13)			1.5 (16)	2.9 (15)			1.8 (12)	2.5 (12)
Openness	closed	0.9 (18)	0.4 (17)	1.3 (13)	–0.3 (13)			–0.2 (18)	0.6 (18)	-0.2 (15)	1.5 (10)		
	open	2.4 (13)	2.7 (12)	2.1 (10)	3.1 (9)			2.7 (11)	2.4 (10)			2.4 (9)	2.6 (9)

[a]For definitions and sources of variables, see Appendix. Number of observations in parentheses. – [b]Each country subgroup according to host-country characteristics is further divided into two FDI groups. Depending on the number of zero observations with regard to FDI stocks, the separation is between FDI = 0 and FDI > 0 or between FDI = low and FDI = high. In the latter case, FDI = low includes FDI = 0.

Source: BEA (2003); World Bank (2002); Kaufmann et al. (2002); Sachs and Warner (1995).

deteriorated the terms of trade (Dutt 1997) and the balances of payments in these host countries,[6] or the benefits of FDI may have been embezzled or squandered by corrupt local elites.

The picture is brighter for host countries with favorable characteristics. The difference in median growth rates between attractive host countries with higher total FDI stocks and those with lower total FDI stocks remains marginal if locational attractiveness is measured by per-capita GDP and openness to trade. However, Table 3 reveals considerably positive growth differences with regard to the other two host-country characteristics. The results for schooling are consistent with the findings of Borensztein et al. (1998), suggesting that the availability of complementary human capital in the host countries is important for FDI to stimulate economic growth.

As concerns the relationship between economic growth and FDI stocks in particular sectors, the results for the petroleum industry support the previous finding that positive growth effects of higher FDI stocks are restricted to the subgroup with favorable host-country characteristics. The problem of resource-seeking FDI resulting in foreign dominated enclaves with few growth-enhancing

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6 By drawing on the theoretical and empirical literature, Dutt (1998: 165–166) argues that "because of high levels of profit repatriation (especially if one takes into account practices such as transfer pricing) new direct foreign [investment] inflows is in most periods less than capital outflows due to profit repatriation.

spillovers seems to be concentrated in closed host countries with a deficient institutional environment.

By contrast, host countries with unfavorable characteristics appear to have benefited from higher FDI in the services sector, and in fact even more so than host countries with favorable characteristics. This can be attributed to two factors. In many host countries with unfavorable characteristics, FDI stocks in the services sector are of a very recent vintage since they are the outcome of the move to privatize public enterprises. While this type of FDI often takes place in the form of M&As, which tend to crowd out local investment, it typically leads to follow-up FDI as well as transfers of technology and know-how in order to modernize the undercapitalized operations. Negative balance of payments effects are, thus, highly unlikely. Additionally, the potential of increasing the level of competition and of dismantling distortions in the economic policy should be greater in host countries with unfavorable characteristics.

Yet, the results for the services sector in Table 3 have to be qualified since they are not fully comparable between the subgroups with favorable and unfavorable characteristics. For the former subgroup, the distinction in two FDI groups had to be made between FDI=0 and FDI>0; for the latter subgroup which included considerably less zero observations, the distinction had to be made between low and high FDI. If three FDI groups are considered instead of two (Table 4), the

Table 4 — Economic Growth Rates for Country Subgroups (Median), According to Host-country Characteristics and FDI Stocks in Different Sectors[a]: Three FDI Groups[b]

Host-country characteristics		Petroleum			Manufacturing			Services		
		FDI = 0	FDI low	FDI high	FDI = 0	FDI low	FDI high	FDI = 0	FDI low	FDI high
Per-capita GDP (PPP)	below median	1.7 (9)	1.8 (11)	–0.3 (11)	1.2 (19)	0.8 (9)	0.1 (8)	0.1 (19)	2.6 (6)	1.4 (5)
	above median	1.1 (4)	1.8 (12)	2.9 (12)	2.4 (12)	2.2 (12)	2.1 (12)	2.4 (11)	2.2 (8)	2.8 (7)
Schooling	below median	1.5 (8)	1.4 (11)	0.7 (10)	1.2 (18)	0.1 (9)	0.9 (8)	–0.1 (18)	1.4 (5)	1.4 (5)
	above median	2.4 (5)	2.6 (11)	2.3 (10)	1.9 (10)	2.3 (12)	2.5 (12)	2.3 (10)	1.6 (7)	2.9 (7)
Institutional development	below median	2.2 (5)	1.7 (10)	–0.3 (10)	–0.2 (15)	0.8 (9)	0.0 (8)			
	above median	2.0 (4)	1.8 (11)	2.6 (11)	1.5 (8)	2.3 (12)	2.6 (11)	1.8 (8)	1.3 (8)	3.1 (8)
Openness	closed	1.7 (7)	0.6 (10)	–0.3 (9)	–0.2 (14)	0.8 (11)	0.4 (11)	–0.2 (15)	1.7 (5)	1.3 (5)
	open				1.5 (6)	2.9 (8)	2.6 (7)	2.4 (7)	1.5 (6)	2.9 (5)

[a]For definitions and sources of variables, see Appendix. Number of observations in parentheses. – [b]Each country subgroup according to host-country characteristics is further divided into three FDI groups; the first group consists of zero observations with regard to FDI stocks; the rest of the subgroup is divided into countries with FDI = low and FDI = high, taking the median as the dividing line between these two groups. Results for three FDI groups are reported only when at least four observations are available for each group. Therefore, no results are reported for all sectors taken together (zero observations are very few for total FDI stocks).

Source: BEA (2003); World Bank (2002); Kaufmann et al. (2002); Sachs and Warner (1995).

link between FDI and economic growth turns out to be highly ambiguous for countries with favorable characteristics as well as those with unfavorable characteristics. Independently of host-country characteristics, the evidence is in conflict with the proposition of a strictly positive relation between zero, low and high FDI on the one hand and median growth rates on the other hand. The latter finding largely applies to the manufacturing sector, too. This non-linearity offers a possible explanation for the significantly negative coefficient of FDI in the manufacturing sector in Table 1.

The results for the manufacturing sector in Table 3 (i.e., for only two FDI groups) are similar to the results for all sectors taken together in that the growth impact of FDI tends to be more benign for host countries with favorable characteristics. The contrast between the two subgroups of host countries is greatest if locational attractiveness is measured by institutional development. The difference in the median growth rate of per-capita GDP between countries with low and high FDI is 1.4 percentage points in the subgroup with better institutional development, but only 0.3 percentage points in the subgroup with poorer institutional development. For per-capita GDP and schooling, we find negative growth effects in host countries with poor characteristics and basically no growth effects in host countries with favorable characteristics. Most surprisingly, however, the finding that the growth impact of FDI is more benign in host countries with favorable characteristics does not hold if locational

attractiveness is measured by the Sachs and Warner (1995) index on openness to trade. This result, which is in conflict with the above reasoning on the virtues of efficiency-seeking FDI, could be due to that US FDI in manufacturing was still dominantly market-seeking in 1990.[7] It can neither be ruled out, however, that the growth effects of efficiency-seeking FDI do not differ from the growth effects of market-seeking FDI. In any case, it appears easier to attract FDI by opening up to international trade (see Table 2 above) than to derive positive growth effects of FDI in this way.

Another finding in Table 3 casts doubts on the widely perceived rise and superiority of efficiency-seeking FDI: The relevance of openness is very much the same for the growth effects of FDI in manufacturing and the growth effects of FDI in services, where due to the non-tradability of most services, FDI is market-seeking almost by definition. In order to shed more light on the difference between market-seeking and efficiency-seeking FDI with respect to their growth impact, we disaggregate the manufacturing sector into seven industries in the subsequent section.

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7 According to Dunning (2002), traditional market-seeking FDI, together with resource-seeking FDI, still accounts for the majority of FDI undertaken in developing countries.

c) The Relevance of Industry Characteristics

The seven manufacturing industries for which the Bureau of Economic Analysis reports separate FDI stock data reveal pronouncedly different characteristics in various respects (Table 5). For instance, labor intensity, indicated by the number of employees per million US$ of value added of US affiliates in all developing host countries, differs by a factor of three between electrical equipment and chemicals. Chemicals represent the most human capital intensive industry with an average compensation of about 20 000 US$ per employee, compared to about 8 000 US$ in electrical equipment. Chemicals, together with machinery, also range high with respect to R&D expenditures of US affiliates in developing host countries and technology transfers from parent companies.

Most interestingly, Table 5 offers some clues on the type of FDI undertaken in manufacturing industries. It can reasonably be assumed that efficiency-seeking FDI should result in a closer vertical integration between US parent companies and their affiliates in developing countries and a stronger export orientation of the latter. Considering both indicators together, Table 5 suggests that US FDI in

Table 5: Characteristics of Manufacturing Industries: Selected Indicators[a]

	Labor intensity[b]	Human capital intensity[c]	R&D intensity[d]	Technology transfers[e]	Export orientation[f]	Vertical integration[g] (1)	Vertical integration[g] (2)
Food	27.9	12.5	1.51	2.39	20.8	3.6	5.4
Chemicals	19.9	19.7	6.51	5.77	18.8	11.3	12.1
Metals	25.1	16.5	0.96	1.54	30.8	10.6	9.2
Machinery	28.2	12.8	5.56	12.43	75.7	43.3	59.1
Electr. equip.	61.0	8.1	2.70	2.91	53.0	64.9	120.2
Transp. equip.	22.2	15.1	6.35	1.13	40.6	65.1	76.4
Other manuf.	25.8	14.2	1.29	3.18	24.8	17.1	22.3
Total manuf.	30.1	12.8	3.70	4.64	40.5	35.0	43.9

[a]Data refer to majority-owned non-bank US affiliates, except technology transfers (all affiliates). Data are for 1995, if not mentioned otherwise, since many observations are missing for earlier years. Industry characteristics are calculated for all developing host countries, by adding up Africa, Asia (excluding Australia and Japan), Middle East and Latin America, if not mentioned otherwise. – [b]Number of employees of US affiliates per million US$ of value added. – [c]Compensation of employees (1000 US$) per person employed by US affiliates. – [d]R&D expenditures of US affiliates in percent of value added. – [e]Royalties and license fees paid by US affiliates to their parent companies in percent of value added. Data refer to 1999 because of missing data for earlier years. – [f]Total exports of US affiliates in percent of total sales. Data refer to 1996. All developing host countries proxied by substracting Canada, Europe and Japan from all host countries (because of missing observations for developing country regions). – [g]Sum of exports of US affiliates to, and imports of US affiliates from their parent companies in percent of total sales of affiliates. Data refer to 1996. Column (1): all developing host countries proxied by substracting Australia, Canada and Europe from all host countries (Japan not excluded because of missing observations); column (2): only Latin American host countries (missing observations for other developing country regions).

Source: BEA (2003).

machinery, electrical equipment and transport equipment tends to be efficiency-seeking, whereas US FDI in the food, chemicals and metals industry tends to be market-seeking.[8] Taking into account that chemicals and electrical equipment represent the most important industries for US direct investors in developing countries, in terms of FDI stocks in 1990, these two industries can be regarded as the prototypes of market-seeking and efficiency-seeking FDI in the following.[9]

The host-country characteristics introduced in the previous section matter for developing countries' attractiveness for both market-seeking FDI in chemicals and efficiency-seeking FDI in electrical equipment (Table 6). Not surprisingly, the differences in average FDI stocks between host country subgroups with favorable and unfavorable characteristics are less pronounced, though clearly positive with few exceptions, for industries in which US direct investors were less engaged in developing countries. The relevance of host-country characteristics for average FDI stocks differs between chemicals and electrical

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8 It may be surprising that FDI in transport equipment is classified as efficiency-seeking (mainly because vertical integration is clearly above the average for total manufacturing) as US automobile companies were engaged in countries such as Brazil predominantly for serving the local markets. However, the characteristics of transport equipment are shaped significantly by US FDI in Mexico, which accounted for more than 40 percent of US FDI stocks in this industry in all developing countries in 1990. In Mexico, US automobile companies pursued integration strategies much earlier than in other host countries.

9 The chemical industry accounted for about 21 percent of US FDI stocks in the manufacturing sector of developing countries; the share of electrical equipment was about 17 percent. Machinery ranked third with 14 percent.

equipment in one remarkable respect. In chemicals, all four characteristics have almost the same importance.[10] In electrical equipment, however, openness to international trade turns out to be a more important stimulus to FDI than the other three host-country characteristics, as was to be expected for an export-oriented industry.

Table 6 — Host-country Characteristics[a] and FDI Stocks in Manufacturing Industries[b]

Host-country characteristics		FDI stocks in 1990 (percent of GDP)						
		Food	Chemi-cals	Metals	Machi-nery	Electr. equip.	Transp. equip.	Other
Per-capita GDP (PPP)	below median	0.02	0.02	0.01	0.00	0.00	0.00	0.02
	above median	0.10	0.23	0.02	0.08	0.19	0.03	0.14
Schooling	below median	0.03	0.04	0.01	0.01	0.02	0.01	0.06
	above median	0.10	0.22	0.01	0.07	0.19	0.02	0.10
Institutional development	below median	0.05	0.05	0.01	0.00	0.01	0.01	0.04
	above median	0.08	0.23	0.01	0.09	0.21	0.03	0.13
Openness	closed in 1990	0.04	0.07	0.02	0.02	0.01	0.02	0.07
	open in 1990	0.11	0.27	0.01	0.10	0.28	0.03	0.14

[a]For definitions and data sources of variables, see Appendix. – [b]Average for the respective subgroup of host countries.

Source: BEA (2003); World Bank (2002); Kaufmann et al. (2002); Sachs and Warner (1995).

Turning to the relationship between median growth rates and FDI stocks in individual manufacturing industries, Table 7 corroborates the absence of a strictly positive relationship if sample countries are grouped into three FDI groups with zero, low and high FDI stocks in 1990. Varying industry

10 For all four characteristics, the ratio of FDI stocks to GDP was 0.2 percentage points higher in more attractive host countries than in less attractive host countries.

characteristics notwithstanding, metals, machinery and transport equipment have in common that the median growth rate is even lower in the high FDI group than in the group without any FDI stocks. This may be attributed to FDI-related capital outflows in countries where the engagement of US direct investors had reached an optimal size through an earlier accumulation of FDI stocks. However, the proposition of negative balance of payments effects when high FDI stocks comprise a larger share of long-standing engagements cannot be tested with the data at hand.

Nevertheless, Table 7 points to different growth effects of US FDI stocks in individual industries which appear to be related to industry characteristics. Most interestingly, the difference in median growth rates between countries with and without FDI stocks (i.e., for only two FDI groups) is highest in electrical equipment (1.3 percentage points) and machinery (1.1 percentage points). In all other industries, this difference is below one percentage point (e.g., 0.7 percentage points in chemicals). A similar result is achieved when industry-specific FDI stocks in 1990 and average annual growth rates in 1991-2000 are correlated across all sample countries. It is only for electrical equipment and machinery that this correlation is significantly positive.[11]

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11 The correlation coefficient of 0.24 for electrical equipment is significant at the 3 percent level; the correlation coefficient of 0.18 for machinery is significant at the 10 percent level.

Table 7 — Economic Growth Rates of Sample Countries (Median), According to FDI Stocks in Manufacturing Industries[a]

Industry		FDI = 0	FDI >0	FDI low	FDI high
Food	two FDI groups	1.4 (52)	2.3 (29)		
	three FDI groups	1.4 (52)		2.4 (15)	1.6 (14)
Chemicals	two FDI groups	1.2 (52)	1.9 (29)		
	three FDI groups	1.2 (52)		2.3 (15)	1.6 (14)
Metals	two FDI groups	1.4 (62)	2.1 (20)		
	three FDI groups	1.4 (62)		3.2 (10)	1.0 (10)
Machinery	two FDI groups	1.2 (72)	2.3 (16)		
	three FDI groups	1.2 (72)		3.0 (8)	1.6 (8)
Electrical equipment	two FDI groups	1.1 (64)	2.4 (20)		
	three FDI groups	1.1 (64)		2.4 (10)	2.4 (10)
Transport equipment	two FDI groups	1.4 (78)	2.0 (10)		
	three FDI groups	1.4 (78)		2.6 (5)	1.3 (5)
Other	two FDI groups	1.4 (57)	1.3 (23)		
	three FDI groups	1.4 (57)		0.4 (12)	1.4 (11)

[a]FDI = low includes FDI = 0 in the case of two FDI groups; number of observations in parentheses.

Source: BEA (2003); World Bank (2002); Kaufmann et al. (2002); Sachs and Warner (1995).

It may be noted that the growth effects of FDI in electrical equipment and in machinery are particularly strong although both industries differ in several respects. The labor intensity is much higher in electrical equipment; R&D expenditures and technology transfers are clearly above the average for total manufacturing in machinery, but below average in electrical equipment (Table 5). Yet, both industries share important characteristics. First, FDI in machinery

and electrical equipment is less demanding in terms of complementary human capital in the host countries than FDI in other industries. Second, the export orientation of FDI is strongest in machinery and electrical equipment. Third, the integration of US affiliates into corporate networks via intra-firm trade is fairly strong in both industries. These factors seem to have helped positive growth effects of FDI.

Furthermore, industry characteristics help explain why a positive growth impact of FDI is more questionable in Latin American host countries than in Asian host countries (Section IV.a).[12] The industry structure of US FDI stocks in manufacturing is strikingly different in these two regions. Market-seeking FDI in the food, chemicals and metals industries accounted for 41 percent of US FDI in total manufacturing in Latin America, but for only 26 percent in Asia. By contrast, the share of machinery and electrical equipment in FDI in total manufacturing in Asia (58 percent) was almost three times the corresponding share in Latin America (20 percent). Hence, the industry structure of FDI offers an explanation, which is complementary to the reasoning on crowding out by Agosin and Mayer (2000), for relatively weak growth effects of FDI in Latin America.

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12 We focus on Asia versus Latin America since 95 percent of US FDI stocks in all developing countries were located in these two regions in 1990 (BEA 2003).

d) Host-country Characteristics and Different Types of FDI

In the final step of our analysis, we check whether, and in which way, the growth impact of FDI is shaped by the interplay of host-country characteristics and industry characteristics. In Table 8, we assess the relevance of the host-country characteristics introduced in Section IV.b for the link between economic growth and US FDI stocks in particular manufacturing industries, keeping in mind the characteristics of these industries presented in Section IV.c. The calculation of median growth rates is restricted to two FDI groups with FDI = 0 and FDI > 0. The additional separation into three FDI groups (FDI = 0, low FDI, high FDI) applied above is not reported here since the number of observations is extremely small in various cases.[13] Furthermore, the results for transport equipment and other manufacturing reported in Table 8 are ignored in the following. This is because US FDI in transport equipment is extremely concentrated in few developing host countries, while other manufacturing comprises a too heterogeneous set of industries to allow for a meaningful interpretation.

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13 It should be noted, however, that the absence of a strictly positive relation between zero, low and high FDI on the one hand and economic growth on the other hand is corroborated for almost all combinations of host-country characteristics and industry-specific FDI stocks.

Table 8 — Economic Growth Rates for Country Subgroups (Median), According to Host-country Characteristics and FDI Stocks in Manufacturing Industries[a]

Industry/FDI		Host-country characteristics							
		Per-capita GDP		Schooling		Institutional development		Openness	
		below median	above median	below median	above median	below median	above median	closed	open
Food	FDI = 0	1.2 (29)	2.3 (18)	0.9 (26)	1.9 (18)	0.8 (23)	1.4 (17)	-0.2 (23)	1.6 (9)
	FDI > 0	1.4 (9)	2.3 (20)	1.0 (12)	2.4 (17)	0.0 (10)	2.4 (18)	1.3 (13)	2.5 (15)
Chemicals	FDI = 0	0.6 (30)	2.4 (18)	0.1 (29)	2.3 (16)	-0.0 (24)	1.7 (15)	-0.2 (23)	1.7 (12)
	FDI > 0	1.4 (10)	2.3 (19)	1.0 (10)	2.6 (19)	0.6 (10)	2.5 (19)	1.0 (14)	2.7 (14)
Metals	FDI = 0	1.1 (33)	2.3 (24)	0.6 (32)	2.2 (22)	0.2 (28)	1.7 (21)	-0.1 (28)	1.6 (13)
	FDI > 0	0.4 (7)	2.4 (13)	0.9 (6)	2.5 (14)	0.2 (8)	2.7 (12)	0.2 (10)	2.8 (10)
Machinery	FDI = 0	0.4 (39)	2.2 (28)	0.4 (37)	1.4 (27)	-0.0 (34)	1.7 (25)	-0.2 (34)	1.6 (17)
	FDI > 0	1.6 (4)	2.4 (12)	0.7 (4)	2.9 (12)	-0.5 (3)	2.6 (13)	1.0 (6)	3.1 (9)
Electrical equipment	FDI = 0	0.6 (34)	2.2 (25)	0.4 (33)	1.6 (23)	-0.0 (30)	1.4 (21)	-0.2 (29)	1.4 (15)
	FDI > 0	2.4 (5)	2.5 (15)	2.1 (6)	2.5 (14)	-0.1 (5)	2.5 (15)	2.3 (7)	2.6 (11)
Transport equipment	FDI = 0	0.9 (40)	2.3 (33)	0.7 (40)	2.2 (30)	0.1 (35)	1.8 (30)	-0.0 (34)	2.1 (22)
	FDI > 0	1.7 (2)	2.0 (8)	0.6 (2)	2.4 (8)	-0.2 (2)	2.4 (8)	1.3 (6)	2.4 (4)
Other	FDI = 0	1.4 (33)	2.4 (19)	1.1 (29)	2.3 (20)	0.4 (26)	1.7 (18)	-0.2 (26)	2.1 (10)
	FDI > 0	0.1 (9)	2.0 (14)	0.4 (7)	2.0 (16)	-0.2 (9)	2.5 (14)	0.4 (13)	2.2 (9)

[a]For definitions and data sources of variables, see Appendix. Number of observations in parentheses.

Source: BEA (2003); World Bank (2002); Kaufmann et al. (2002); Sachs and Warner (1995).

A clear picture emerges for the interplay of the institutional development of host countries and the growth impact of FDI in manufacturing industries. Institutional development has a similar influence on the link between FDI and economic growth for all manufacturing industries. On the one hand, sample countries where institutional development was above the median reported a higher growth rate when they had attracted FDI by 1990; the difference in median growth rates is about one percentage point in all industries. This indicates that a favorable institutional environment helped positive growth effects of FDI, independently of whether FDI was undertaken in technologically advanced or less advanced industries, and for market-seeking or efficiency-seeking reasons. On the other hand, poor institutions have two effects: (a) few countries receive FDI in manufacturing under such conditions, especially so in industries in which FDI tends to be efficiency-seeking (machinery, electrical equipment); (b) for all industries except chemicals, FDI lacks positive growth effects under such conditions. In other words, a threshold of institutional development is required to attract FDI **and** to benefit from higher subsequent growth.

Yet, Table 8 underscores that the link between FDI and economic growth varies between different types of FDI and that host-country characteristics have an important say in this respect. For all host-country characteristics except institutional development, the difference in median growth rates between

countries with and without FDI, typically, turns out to be smaller in industries where FDI is market-seeking (food, chemicals, metals) than in industries where FDI is efficiency-seeking (machinery, electrical equipment).[14] This applies to both subgroups, i.e., countries with favorable characteristics and those with unfavorable characteristics.

The results for the subgroup with unfavorable characteristics must be interpreted with a considerable degree of caution. In various instances, very few countries with unfavorable characteristics hosted US FDI, especially when it comes to efficiency-seeking FDI in machinery and electrical equipment. Nonetheless, two results for the subgroup with unfavorable characteristics should be noted. First, on average, the link between FDI and economic growth is more pronounced in industries in which FDI is considered efficiency-seeking. Second, the difference in median growth rates is considerably higher in electrical equipment than in machinery, notably in the case of schooling as indicator for locational attractiveness. The latter result suggests that it is more difficult for host countries with relatively low secondary school enrollment ratios to reap positive growth effects of FDI in machinery, which, according to Table 5, is more demanding than electrical equipment in terms of requiring complementary

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14 On average, the growth rate of countries with FDI > 0 exceeded the growth rate of countries with FDI = 0 by half a percentage point in the food, chemicals and metals industries when per-capita GDP, schooling and openness are taken into account as host-country characteristics. The corresponding difference in growth rates amounted to 1.2 percentage points in machinery and electrical equipment.

human capital in the host countries. At the same time, the higher labor intensity and the lower technology intensity of electrical equipment renders it easier for less advanced developing countries to benefit from FDI in this industry.

In contrast to countries with unfavorable characteristics, open host countries with relatively high secondary school enrollment ratios reveal a particularly strong link between FDI and economic growth in machinery. The industry characteristics reported for machinery provided a better fit with the host-country characteristics in this subgroup of countries. Taken together, these results for countries with favorable and unfavorable characteristics support the hypothesis that higher growth effects of FDI are more likely when the gap between the operations of foreign direct investors and host-country conditions in terms of technology and factor intensities is relatively small. The opposite hypothesis, according to which a larger gap fosters FDI-induced catching up processes, has to be rejected.

Among the host-country characteristics considered, it is mainly with regard to schooling that efficiency-seeking FDI turns out to be superior to market-seeking FDI in stimulating higher growth in host countries with favorable characteristics. In particular, schooling appears to be much more important than

the general level of economic development, measured by per-capita GDP.[15] More surprisingly, it is for essentially all manufacturing industries that the difference in median growth rates between host countries with and without FDI tends to be particularly large when openness is taken as indicator for locational attractiveness. Yet, open host countries benefit most from FDI in machinery, which was to be expected given the outstandingly high export orientation of FDI in this industry reported in Table 5.[16]

The observation that even market-seeking FDI in the food, chemicals and metals industries is associated with an about one percentage point higher growth rate in open host countries may be because openness tends to contain the allocative distortions arising from FDI in import-substituting industries. Nevertheless, openness does not seem to be required for reaping positive growth effects of market-seeking FDI. The difference in median growth rates is roughly the same for closed economies, notably for FDI in chemicals. This finding points to two limitations of our classification of industry and host-country characteristics:

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15 The difference in median growth rates between higher-income countries with and without FDI ranges only from 0.3 percentage points in electrical equipment to –0.1 percentage points in chemicals.

16 Moreover, the difference in growth rates related to FDI in electrical equipment, which ranks second with regard to export orientation, is still larger than the difference in growth rates related to FDI in chemicals, which represent the most important target of market-seeking FDI.

- The classification of FDI in food, chemicals and metals as market-seeking in Table 5 is based on the operations of US affiliates in all developing host countries.[17] It cannot be ruled out that the export orientation of FDI in chemicals, for example, is considerably higher in open host countries than in closed host countries.

- For classifying host countries as open or closed, we refer to the assessment of Sachs and Warner (1995) for the year 1990. However, several countries have opened up to international trade in subsequent years. Possibly, these liberalizers account for the considerable difference in median growth rates between closed countries with and without FDI in several industries, including chemicals.

We checked these possibilities tentatively by referring to US FDI in the chemical industry. Eliminating twelve developing countries which opened up to international trade in 1991–1994 (Sachs and Warner 1995) from the subgroup considered closed in Table 8 had little effect on the difference in median growth rates between countries with and without FDI (not shown). However, the robustness of this result is open to question: Just five of the 25 sample countries that remained closed in 1994 hosted US FDI stocks in chemicals, while US FDI

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17 This is because country-specific data on operational characteristics of US affiliates are extremely patchy. Note also that the data do not allow for a finer disaggregation of FDI in fairly heterogeneous industries such as chemicals.

was absent in just three of the twelve countries that opened up in 1991–1994. What can safely be concluded from this pattern is that opening up to international trade matters for becoming attractive for FDI in chemicals. At the same time, there are indications that the nature of FDI in industries such as chemicals may change when host countries open up. For instance, the export orientation of US FDI in chemicals is extremely low (5 percent) in the Brazilian economy, which Sachs and Warner (1995) considered closed in 1990. It is four times as high in Mexico which opened up much earlier than Brazil, and still considerably higher (32 percent) in Malaysia where openness has a long tradition. The different nature of FDI in particular industries and the relation to host-country characteristics should be an issue for further research. However, serious data constraints render this task fairly difficult.

V. SUMMARY AND CONCLUSIONS

Positive growth effects of FDI in developing countries are anything but guaranteed. Our analysis based on US FDI stocks in a large number of developing countries clearly suggests that the currently prevailing euphoria about FDI among policymakers and external advisers rests on weak empirical foundations. This is for several reasons:

- We confirm earlier regression results according to which the link between FDI and economic growth in the host countries is insignificant at best, once

the explanatory FDI variable is based on stock data. Allowing for regional differences, FDI in the manufacturing sector turns out to be negatively related to economic growth in Latin America, where Agosin and Mayer (2000) observed strong crowding-out effects of FDI.

- The link between FDI and subsequent growth varies considerably when host countries are classified according to locational characteristics such as GDP per capita, schooling, institutional development and openness to trade. In host countries with unfavorable characteristics, higher total FDI stocks tend to be associated with lower subsequent growth. Even though the picture is brighter for countries with favorable characteristics, it, generally, seems to be much easier to attract FDI than to derive macroeconomic benefits from FDI.

- The comparison of median growth rates between subgroups of host countries reveals that the link between FDI and economic growth is stronger in the services sector than in the manufacturing sector. For both sectors, however, we fail to find a strictly positive relation when we differentiate between developing countries with zero, low and high US FDI stocks.

- The growth effects of FDI also differ between manufacturing industries. These differences are related to industry characteristics such as factor requirements, export orientation and integration into corporate networks via intra-firm trade. Drawing on these characteristics for separating efficiency-

seeking FDI from market-seeking FDI in manufacturing, it is mainly for the former type of FDI that we find positive growth effects.

- Finally we reject the hypothesis that a large technological gap between the host and home country of FDI fosters FDI-induced catching-up processes in developing countries. Rather, the interplay of host-country and industry characteristics suggests that positive growth effects of FDI are more likely when the technological gap is relatively small.

Taken together, this invites the conclusion that policymakers in developing countries and external advisors (see, e.g., United Nations 2002) are focusing on the wrong question. The central challenge is not to attract FDI. Succeeding in this respect would only solve the minor part of the problem, which is to derive macroeconomic benefits from FDI. For developing countries with unfavorable locational characteristics, in particular, it makes little sense to offer fiscal incentives and outright subsidies, in order to attract potential foreign direct investors into technologically advanced industries. These public resources could be used more productively.

Apart from improving the local availability of a sufficiently qualified labor force, host countries are well advised to focus on developing sound institutions, which appear to be a prerequisite for attracting, and benefiting from both market-seeking and efficiency-seeking FDI. Finally, openness to trade is

required to successfully participate in the widely perceived trend towards efficiency-seeking FDI. As it seems, opening up to international trade may even turn market-seeking FDI into efficiency-seeking FDI in manufacturing industries such as chemicals and, thus, improve the growth impact of FDI. Especially this issue deserves more attention in future research on the link between FDI and economic growth in developing countries.

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APPENDIX:

Definition of Variables and Data Sources

The subscript i refers to the industry and j to the host country. All monetary variables are in million current US $.

EMP_{ij}	Total number of employees of majority-owned non-bank US affiliates. BEA (2003).
FDI_{ij}	US direct investment position abroad on a historical-cost basis. BEA (2003).
$GDPPC_j$	Gross domestic product per capita in PPP terms. World Bank (2002).
$GROWTH_j$	Growth rate of gross domestic product per capita. World Bank (2002).
HCI_{ij}	Average human capital intensity of majority-owned non-bank US affiliates, defined as $HCI_{ij} = \frac{WAGE_{ij}}{EMP_{ij}}$. BEA(2003).
$INST_j$	Index of institutional development. Kaufmann et al. (2002).
LI_{ij}	Average labor intensity of majority-owned non-bank US affiliates, defined as $LI_{ij} = \frac{EMP_{ij}}{VALUE_{ij}}$. BEA(2003).
LIC_{ij}	Royalties and license fees paid by US affiliates to parent company. BEA (2003).
MP_{ij}	Total imports of majority-owned non-bank US affiliates from parent companies. BEA (2003).
$OPEN_j$	Index on openness to trade (0 = closed, 1 = open). Sachs and Warner (1995).
RES_{ij}	Expenditure for research and development of majority-owned non-bank US affiliates. BEA (2003).

$SALES_{ij}$	Total sales of majority-owned non-bank US affiliates. BEA (2003).
SES_j	Secondary school enrollment (in percent of population of official school age). World Bank (2002).
$VALUE_{ij}$	Total value added of majority-owned non-bank US affiliates. BEA (2003).
$VERT_{ij}$	Degree of vertical integration of majority-owned non-bank US affiliates, defined as $VERT_{ij} = \frac{XP_{ij} + MP_{ij}}{SALES_{ij}}$. BEA(2003).
$WAGE_{ij}$	Total employee compensation of majority-owned non-bank US affiliates. BEA (2003).
X_{ij}	Total exports of majority-owned non-bank US affiliates. BEA (2003).
XIN_{ij}	Average export intensity of majority-owned non-bank US affiliates, defined as $XIN_{ij} = \frac{X_{ij}}{SALES_{ij}}$. BEA (2003)
XP_{ij}	Total exports of majority-owned non-bank US affiliates to parent companies. BEA (2003).
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