Does Foreign Direct Investment Accelerate Economic Growth?

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Abstract: This paper uses new statistical techniques and two new databases to reassess the relationship between economic growth and FDI. After resolving biases plaguing past work, we find that the exogenous component of FDI does not exert a robust, independent influence on growth.

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I. Introduction

With the drying-up of commercial bank lending to developing economies in the 1980s, most countries eased restrictions on foreign direct investment (FDI) and many aggressively offered tax incentives and subsidies to attract foreign capital (Aitken and Harrison, 1999; World Bank, 1997a,b). Along with these policy changes, there was a surge of non-commercial bank private capital flows to developing economies in the 1990s. Private capital flows to emerging market economies exceeded $320 billion in 1996 and reached almost $200 billion in 2000. Even the 2000 figure is almost four times larger than the peak commercial bank lending years of the 1970s and early 1980s. Furthermore, FDI now accounts for over 60 percent of private capital flows. While the explosion of FDI flows is unmistakable, the growth effects remain unclear.

The economic rationale for offering special incentives to attract FDI frequently derives from the belief that foreign investment produces externalities in the form of technology transfers and spillovers. Romer (1993), for example, argues that there are important "idea gaps" between rich and poor countries. He notes that foreign investment can ease the transfer of technological and business know-how to poorer countries. These transfers may have substantial spillover effects for the entire economy. Thus, foreign investment may boost the productivity of all firms -- not just those receiving foreign capital (Rappaport, 2000). While there are sound conceptual reasons for believing that FDI can ignite economic growth, the empirical evidence is divided.

Firm-level studies of particular countries often find that FDI does *not* boost economic growth and these studies frequently do *not* find positive spillovers running from foreign-owned to domestic-owned firms. Aitken and Harrison's (1999) influential study finds no evidence of a positive technology spillover from foreign firms to domestically owned ones in Venezuela between 1979 and 1989. Similarly, Germidis (1977), Haddad and Aitken (1993), and Mansfield and Romeo (1980) find that FDI does not accelerate growth.[1] Taken together, firm-level studies do not lend much support for the view that FDI accelerates overall economic growth.[2]

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[1] While Blomstrom (1986) finds that Mexican sectors with a higher degree of foreign ownership exhibit faster productivity growth, the study – and similar studies -- suffer from a critical identification problem: if foreign investment gravitates toward more productive industries, the observed positive correlation will overstate the positive impact of FDI on growth. Aitken and Harrison (1999) solve this problem and find no evidence of a positive technology spillover.

[2] Also, see Aitken, Hanson, and Harrison (1997), De Mello (1997), Harrison (1996), and Wheeler and Mody (1992).

Unlike the microeconomic evidence, macroeconomic studies – using aggregate FDI flows for a broad cross-section of countries – generally suggest a positive role for FDI in generating economic growth especially in particular environments (De Gregorio, 1992). For instance, Borensztein, De Gregorio, and Lee (1998) argue that FDI has a positive growth-effect when the country has a highly educated workforce that allows it to exploit FDI spillovers. While Blomstrom, Lipsey, and Zejan (1994) find no evidence that education is critical, they argue that FDI has a positive growth-effect when the country is sufficiently rich. In turn, Alfaro, Chandra, Kalemli-Ozcan, and Sayek. (2000) find that FDI promotes economic growth in economies with sufficiently developed financial markets, while Balasubramanyam, Salisu, and Dapsoford (1996) stress that trade openness is crucial for obtaining the growth-effects of FDI.

The macroeconomic findings on growth and FDI must be viewed skeptically, however. Existing studies do not fully control for simultaneity bias, country-specific effects, and the routine use of lagged dependent variables in growth regressions.[3] These weaknesses can bias the coefficient estimates as well as the coefficient standard errors. Thus, the profession needs to reassess the macroeconomic evidence with econometric procedures that eliminate these potential biases.

This paper uses new statistical techniques and two new databases to reassess the relationship between economic growth and FDI. First, based on a recent World Bank dataset (Kraay, Loayza, Serven, and Ventura, 1999), we construct a panel dataset with data averaged over each of the seven 5-year periods between 1960 and 1995. We also confirm the results using new FDI data from the International Monetary Fund's World (IMF)

Methodologically, we use the Generalized Method of Moments (GMM) panel estimator designed by Arellano and Bover (1995) and Blundell and Bond (1997) to extract consistent and efficient estimates of the impact of FDI flows on economic growth. Unlike past work, the GMM panel estimator exploits the time-series variation in the data, accounts for unobserved country-specific effects, allows for the inclusion of lagged dependent variables as regressors, and controls for endogeneity of all the explanatory variables, including international capital flows. Thus, this paper advances the literature on growth and FDI by enhancing the quality and quantity of the data and by using econometric techniques that ameliorate biases.

Investigating the impact of foreign capital on economic growth has important policy implications. If FDI has a positive impact on economic growth after controlling for endogeneity and other growth determinants, then this weakens arguments for restricting foreign investment. If, however, we find that FDI does not exert a positive impact on growth, then this would suggest a reconsideration of the rapid expansion of tax incentives, infrastructure subsidies, import duty exemptions, and other measures that countries have adopted to attract FDI. While no single paper will resolve these policy issues, this paper contributes to these debates.

This paper finds that the exogenous component of FDI does not exert a robust, positive influence on economic growth. By accounting for simultaneity, country-specific effects, and lagged dependent variables as regressors, we reconcile the microeconomic and macroeconomic evidence. Specifically, there is not reliable cross-country empirical evidence supporting the claim that FDI per se accelerates economic growth.

This paper's findings are robust to (a) econometric specifications that allow FDI to influence growth differently depending on national income, school attainment, domestic financial development, and openness to international trade, (b) alternative estimation procedures, (c) different conditioning information sets and samples, (d) the use of portfolio inflows instead of FDI, and (e) the use of alternative databases on FDI. The data produce consistent results: there is not a robust, causal link running from FDI to economic growth.

This paper's results, however, should not be viewed as suggesting that foreign capital is irrelevant for long-run growth. Blomstrom, Lipsey, and Zejan (1994), Borensztein, De Gregorio, and Lee (1998) show, and this paper confirms, that there are many econometric specifications in which FDI is positively linked with long-run growth. FDI may even be a good signal of economic success as emphasized by Blomstrom, Lipsey, and Zejan (1994). More generally, "openness"—defined in a less narrow sense than FDI inflows -- may be crucial for economic success, as suggested by other research (e.g., Landes, 1997; Henry, 2000; Bekaert, Harvey, and Lundblad, 2001; Klein, Michael, and Giovanni Olivei, 2001). Rather, than examine these broad issues, this paper's contribution is much narrower: after controlling for the joint determination of growth and foreign capital flows, country-specific factors, and other growth determinants, the data do not suggest a strong independent impact of FDI on economic growth. In terms of policy implications, this paper's analyses – along with the influential microeconomic study by

[3] While Blomstrom, Lipsey, and Zejan (1994) find that FDI Granger-causes economic growth, Kholdy (1995) disagrees.

Aitken and Harrison (1999) – do not support special tax breaks and subsidies to attract foreign capital. Instead, the literature suggests that sound policies encourage economic growth and also provide an attractive environment for foreign investment.

Before continuing, it is worth emphasizing this paper's boundaries. We do not discuss the determinants of FDI. Instead, we extract the exogenous component of FDI and using lagged values of the regressors. Also, we do not examine any particular country in depth. We use data on 72 countries over the period 1960-95. Thus, our investigation provides evidence based on a cross-section of countries.

II. **Econometric Framework**

This section describes two econometric methods that we use to assess the relationship between FDI inflows and economic growth. We first use simple ordinary least squares (OLS) regressions with one observation per country over the 1960-95 period. Second, we use a dynamic panel procedure with data averaged over five-year periods, so that there are seven possible observations per country over the 1960-95 period.

A. OLS framework

The pure cross-sectional, OLS analysis uses data averaged over 1960-95, such that there is one observation per country, and heteroskedasticity-consistent standard errors. The basic regression takes the form:

$$\text{GROWTH}_i = \alpha + \beta FDI_i + \gamma' [\text{CONDITIONING SET}]_i + \varepsilon_i, \qquad (1)$$

where the dependent variable, GROWTH, equals real per capita GDP growth, FDI is gross private capital inflows to a country, and CONDITIONING SET represents a vector of conditioning information.

B. Motivation for the Dynamic Panel Model

The dynamic panel approach offers advantages to OLS and also improves on previous efforts to examine the FDI-growth link using panel procedures. First, estimation using panel data -- that is pooled cross-section and time-series data – allows us to exploit the time-series nature of the relationship between FDI and growth. Second, in a pure cross-country instrumental variable regression, any unobserved country-specific effect becomes part of the error term, which may bias the coefficient estimates as we explain in detail below. Our panel procedures control for country-specific effects. Third, unlike existing cross-country studies, our panel estimator (a) controls for the potential endogeneity of *all* explanatory variables and (b) accounts explicitly for the biases induced by including

initial real per capita GDP in the growth regression. These weaknesses may bias both the coefficient estimates and their standard errors, potentially leading to erroneous conclusions.

C. Detailed Presentation of the Econometric Methodology

We use the Generalized-Method-of-Moments (GMM) estimators developed for dynamic panel data that were introduced by Holtz-Eakin, Newey, and Rosen (1990), Arellano and Bond (1991), and Arellano and Bover (1995). Our panel consists of data for a maximum of 72 countries over the period 1960-1995, though capital flow data does not begin until 1970 for many countries. We average data over non-overlapping, five-year periods, so that data permitting there are seven observations per country (1961-65; 1966-70; etc.). The subscript "t" designates one of these five-year averages. Consider the following regression equation,

$$y_{i,t} - y_{i,t-1} = (\alpha - 1)y_{i,t-1} + \beta' X_{i,t} + \eta_i + \varepsilon_{i,t} \qquad (2)$$

where y is the logarithm of real per capita GDP, X represents the set of explanatory variables (other than lagged per capita GDP), η is an unobserved country-specific effect, ε is the error term, and the subscripts i and t represent country and time period, respectively. Specifically, X includes FDI inflows to a country as well as other possible growth determinants. We also use time dummies to account for period-specific effects, though these are omitted from the equations in the text. We can rewrite equation (2).

$$y_{i,t} = \alpha y_{i,t-1} + \beta' X_{i,t} + \eta_i + \varepsilon_{i,t} \qquad (3)$$

To eliminate the country-specific effect, take first-differences of equation (3).

$$y_{i,t} - y_{i,t-1} = \alpha\left(y_{i,t-1} - y_{i,t-2}\right) + \beta'\left(X_{i,t} - X_{i,t-1}\right) + \left(\varepsilon_{i,t} - \varepsilon_{i,t-1}\right)$$

The use of instruments is required to deal with (1) the endogeneity of the explanatory variables, and, (2) the problem that by construction the new error term $\varepsilon_{i,t} - \varepsilon_{i,t-1}$ is correlated with the lagged dependent variable, $y_{i,t-1} - y_{i,t-2}$. Under the assumptions that (a) the error term is not serially correlated, and (b) the explanatory variables are weakly exogenous (i.e., the explanatory variables are uncorrelated with future realizations of the error term), the GMM dynamic panel estimator uses the following moment conditions.

$$E\left[y_{i,t-s} \cdot \left(\varepsilon_{i,t} - \varepsilon_{i,t-1}\right)\right] = 0 \quad for\ s \geq 2; t = 3, \ldots, T \qquad (4)$$

$$E\left[X_{i,t-s}\cdot\left(\varepsilon_{i,t}-\varepsilon_{i,t-1}\right)\right]=0 \quad for\ s\geq 2; t=3,\ldots,T \tag{5}$$

We refer to the GMM estimator based on these conditions as the difference estimator.

There are, however, conceptual and statistical shortcomings with this difference estimator. Conceptually, we would also like to study the cross-country relationship between financial development and per capita GDP growth, which is eliminated in the difference estimator. Statistically, Alonso-Borrego and Arellano (1996) and Blundell and Bond (1997) show that when the explanatory variables are persistent over time, lagged levels make weak instruments for the regression equation in differences. Instrument weakness influences the asymptotic and small-sample performance of the difference estimator. Asymptotically, the variance of the coefficients rises. In small samples, weak instruments can bias the coefficients.

To reduce the potential biases and imprecision associated with the usual estimator, we use a new estimator that combines in a system the regression in differences with the regression in levels [Arellano and Bover's 1995 and Blundell and Bond 1997]. The instruments for the regression in differences are the same as above. The instruments for the regression in levels are the lagged differences of the corresponding variables. These are appropriate instruments under the following <u>additional</u> assumption: although there may be correlation between the levels of the right-hand side variables and the country-specific effect in equation (3), there is no correlation between the differences of these variables and the country-specific effect, i.e.,

$$\begin{aligned} &E\left[y_{i,t+p}\cdot\eta_i\right]=E\left[y_{i,t+q}\cdot\eta_i\right] \\ &and\quad E\left[X_{i,t+p}\cdot\eta_i\right]=E\left[X_{i,t+q}\cdot\eta_i\right] \quad for\ all\ p\ and\ q \end{aligned} \tag{6}$$

The additional moment conditions for the second part of the system (the regression in levels) are:

$$E\left[\left(y_{i,t-s}-y_{i,t-s-1}\right)\cdot\left(\eta_i+\varepsilon_{i,t}\right)\right]=0 \quad for\ s=1 \tag{7}$$

$$E\left[\left(X_{i,t-s}-X_{i,t-s-1}\right)\cdot\left(\eta_i+\varepsilon_{i,t}\right)\right]=0 \quad for\ s=1 \tag{8}$$

Thus, we use the moment conditions presented in equations (4), (5), (7), and (8), use instruments lagged two period (t-2), and employ a GMM procedure to generate consistent and efficient parameter estimates.[4,5]

[4] We use a variant of the standard two-step system estimator that controls for heteroskedasticity. Typically, the system estimator treats the moment conditions as applying to a particular time period. This provides for a more flexible variance-covariance structure of the moment conditions because the variance for a given moment condition is not assumed to be the

Consistency of the GMM estimator depends on the validity of the instruments. To address this issue we consider two specification tests suggested by Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1997). The first is a Sargan test of over-identifying restrictions, which tests the overall validity of the instruments by analyzing the sample analog of the moment conditions used in the estimation process. The second test examines the hypothesis that the error term $\varepsilon_{i,t}$ is not serially correlated. In both the difference regression and the system difference-level regression we test whether the differenced error term is second-order serially correlated (by construction, the differenced error term is probably first-order serially correlated even if the original error term is not).

III. Data

We collected data on FDI from two sources. First, we use data from the World Bank's ongoing project to improve the accuracy, breadth, and length of national accounts data (Kraay, Loayza, Serven, and Ventura, 1999). Second, we confirm the findings using the IMF's World Economic Output (2001) data on openness.

FDI equals gross FDI inflows as a share of GDP. We confirm the results using FDI inflows per capita.[6]

GROWTH equals the rate of real per capita GDP growth.

To assess the link between international capital flows and economic growth and its sources, we control for other growth determinants. *Initial income per capita* equals the logarithm of real per capita GDP at the start of each period, so that it equals 1960 in the pure cross-country analyses and the first year of the five-year period in the

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same across time. This approach has the drawback that the number of overidentifying conditions increases dramatically as the number of time periods increases. Consequently, this typical two-step estimator tends to induce over-fitting and potentially biased standard errors. To limit the number of overidentifying conditions, we follow Calderon, Chong and Loayza (2000) and apply each moment condition to all available periods. This reduces the over-fitting bias of the two-step estimator. However, applying this modified estimator reduces the number of periods by one. While in the standard estimator time dummies and the constant are used as instruments for the second period, this modified estimator does not allow the use of the first and second period. We confirm the results using the standard system estimator.

[5] Recall that we assume that the explanatory variables are "weakly exogenous." This means they can be affected by current and past realizations of the growth rate but not future realizations of the error term. Weak exogeneity does not mean that agents do not take into account expected future growth in their decision to undertake FDI; it just means that unanticipated shocks to future growth do not influence current FDI. We statistically assess the validity of this assumption.

[6] Countries in the sample: Argentina, Australia, Austria, Belgium, Bolivia, Brazil, Central African Republic, Canada, Switzerland, Chile, Cameroon, Congo, Colombia, Costa Rica, Cyprus, Denmark, Dominican Republic, Algeria (DZA), Ecuador, Egypt, Finland, France, Gambia, Great Britain, Germany, Ghana, Guatemala, Guyana, Greece, Haiti, Honduras, Hong Kong, India, Indonesia, Ireland, Israel, Italy, Jamaica, Japan, Kenya, Korea, Sri Lanka, Lesotho, Mexico, Malta, Malaysia, Mauritius, Niger, Nicaragua, Netherlands, Norway, New Zealand, Pakistan, Panama, Peru, Philippines, Papua New

panel estimates. *Average years of schooling* equals the average years of schooling of the working age population. *Inflation* equals the average growth rate in the consumer price index. *Government size* equals the size of the government as a share of GDP. *Openness to trade* equals exports plus imports relative to GDP. *Black market premium* equals the black market premium in the foreign exchange market. *Private Credit* equals credit by financial intermediaries to the private sector as a share of GDP (Beck, Levine, Loayza, 2000).

Table 1 present summary statistics and correlations using data averaged over the 1960-95 period, one observation per country. There is considerable cross-country variation. For instance, the mean per capita growth rate for the sample is 1.9 percent per annum, with a standard deviation of 1.8. The maximum growth rate was enjoyed by Korea (7.2), while Niger and Zaire suffered with a per capital growth rate of worse than –2.7 percent per annum. In terms of five-year periods, the minimum value is –10.0 percent growth (Rwanda, 1990-95) and a number of countries experienced five-year growth spurts of greater than 8 percent per annum. The data also suggest large variation in FDI. The average was 1.1 percent of GDP. Malaysia and Trinidad and Tobago had FDI inflows of more than 3.6 percent of GDP over the entire 1960-95 period, while Sudan essentially had no FDI over this period. In terms of five-year period, the maximum value of FDI was 7.3 percent of GDP (Malaysia, 1990-95). The variability over five-year periods is much larger than when using lower frequency data. Although Table 1 does not suggest a simple, positive relationship between FDI and growth, we will see that there are many growth regression specifications that yield a positive coefficient on FDI.

IV. **Results**

This paper estimates the effects of FDI inflows on economic growth after controlling for other growth determinants and the potential biases induced by endogeneity, country-specific effects, and the inclusion of initial income as a regressor. Moreover, we examine whether the growth-effects of FDI depend on the level of educational attainment of the recipient country, the level of economic development of the recipient country, the level of financial development of the recipient country, and trade openness.

Guinea, Portugal, Paraguay, Rwanda, Spain, Sweden, Senegal, Sierra Leone, El Salvador, Suriname, Sweden, Syria, Togo, Thailand, Trinidad and Tobago, Uruguay, United States, Venezuela, South Africa, Zaire, Zimbabwe.

A. Findings

Table 2 shows that the exogenous component of FDI does not exert a reliable, positive impact on economic growth. The table presents OLS and Panel estimates using a variety of conditioning information sets. In the OLS regressions, initial income and average years of schooling enter significantly and with the signs and magnitudes found in many pure cross-country regressions. FDI does not enter these growth regressions significantly. When we move to the five-year panel data, FDI enters three of the regressions significantly but not the other four. FDI enters the regressions significantly and positively in the regression that only includes initial income per capita and average years of schooling as control variables. FDI remains significantly and positively linked with growth when controlling for inflation or government size. However, FDI becomes insignificant once we control for trade openness, the black market premium, or financial development. Furthermore, the coefficient on FDI is unstable in the panel regressions, ranging from 323 (when controlling for initial income, schooling, and inflation) to –34 (when controlling for initial income, schooling, and financial development). This instability is not due to changes in sample. When the regressions are restricted to have the same number of observations, the coefficient on FDI remains unstable.[7] Note that the Sargan and serial correlation tests do not reject the econometric specification. The Table 2 regressions do not reject the null hypothesis that FDI does not exert an independent influence on economic growth.

We also assess whether the impact of FDI on growth depends importantly on the stock of human capital. Borensztein et al. (1998) find that in countries with low levels of human capital the direct effect of FDI on growth is negative, though sometimes insignificant. But, once human capital passes a threshold, they find that FDI has a positive growth-effect. The rationale is that only countries with sufficiently high levels of human capital can exploit the technological spillovers associated with FDI. Thus, we include the term, FDI*SCHOOL, which equals the product of FDI and the average years of schooling of the working age population.

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[7] Also, note that the coefficient on FDI is frequently, though not always, an order of magnitude larger in the panel than the OLS regressions. We speculate that this is due to the use of more volatile data. When we restrict the sample to richer countries (which are also countries with less volatile growth rates), the panel coefficient on FDI approaches that in the OLS regressions. Similarly, when we use the IMF's World Economic Outlook data, which contains fewer very poor, highly volatile countries than the World Bank data, the panel coefficients are closer to the coefficients from the OLS regressions. These estimates are consistent with the view that short-run fluctuations in the investment environment, and hence FDI, are associated with large,

Table 3 shows that the lack of an impact of FDI on growth does not depend on the stock of human capital. In the OLS regressions, FDI and the interaction term do not enter significantly in any of the six regressions. In the panel regressions, FDI and the interaction term occasionally enter significantly, but even here the results do not conform to theory. Namely, when FDI and the interaction do enter significantly, the term on FDI is significant and the coefficient on the interaction term is negative. This suggests that FDI is only growth enhancing in countries with low educational attainment. These counter intuitive results may result from including schooling, FDI, and the interaction term simultaneously.[8] When excluding schooling, however, the regressions do not yield robust results with a positive coefficient on the interaction term. Finally, we also examined the importance of human capital using an alternative specification. Instead of including the interaction term, FDI*schooling, we created a dummy variable, D, that takes on the value one if the country has greater than average schooling and zero otherwise. We then included the term FDI*D. This specification also indicated that the impact of FDI on growth does not robustly vary with the level of educational attainment. While some may interpret the results in Table 3 as suggesting that the coefficient on FDI becomes significant and positive in the panel regressions when controlling for the interaction with schooling, we note that (i) the interaction terms is frequently insignificant, (ii) the signs do not conform with theory, (iii) and the OLS regressions suggest a fragile relationship.

Table 4 shows that there is not a reliable link between growth and FDI when allowing for the impact of FDI on growth to depend on the level of income per capita. Blomstrom, Lipsey, and Zejan (1994) argue that very poor countries – countries that are very technologically backward – are not able to exploit FDI. They find that very poor countries do not enjoy substantial growth benefits from FDI, but sufficiently rich countries do. Thus, we re-ran the regressions using the interaction term, FDI*income per capita. This interaction does not robustly enter the growth regressions significantly.[9]

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though temporary, booms and busts in economic performance; thus, the use of higher frequency data produces larger (though still insignificant) coefficients on FDI than pure cross-country regressions with data averaged over the 1960-95 period.

[8] This conjecture is supported by the observation that no country passes the inflection point. For instance, from the panel results in regression six, 351/108.6 equals 3.23, but the highest level of school attainment is 2.4 in Denmark.

[9] The only regression where the interaction enters significantly is the regression controlling only for the black market premium. Even here, however, the interaction term enters negatively, and does not alter the relationship for hardly any countries in the sample because the cut-off is so high, e.g., the logarithm of real per capita GDP would have to be greater than, 1114.7/110.4 = 10.1, which is the case for only a handful of countries during the end of the sample.

Table 5 assesses whether the level of financial development in the recipient country influences the growth-FDI relationship. Better-developed financial systems improve capital allocation and stimulate growth (Beck, Levine, and Loayza, 2000). Capital inflows to a country with a well developed financial may, therefore, produce substantial growth effects. Thus, we re-ran the regressions using the interaction term, FDI*Credit.

The OLS regressions in Table 5 suggest that FDI has a positive growth effect in sufficiently financially developed economies, which confirms the Alfaro et al. (2001) findings. Economically, however, these results are not as compelling as the t-statistics suggest. When we ask the question, at what level of financial development does FDI produce a positive impact on economic growth, the answer is none. For example, from Table 5 regression 1 (OLS), the cut-off is 417/124, which equals 3.4, so that countries where the logarithm of Private Credit is greater than 3.4 have a positive growth-FDI relationship. But, the maximum value of the logarithm of Private Credit in the sample is 0.35 (Switzerland).

Moreover, the panel evidence is even weaker. The panel regressions never demonstrated a significant coefficient on the FDI-financial development interaction term. On net, these results do not provide much support for the view that FDI flows to financially developed economies exert an exogenous impact on growth.

Table 7 assesses whether the relationship between FDI and growth varies with the degree of trade openness. Balasubramanyam, Salisu, and Sapsford (1996, 1999) and Kawai (1994) find evidence that FDI is particularly good for economic growth in countries with open trade regimes. Thus, we include an interaction term of FDI and Openness to Trade in the Table 7 regressions. The FDI-Trade interaction term does not enter significantly in any of the OLS regressions. While the FDI-Trade interaction term enters significantly at the 0.10 level in three of the panel regressions, it enters insignificantly in the other three. In sum, we do not find a robust link between FDI and growth even when allowing this relationship to vary with trade openness.

While FDI flows may go hand-in-hand with economic success, they do not tend to exert an independent growth effect. Thus, by correcting statistical shortcoming with past work this paper reconciles the broad-cross country evidence with microeconomic studies.

B. Sensitivity Analyses

We conduct a number of sensitivity analyses to assess the robustness of the results. First, we use a standard instrumental variable estimator in a pure cross-country context (one observation per country) and reexamine whether cross-country variations in the exogenous component of FDI explain cross-country variations in the rate of economic growth. We use generalized method of moments (GMM).[10] We use *linear* moment conditions, which amounts to the requirement that the instrumental variables (Z) are uncorrelated with the error term in the growth regression in equation (1). The economic meaning of these conditions is that the instrumental variables can only affect GROWTH through FDI and the other variables in the conditioning information set. To test this condition, we use Hansen's (1982) test of the overidentifying restrictions, and we cannot reject the given moment conditions.[11] The GMM results confirm this paper's results.

Second, we confirm this paper's findings using two alternative estimators. Instead of using the Calderon, Chong and Loayza's (2000) method of limiting the possibility of over-fitting by restricting the dimensionality of the instrument set (described above), we use the standard system estimator. We confirm this paper's results. In addition, although the standard estimator and the Calderon, Chong and Loayza's (2000) modification are two-step estimators where the variance-covariance matrix is constructed from the first-stage residuals to allow for non-spherical distributions of the error term and thereby get more efficient estimates in the second stage, these two-step GMM estimators sometimes converges to their asymptotic distributions slowly. This tends to bias the t-statistics upward! Nonetheless, we re-ran the regressions using the first-stage results, which assume homoskedasticity and independence of the error terms. We again confirm this paper's results.

Third, we used alternative samples and specifications. When using a common sample across all of the regressions, this does not change the results. Similarly, using the natural logarithm of FDI does not alter the

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[10] Two-stage instrumental variable procedures produce the same conclusions.

[11] Intuitively, the fact that we have more moment conditions (instruments) than parameters means that estimation could be done with fewer conditions. Thus, we can estimate the error term under a set of moment conditions that excludes one instrumental variable at a time; we can then analyze if each estimated error term is uncorrelated with the excluded instrumental variable. The null hypothesis of Hansen's test is that the overidentifying restrictions are valid, that is, the instrumental variables are not correlated with the error term. The test statistic is simply the sample size times the value attained for the objective function at the GMM estimate (called the *J-statistic*). Hansen's test statistic is distributed as χ^2 with degrees of freedom equal to the number of moment conditions minus the number of estimated parameters.

conclusions. Limiting the sample to developing countries, i.e., countries not classified by the World Bank as high-income economies, does not alter the findings. We also considered exchange rate volatility, changes in the terms of trade in the regression, and various combinations of the conditioning information set (Levine and Renelt, 1992). Including these factors did not alter the conclusions. This paper does not prove that FDI is unimportant. Rather, this cross-country analysis – in conjunction with microeconomic evidence -- reduces confidence in the belief that FDI accelerate GDP growth.

Fourth, we examine whether FDI exerts on impact on productivity growth using the Easterly and Levine (2001) measure of total factor productivity (TFP). We find that FDI does not exert a robust impact on TFP.

Fifth, we examined portfolio inflows, and find that they do not have a positive impact on growth.

Finally, we repeated the analyses using the IMF's (World Economic Outlook, 2001) new database on international capital flows. These data were cleaned by the IMF and extended through the end of 2000. The results are very similar to those reported above, so we do not report them.

V. Conclusion

FDI has increased dramatically since the 1980s. Furthermore, many countries have offered special tax incentives and subsidies to attract foreign capital. An influential economic rationale for treating foreign capital favorably is that FDI and portfolio inflows encourage technology transfers that accelerate overall economic growth in recipient countries. While microeconomic studies generally, though not uniformly, shed pessimistic evidence on the growth-effects of foreign capital, many macroeconomic studies find a positive link between FDI and growth. Previous macroeconomic studies, however, do not fully control for endogeneity, country-specific effects, and the inclusion of lagged dependent variables in the growth regression.

After resolving many of the statistical problems plaguing past macroeconomic studies and confirming our results using two new databases on international capital flows, we find that FDI inflows do not exert an independent influence on economic growth. Thus, while sound economic policies may spur both growth and FDI, the results are inconsistent with the view the FDI exerts a positive impact on growth that is independent of other growth determinants.

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Table 1. Summary Statistics

	Mean	Std. Dev.	Min. Value	Max. Value
Growth rate	1.89	1.81	-2.81	7.16
School (years of school in 1960)	5.01	2.51	1.20	11.07
Inflation rate	0.16	0.18	0.04	0.91
Government size (Government Consumption/GDP)	0.15	0.05	0.07	0.31
Openness to trade ((Exports + Imports)/GDP)	0.60	0.37	0.14	2.32
Black market premium	0.23	0.49	0.00	2.77
Private Credit	0.40	0.29	0.04	1.41
Foreign direct investment (as a share of GDP)	0.011	0.010	0.000	0.043

Correlation Matrix

	Growth	School[1]	Inflation[2]	Gov. size[1]	Openness to trade[1]	Black mkt premium[2]	Private Credit[1]	FDI
Growth	1							
Average years of schooling[1]	0.4452*	1						
Inflation[2]	-0.2833*	-0.0752	1					
Government size[1]	0.2402*	0.4151*	-0.2818*	1				
Openness to trade[1]	0.21	0.04	-0.3586*	0.3316*	1			
Black market premium[2]	-0.4341*	-0.3994*	0.3800*	-0.2019	0.0698	1		
Private Credit[1]	0.5528*	0.6791*	-0.4309*	0.3921*	0.028	-0.5995*	1	
Foreign direct investment	0.17	0.12	-0.21	0.2335	0.5557*	-0.0076	0.0457	1

Notes:
1. In the correlations, this variable is included as Ln(variable).
2. In the correlations, this variable is included as Ln(1 + variable).
3. Based on a common sample of 64 countries using the average over the 1960-95 period, so one observation per country.
* - Indicates significant at the 0.05 level.

Table 2: Growth and Foreign Direct Investment

Dependent Variable: Real Per Capita GDP Growth

	1		2		3		4		5		6		7	
Conditioning information se	OLS	Panel	OLS	Panel	OLS	Panel	OLS	Panel	OLS	Panel	OLS	Panel	OLS	Panel
Constant	6.797	-0.723	7.732	9.324	7.363	-10.640	6.222	5.646	7.103	2.391	11.579	5.256	11.702	2.701
	(0.009)	(0.896)	(0.002)	(0.314)	(0.015)	(0.303)	(0.074)	(0.259)	(0.006)	(0.716)	(0.000)	(0.332)	(0.000)	(0.668)
Initial income per capita[1]	-1.175	-0.252	-1.226	-3.026	-1.274	-1.522	-1.236	0.233	-1.191	-0.667	-1.414	0.720	-1.643	-0.508
	(0.008)	(0.854)	(0.003)	(0.254)	(0.005)	(0.500)	(0.006)	(0.822)	(0.007)	(0.708)	(0.000)	(0.415)	(0.000)	(0.679)
Average years of schooling[2]	2.752	2.551	2.774	8.629	2.979	6.770	2.934	0.096	2.661	2.480	1.840	-2.576	2.115	1.617
	(0.000)	(0.407)	(0.000)	(0.182)	(0.000)	(0.195)	(0.000)	(0.967)	(0.001)	(0.556)	(0.003)	(0.230)	(0.001)	(0.696)
Inflation[2]			-3.377	-0.887									1.398	-0.161
			(0.034)	(0.839)									(0.355)	(0.949)
Government size[1]					-0.083	-6.461							-0.854	-2.796
					(0.878)	(0.060)							(0.127)	(0.165)
Openness to trade[1]							0.193	4.830					0.427	1.664
							(0.650)	(0.000)					(0.329)	(0.375)
Black market premium[2]									-0.292	-0.590			-1.028	-1.505
									(0.792)	(0.645)			(0.272)	(0.285)
Private sector credit[2]											(1.397)	2.262	(1.714)	(1.250)
											(0.000)	(0.027)	(0.001)	(0.333)
Foreign direct investment	12.553	202.167	2.852	322.933	16.598	215.245	10.677	17.045	12.558	220.854	14.854	-34.511	21.931	-9.434
	(0.582)	(0.006)	(0.897)	(0.051)	(0.469)	(0.049)	(0.631)	(0.748)	(0.579)	(0.160)	(0.414)	(0.609)	(0.238)	(0.917)
Number of observations[3]	68	279	68	270	68	273	67	277	66	260	67	246	64	242
R^2 (adjusted)	0.238		0.287		0.238		0.258		0.209		0.437		0.510	
Sargan test (p-value)[4]		0.098		0.770		0.756		0.299		0.302		0.304		0.191
Serial correlation test (p-value)[5]		0.939		0.922		0.897		0.580		0.805		0.234		0.256

Notes: P-values are in parentheses below estimates coefficient values.

1. In the regression, this variable is included as Ln(variable).
2. In the regression, this variable is included as Ln(1 + variable).
3. Panel estimations use 5-year periods.
4. The null hypothesis is that the instruments are not correlated with the residuals.
5. The null hypothesis is that the errors in the first difference regression exhibit no second order serial correlation.

Table 3: Growth, Foreign Direct Investment and Education

Dependent Variable: Real Per Capita GDP Growth

	1		2		3		4		5		6	
Conditioning information set	OLS	Panel	OLS	Panel	OLS	Panel	OLS	Panel	OLS	Panel	OLS	Panel
Constant	6.841	1.504	7.727	11.765	7.312	-21.189	6.050	6.882	7.250	-3.460	6.812	-4.611
	(0.011)	(0.857)	(0.003)	(0.252)	(0.017)	(0.120)	(0.093)	(0.179)	(0.007)	(0.651)	(0.029)	(0.513)
Initial income per capita[1]	-1.175	-1.484	-1.226	-4.718	-1.281	-2.346	-1.238	-0.625	-1.190	-0.631	-1.391	-3.843
	(0.008)	(0.451)	(0.003)	(0.091)	(0.005)	(0.295)	(0.007)	(0.593)	(0.007)	(0.738)	(0.002)	(0.012)
Average years of schooling[2]	2.721	7.025	2.778	15.183	3.120	12.607	3.052	2.612	2.557	5.520	3.415	14.161
	(0.001)	(0.111)	(0.000)	(0.026)	(0.002)	(0.015)	(0.000)	(0.341)	(0.006)	(0.191)	(0.001)	(0.000)
Inflation[2]			-3.378	-2.783							-3.812	-6.959
			(0.035)	(0.586)							(0.052)	(0.026)
Government size[1]					-0.122	-10.233					-0.555	-7.242
					(0.837)	(0.015)					(0.388)	(0.013)
Openness to trade[1]							0.199	4.012			-0.078	1.706
							(0.644)	(0.005)			(0.871)	(0.440)
Black market premium[2]									-0.314	0.690	0.037	2.256
									(0.782)	(0.549)	(0.977)	(0.014)
Foreign direct investment	7.585	471.575	3.460	567.935	35.139	588.334	28.284	155.478	-2.463	681.882	46.078	351.000
	(0.901)	(0.010)	(0.953)	(0.028)	(0.604)	(0.004)	(0.618)	(0.040)	(0.970)	(0.000)	(0.485)	(0.000)
FDI * Schooling	3.350	-183.992	-0.411	-161.501	-12.179	-250.233	-11.905	-48.640	10.084	-243.945	-23.042	-108.606
	(0.935)	(0.036)	(0.992)	(0.198)	(0.785)	(0.063)	(0.756)	(0.232)	(0.817)	(0.000)	(0.606)	(0.014)
Number of observations[3]	68	279	68	270	66	273	67	277	66	260	65	248
R^2 (adjusted)	0.226		0.275		0.226		0.247		0.197		0.258	
Sargan test (p-value)[4]		0.340		0.690		0.828		0.286		0.324		0.144
Serial correlation test (p-value)[5]		0.332		0.506		0.273		0.283		0.158		0.221

Notes: P-values are in parentheses below estimates coefficient values.

1. In the regression, this variable is included as Ln(variable).
2. In the regression, this variable is included as Ln(1 + variable).
3. Panel estimations use 5-year periods.
4. The null hypothesis is that the instruments are not correlated with the residuals.
5. The null hypothesis is that the errors in the first difference regression exhibit no second order serial correlation.

Table 4: Growth, Foreign Direct Investment and Income Level

Dependent Variable: Real Per Capita GDP Growth

Conditioning information set	1 OLS	Panel	2 OLS	Panel	3 OLS	Panel	4 OLS	Panel	5 OLS	Panel	6 OLS	Panel
Constant	4.609	-5.254	5.623	8.400	5.263	-15.806	4.493	4.792	5.029	-4.906	3.765	-3.550
	(0.209)	(0.459)	(0.102)	(0.446)	(0.167)	(0.213)	(0.293)	(0.410)	(0.178)	(0.562)	(0.368)	(0.675)
Initial income per capita[1]	-0.880	0.320	-0.942	-3.356	-0.939	-1.638	-0.961	-0.247	-0.918	-0.113	-1.002	-1.340
	(0.115)	(0.837)	(0.071)	(0.225)	(0.101)	(0.457)	(0.090)	(0.829)	(0.100)	(0.952)	(0.072)	(0.315)
Average years of schooling[2]	2.698	2.731	2.723	10.933	2.998	8.922	2.901	2.240	2.635	4.043	3.205	6.488
	(0.000)	(0.377)	(0.000)	(0.075)	(0.000)	(0.057)	(0.000)	(0.391)	(0.001)	(0.327)	(0.000)	(0.018)
Inflation[2]			-3.354	-2.248							-4.078	-4.433
			(0.034)	(0.609)							(0.034)	(0.124)
Government size[1]					-0.282	-7.663					-0.662	-4.512
					(0.627)	(0.029)					(0.288)	(0.090)
Openness to trade[1]							0.100	4.034			-0.239	2.918
							(0.813)	(0.005)			(0.618)	(0.173)
Black market premium[2]									-0.232	0.893	0.127	1.105
									(0.840)	(0.572)	(0.920)	(0.257)
Foreign direct investment	224.576	610.123	206.638	664.202	268.111	669.822	226.791	254.810	209.550	1114.655	322.879	311.729
	(0.265)	(0.055)	(0.289)	(0.149)	(0.219)	(0.178)	(0.245)	(0.421)	(0.312)	(0.030)	(0.131)	(0.137)
FDI * Income per capita	-27.398	-53.443	-26.325	-46.457	-32.294	-56.910	-27.567	-22.900	-25.438	-110.359	-39.591	-30.888
	(0.257)	(0.202)	(0.262)	(0.463)	(0.219)	(0.385)	(0.241)	(0.607)	(0.307)	(0.043)	(0.125)	(0.312)
Number of observations[3]	68	279	68	270	65	273	67	277	66	260	65	248
R^2 (adjusted)	0.237		0.286		0.240		0.257		0.206		0.367	
Sargan test (p-value)[4]		0.191		0.745		0.821		0.322		0.440		0.082
Serial correlation test (p-value)[5]		0.553		0.871		0.935		0.680		0.405		0.587

Notes: P-values are in parentheses below estimates coefficient values.

1. In the regression, this variable is included as Ln(variable).
2. In the regression, this variable is included as Ln(1 + variable).
3. Panel estimations use 5-year periods.
4. The null hypothesis is that the instruments are not correlated with the residuals.
5. The null hypothesis is that the errors in the first difference regression exhibit no second order seria correlation.

Table 5: Growth, Foreign Direct Investment and Finance

Dependent Variable: Real Per Capita GDP Growth

Conditioning information set	1 OLS	Panel	2 OLS	Panel	3 OLS	Panel	4 OLS	Panel	5 OLS	Panel	6 OLS	Panel
Constant	9.236	4.453	9.380	-7.651	9.609	-4.337	8.887	8.217	9.454	0.383	9.119	-4.088
	(0.000)	(0.592)	(0.000)	(0.146)	(0.001)	(0.508)	(0.007)	(0.094)	(0.000)	(0.935)	(0.001)	(0.627)
Initial income per capita[1]	-1.407	-0.724	-1.401	1.498	-1.479	1.780	-1.460	-0.743	-1.397	0.624	-1.465	-0.650
	(0.000)	(0.712)	(0.000)	(0.215)	(0.000)	(0.235)	(0.001)	(0.453)	(0.001)	(0.620)	(0.001)	(0.723)
Average years of schooling[2]	2.294	2.087	2.358	-0.596	2.483	-1.910	2.477	2.637	2.162	-1.030	2.503	3.060
	(0.000)	(0.630)	(0.000)	(0.813)	(0.001)	(0.550)	(0.000)	(0.240)	(0.002)	(0.746)	(0.001)	(0.458)
Inflation[2]			-1.730	-2.584							-1.118	-2.123
			(0.222)	(0.197)							(0.464)	(0.475)
Government size[1]					-0.061	1.600					-0.325	-4.397
					(0.911)	(0.326)					(0.573)	(0.071)
Openness to trade[1]							0.114	4.448			0.155	0.506
							(0.753)	(0.001)			(0.714)	(0.824)
Black market premium[2]									-0.732	-4.589	-1.162	-3.900
									(0.336)	(0.062)	(0.100)	(0.034)
Foreign direct investment	-416.605	-340.106	-376.385	71.044	-402.970	-107.266	-402.532	-40.957	-380.217	-237.720	119.251	-300.341
	(0.000)	(0.222)	(0.000)	(0.624)	(0.000)	(0.431)	(0.000)	(0.775)	(0.001)	(0.263)	(0.000)	(0.046)
FDI * Credit	123.541	136.398	110.615	-8.229	120.562	41.469	119.495	33.787	113.364	62.675	93.643	84.242
	(0.000)	(0.100)	(0.000)	(0.855)	(0.000)	(0.347)	(0.000)	(0.429)	(0.000)	(0.218)	(0.001)	(0.133)
Number of observations[3]	67	269	67	264	65	263	66	267	65	250	64	242
R^2 (adjusted)	0.441		0.447		0.442		0.456		0.432		0.451	
Sargan test (p-value)[4]		0.043		0.012		0.034		0.116		0.070		0.306
Serial correlation test (p-value)[5]		0.787		0.992		0.206		0.356		0.213		0.145

Notes: P-values are in parentheses below estimates coefficient values.

1. In the regression, this variable is included as Ln(variable).
2. In the regression, this variable is included as Ln(1 + variable).
3. Panel estimations use 5-year periods.
4. The null hypothesis is that the instruments are not correlated with the residuals.
5. The null hypothesis is that the errors in the first difference regression exhibit no second order serial correlation.

Table 6: Growth, Foreign Direct Investment and Trade

Dependent Variable: Real Per Capita GDP Growth

	1		2		3		4		5		6	
Conditioning information set	OLS	Panel	OLS	Panel	OLS	Panel	OLS	Panel	OLS	Panel	OLS	Panel
Constant	6.462	4.531	7.563	10.971	5.700	-0.876	6.366	5.419	6.935	6.620	6.336	2.524
	(0.018)	(0.478)	(0.004)	(0.255)	(0.055)	(0.918)	(0.020)	(0.330)	(0.011)	(0.376)	(0.027)	(0.706)
Initial income per capita[1]	-1.135	-1.120	-1.230	-3.168	-1.114	-2.698	-1.137	-0.216	-1.151	-1.393	-1.270	-5.637
	(0.013)	(0.482)	(0.004)	(0.242)	(0.018)	(0.257)	(0.014)	(0.863)	(0.012)	(0.504)	(0.005)	(0.005)
Average years of schooling[2]	2.812	5.182	2.878	9.036	2.847	9.223	2.806	2.519	2.659	4.603	2.991	16.644
	(0.000)	(0.155)	(0.000)	(0.187)	(0.000)	(0.100)	(0.000)	(0.413)	(0.001)	(0.373)	(0.000)	(0.001)
Inflation[2]			-3.057	-2.353							-3.609	-9.122
			(0.061)	(0.529)							(0.065)	(0.014)
Government size[1]					-0.281	-4.762					-0.552	-6.782
					(0.598)	(0.084)					(0.354)	(0.005)
Openness to trade[1]							-0.152	4.869			-0.442	-3.553
							(0.734)	(0.001)			(0.369)	(0.068)
Black market premium[2]									-0.605	-1.823	-0.139	0.555
									(0.654)	(0.176)	(0.919)	(0.625)
Foreign direct investment	16.430	150.596	7.310	234.048	17.881	201.450	20.850	75.550	16.894	99.801	22.961	236.671
	(0.458)	(0.041)	(0.746)	(0.106)	(0.435)	(0.037)	(0.473)	(0.109)	(0.417)	(0.504)	(0.424)	(0.009)
FDI * Trade	29.241	259.748	17.771	56.605	33.007	217.435	35.456	89.843	33.880	148.279	39.920	324.020
	(0.491)	(0.001)	(0.670)	(0.626)	(0.445)	(0.053)	(0.479)	(0.162)	(0.370)	(0.237)	(0.361)	(0.008)
Number of observations[3]	67	276	67	267	66	270	67	275	65	257	65	245
R^2 (adjusted)	0.269		0.305		0.241		0.258		0.249		0.270	
Sargan test (p-value)[4]		0.655		0.825		0.931		0.589		0.387		0.876
Serial correlation test (p-value)[5]		0.318		0.940		0.996		0.443		0.985		0.667

Notes: P-values are in parentheses below estimates coefficient values.
1. In the regression, this variable is included as Ln(variable).
2. In the regression, this variable is included as Ln(1 + variable).
3. Panel estimations use 5-year periods.
4. The null hypothesis is that the instruments are not correlated with the residuals.
5. The null hypothesis is that the errors in the first difference regression exhibit no second order serial correlation.