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IMPACT OF FOREIGN DIRECT INVESTMENT ON THE GROSS DOMESTIC PRODUCT, EXPORTS AND IMPORTS OF FOUR ASIAN COUNTRIES

A PANEL DATA ANALYSIS

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THE economies of China and India have grown rapidly in recent years, after each country adopted a policy of trade liberalization. The growth, in part, is attributed to the flows of foreign capital into both these countries. In one sense, China and India took a leaf from the trade policies adopted much earlier by other Asian countries such as Singapore and Malaysia. In this paper, we examine the interrelations among the variables FDI, GDP, exports, and imports of the four countries, China, India, Malaysia, and Singapore, using the technique of Panel Data Analysis. Our study confirms that FDI promotes economic growth, and further provides an estimate that one dollar of FDI adds about 3.27 dollars to the GDP of each of the four countries. In the process of developing this estimate, we also identified the differential negative effects of the Asian financial crisis on the GDP of each country. Further, we also present an autoregressive approach to forecast the FDI inflows to these four countries. This approach has yielded a very interesting result. According to the estimates of the forecasting model, China has been able to attract $15 billion more in FDI than India, because of the combined effect of its policies. It may be worthwhile for Government of India to take a second look at some of the policies and strategies adopted by China, if it wants to be a future magnet for FDI.

Keywords: *Foreign Direct Investment (FDI), Exports, Imports, Panel Data Analysis, China, India, Malaysia, Singapore.*

Introduction

India and China, two of the largest countries in the world, have experienced rapid economic growth in recent years. The growth, in part, is attributed to the adoption of liberal trade policies by each country, and the consequent surge in the flows of foreign capital to both these countries. In one sense, China and India took a leaf from the progressive trade policies adopted much earlier by other Asian countries such as Singapore and Malaysia. Along with other economies, China and India have also seen a rapid growth in the volume and value of their exports and imports. What is the driving force behind the growth of these two giants? One answer readily given is the Foreign Direct Investment (FDI) by multinational corporations (MNCs). FDI is credited as the main stimulus for the phenomenal growth of these two countries. However, India and China are far behind Malaysia and Singapore in terms of their per capita GDP and other developmental measures. Malaysia and Singapore are recognized as the Newly Industrializing Countries (NICs) or even as Developed Countries (DCs) by some measures, whereas India and China fall in the category of Less Developed Countries (LDCs) or developing countries (Cohn, 2005). Given this dichotomy in the economic status of these countries, what is the effect of FDI on their growth? More specifically, does FDI effect the GDP growth of each country the same way? Or, are there significant cross-country differences? How are the exports and imports of these countries affected by

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their FDI inflows? In this paper, we examine the interrelations among the variables FDI, GDP, exports, and imports of the four countries, China, India, Malaysia, and Singapore, using Panel Data Analysis. The data for this study are extracted from the Database of the World Development Indicators 2006, provided by the World Bank (2006).

The remainder of the paper is organized as follows: In Section 2, we briefly discuss the reasons for the dependence of the LDCs on Foreign Direct Investment in order to stimulate their growth. In Section 3, we present a brief literature review of the theories that link growth and FDI. The discontinuity-points in which the economies of the four countries have undergone structural changes are identified through a simple empirical test in Section 4. The regression models that describe the impact of FDI on GDP, exports, and imports are given in Sections 5, 6, and 7 respectively along with the results generated from panel data analysis. In Section 8, we describe an autoregressive approach to forecast the FDI inflows to the four countries. Panel data analysis plays a role in Section 8 too. Section 9 ends the paper with conclusions.

Foreign Direct Investment and Economic Growth

Why should the developing countries open their borders for Foreign Direct Investment (FDI) by the multinational corporations (MNCs)? All the countries in the world, be they the Less Developed Countries (LDCs) in Africa or Asia, the Newly Industrializing Countries (NICs) in East Asia or Latin America, or the Developed Countries (DCs) in the West, have one thing in common; they all continue to strive for growth – rapid economic growth. There are several factors that help or hinder the economic growth of a country, and the factors, that are often identified as stimulants (World Investment Report UNCTAD, 1994) for a country's growth are: (1) Large amounts of investment capital, (2) Advanced Technologies, (3) Highly skilled labor, (4) Well-developed transportation and communication infrastructure, (5) Stable and supportive political and social institutions, (6) Low tax rates, and (7) Favorable regulatory environment. Differences in the growth rates of the countries are explained by the differences in the endowments or levels of these factors. Less Developed Countries often lack one or more of these resources or factors, and therefore, their growth rates lag behind those of the Developed Countries.

In recent years, several of the LDCs have recognized the importance of these factors, and have initiated steps to create a favorable environment for growth. Perhaps, the most important hurdle faced by the LDCs in their quest for rapid economic growth is the lack of capital, especially capital in the form of foreign exchange reserves that can pay for advanced technologies, and infrastructure. Some of the sources of foreign exchange for an LDC are: (a) Remittances by expatriates, (b) Development assistance and loans from other countries or the U.N. affiliated organizations, (c) Exports, (d) Foreign portfolio investment, and (e) Foreign Direct investment (FDI) by multinational corporations (MNCs). The remittances from expatriates do not often enter the capital pool, and there is some evidence that they may even have a negative impact on the capital formation in the country (Chami, et. al. 2005). Funds given as a part of the development assistance or loans from the World Bank or IMF are generally meant for the development of social, educational or infrastructure projects. Often, the LDCs find it difficult to export the products made from indigenous technologies, because of competition from the manufacturers of goods from advanced countries.

While foreign portfolio investment may, in some cases, contribute to the capital formation in a developing country, often, the capital flows via this route are limited, and above all, they do not provide the advanced technologies needed to compete in the world markets. From the discussion so far, it is apparent that the most viable option for the LDCs to accumulate investment capital and stimulate economic growth is to actively seek foreign direct investment by the MNCs. The Multinational Corporations (MNCs) located in the developed countries (DCs) are the primary source of Foreign Direct Investment for the developing countries.

Why should multinational corporations invest in the developing countries? The factors that motivate the MNCs to invest in the LDCs have been studied by many scholars, most notably by Dunning (1988). Some of the factors that have a significant impact on the FDI decisions of MNCs are: (a) Transportation costs, (b) Restrictions or high tariffs on exports by the home country or imports by the host country (c) Impediments to the licensing of the production technologies, (d) Protection of patent rights, proprietary technologies and know-how, (e) Control of downstream raw materials, (f) Specialized knowledge of marketing and distribution channels, (7) Import substitution in the host country, and (8) Favorable tax and regulatory policies in the host country, etc. Of course, the ultimate motive behind the foreign direct investments undertaken by the MNCs is to realize an increased return on their capital.

Literature Review of Theories Linking Growth and FDI

From a theoretical point of view, foreign direct investment is expected to accelerate or contribute to the economic growth of all countries, especially the less developed ones. As discussed in Ram and Zhang (2002), some of the arguments in favor of this hypothesis are: (1) FDI provides the financial resources needed by the host country. (2) FDI acts as a vehicle for the transfer of advanced manufacturing technologies from the DCs to the LDCs. (3) FDI increases competition in the host country's markets, (4) FDI helps the host countries improve their foreign exchange reserves (or balance-of-payments position) by increasing exports. (5) FDI brings along with it the management know-how needed to run the facilities, (6) FDI enhances the training and employment opportunities for the people of the host country, (7) FDI reduces the burden of imports on the host countries through import substitution. (8) FDI acts as catalyst for increasing domestic savings and investment. In general, FDI provides ready access to the world markets and acts as a conduit for the host country to participate in the globalization process.

Of course, as also pointed out in Ram and Zhang (2002), not every thing about FDI is positive for the host countries. Sometimes, the economies of the host countries may suffer, rather than prosper, because of FDI. It is often said that FDI is the Trojan Horse the MNCs bring to the LDCs. Some specific drawbacks the LDCs may suffer as a result of the entry by MNCs are: (1) MNCs may repatriate more funds than they bring in, to their home countries. (2) MNCs may transfer inferior technologies to the host countries. (3) MNCs may monopolize some markets in the host countries by destroying domestic competition through price cutting. (4) MNCs may focus only on the domestic markets of the host country and may not contribute to the exports from the host country. (5) MNCs may exert undue influence on the political and regulatory systems of the host countries so as to benefit the foreign investors. (6) MNCs may have a negative impact on the cultural and social norms of the host countries through the imposition of their standards.

The link between FDI and economic growth has been a subject of great debate for several decades. However, the 1973-74 Oil Crisis, and the subsequent debt problems faced by the Least Developed Countries intensified the interest of scholars in this subject. With regard to the role of multinational corporations in promoting "Third World Capitalism" and growth, Ulmer (1980) raised two questions: "(a) Are the operations of the multinational corporations in the interests of the third world countries? (b) Is it in the interest of the United States to encourage their foreign activities?" His answer to both the questions was in the affirmative. During the last two decades, several scholars have used econometric techniques to establish the link between FDI and growth. In a survey article, De Mello (1997) addresses the first question, and concludes that FDI does indeed help growth by facilitating the transfer of advanced technologies and providing the resources for the training of labor force to acquire new skills. Chadee and Schlichting (1997) discuss some aspects of foreign direct investment in the Asia-Pacific Region and conclude that FDI has made a positive contribution to all the economies in that region. Borensztein, et al. (1998) through a study of 69 developing countries confirm that the LDCs do benefit from FDI, if they have the capabilities to absorb advanced technologies. The World Investment Report UNCTAD (1999) also describes some econometric models for determining the impact of FDI on growth. After analyzing the data from 11 countries in East Asia and Latin America, using econometric techniques such as unit

root and cointegration tests, Zhang (2001) provides evidence that FDI promotes economic growth in countries with a liberalized trade regime, and a workforce with higher job skills and education. Hsiao and Shen (2003) did a panel data analysis of the factors determining FDI and found a feedback relationship between FDI and GDP. The combined role of FDI and trade in promoting economic growth in the LDCs is analyzed in Makki and Somwaru (2004) within the endogenous growth-theory framework Lee (2005) argues that foreign direct investment along with trade liberalization is the answer for economic development. Using a panel data on 84 countries covering the period of 30 years from 1970 to 1999, Li and Liu (2004) find that it is an increasingly endogenous relationship between FDI and growth, especially since the mid-1980's. The theme of endogenous relationship is explored further in Chowdhury and Mavrotas (2006), and Hansen and Rand (2006). The question addressed in Hansen and Rand (2006) is: "Does FDI cause (long-run) growth and development or do fast-growing economies attract FDI flows as transnational companies search for new markets and profit opportunities?" They used panel data covering 31 countries over 31 years. After an extensive econometric analysis of the panel data involving vector autoregression (VAR) and Granger-Causality tests, they find strong evidence that FDI causes growth.

The main conclusion of the studies cited above is that FDI promotes economic growth, but the extent to which a country is benefited by FDI depends on its trade policies, labor force skills and absorptive capabilities. Several of these studies use time-series regression, and panel data analysis to establish the link between FDI and growth. While different studies have used slightly different sets of independent variables in addition to FDI, the dependent variable in almost all studies is either the logarithm of the growth in per capita GDP or the logarithm of the GDP growth rate itself. Also, the independent variable representing FDI is scaled as the ratio of FDI inflows (billions of US$) to the GDP (billions of US$) of the country or the ratio of FDI inflows to the Gross Capital Formation of the country. This is an appropriate way to do the analysis, especially when the time-series covers 25 to 35 years. However, the economies of almost all countries have undergone structural changes (some very severe) frequently because of oil price shocks, wars, terrorist attacks, or stock market collapses or other financial crises, and the effect of these structural changes is not explicitly incorporated in any of the studies mentioned earlier. Perron (1989) has pointed out that unless such structural changes are taken into consideration in the analysis, the results obtained may not be valid. The empirical tests for known and unknown break-points that signify the onset of a structural change in a time-series (relevant to an economy) are discussed in Maddala and Kim (1998).

In the next Section, we present results concerning a known (or presumed) discontinuity point in the growth pattern of the GDP of each of the four countries. To the best of our knowledge, similar results related to these four countries have not appeared in the literature. As already mentioned, in many of the previous studies, the dependent variable is the logarithm of the per capita GDP growth, whose computation involves the entire population of a country. While the contribution of FDI to the economy of any country depends on the country's labor force, the population as a whole has very limited impact on the productivity of FDI, especially in developing countries with very large population. The use of FDI-to-GDP ratio may further mask the true effect of FDI on GDP. After all, the value of goods and services (produced by FDI) in two neighboring countries with comparable costs must be approximately the same, though the GDP of one country may be much larger than the other. Sethi et al. (2003) present evidence that MNCs do not look at just one country in a region, but often look at a whole region's potential before making decisions regarding Foreign Direct Investment. This line of reasoning tells us that, we should explore the relationship between FDI and GDP on a real value basis (expressed, for example, in US$). In this paper, we adopt this alternative approach, and use the dollar value of FDI inflows and the (dollar value of) annual changes in GDP, exports, and imports in developing the regression equations, especially since the time horizon involved in our study is much shorter than the others, cited above. Since FDI is supposed to have a positive impact on the exports of the host countries, in particular, the developing countries, we have included this aspect of FDI in our study and present some related results.

An Empirical Test for Identifying Structural Change in the GDP Growth Pattern

In this Section, we focus on the patterns of changes in the gross domestic products of the four counties after 1975. The economies around the globe suffered steep declines (or severe shocks) in 1973-74 as a result of the Middle East Oil Embargo and the near quadrupling of the price of oil. The economies of both the developed and developing countries started to grow again, albeit at an anaemic pace, after 1975. Inclusion of any data covering the period prior to 1975 in the analysis is likely to cause a bias in the results because of the worldwide depression of 1973-74. Therefore, the year 1975 is selected as the starting point for our analysis. The economies of many countries, including those of India and China grew at a reasonable rate from 1975 to 1990, when the 1990-91 gulf war caused a disruption in the supply of oil and hurt the economies around the world again. India suffered a foreign exchange crisis after the1990-91 gulf war, and immediately adopted a liberal policy towards foreign direct investment. It can be seen from Figure 1 that India's GDP was down significantly in 1992, and then surged forward after it opened its borders for foreign direct investment. Similarly, in case of China, one can see from Figure 1, that its GDP grew more rapidly from 1993 onwards, compared to the period before. The graphs also show that both Malaysia and Singapore started as early as 1986 on the path to a rapid growth. However, their economies suffered after the 1997 Asian financial crisis.

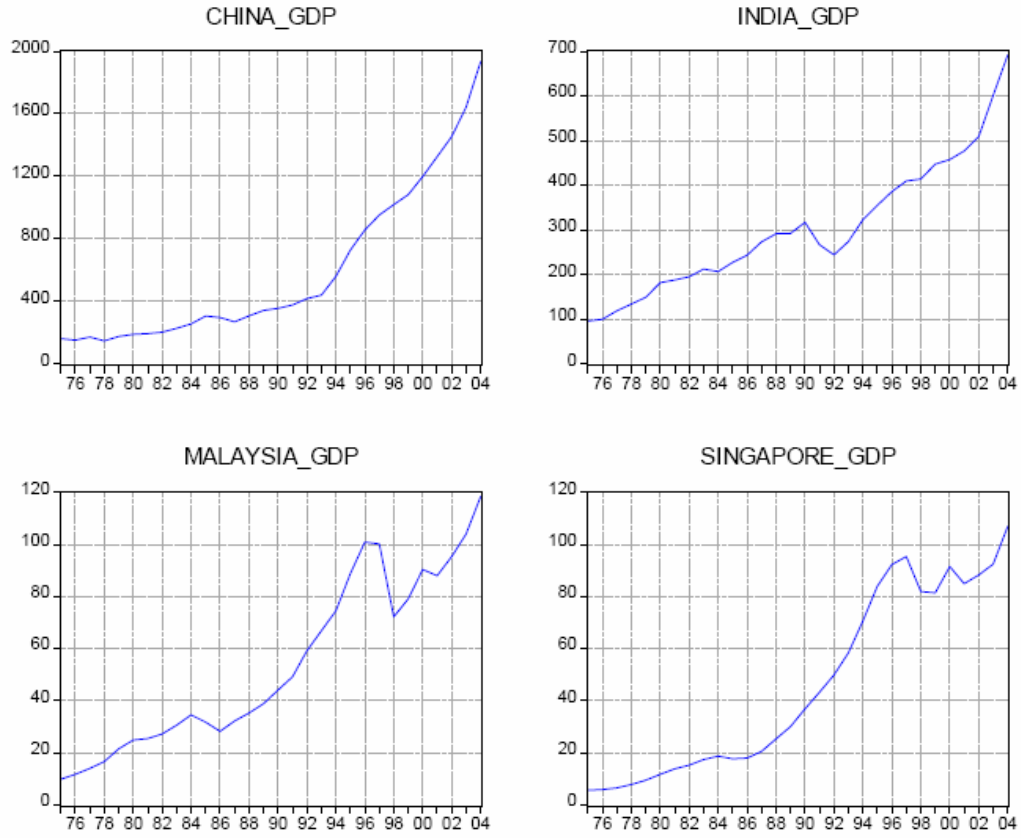

Figure 1: GDP from 1975 to 2004 for China, Malaysia, India and Singapore

Is it possible to verify empirically the structural changes in the economies of these four countries? It is a common practice to use logarithms of the GDP values in the analysis, but we will use the data on the real GDP (in current US $), extracted from the World Development Indicators World Bank (2006) database to highlight the rapid growth achieved by China and India. A procedure involving the use of Chow test to check empirically if there is a structural change in a regression model data is described in

Gujarati (2003) and Maddala and Kim (1998). We will use a similar procedure here to test for the structural change in the GDP growth pattern of each of the four counties. We will illustrate the procedure for India, and provide summary of the results for the other three countries.

The question about the growth pattern of the Indian GDP is: *Did the GDP of India undergo a structural change in 1992?* To answer this question, we define three regression equations as follows:

(1) $Y = \alpha_1 + \alpha_2 = +$ for the period covering 1975-1991 (17 years)

(2) $Y = \beta_1 + \beta_2 = +$ for the period covering 1992-2004 (13 years)

(3) $Y = \gamma_1 + \gamma_1 = +$ for the period covering 1975-2004 (30 years)

We use Y to denote the GDP (in billions), and T is the time in years measured from 1970 (i.e., T = current year – 1970).

Regression results:

Model (1): $\alpha_1 = 30.573$, $\alpha_2 = 13.447$, $R^2 = 0.951$, $SSE_1 = 3808.18$, $df = 15$.

Model (2): $\beta_1 = -432.670$, $\beta_1 = 30.799$, $R^2 = 0.931$, $SSE_2 = 12776.75$, $df = 11$.

Model (3): $\gamma_1 = -8.704$, $\gamma_2 = 15.964$, $R^2 = 0.904$, $SSE_3 = 60912.99$, $df = 28$.

If there were no structural change in 1992, we must have: $H_0 : \alpha_1 = \beta_1$, and $\alpha_2 = \beta_2$.

$$F\ (test\_value) = \frac{(SSE_3 - (SSE_1 + SSE_2))/2}{(SSE_1 + SSE_2)/26} = 34.7483$$

The null hypothesis is rejected at a significance level of 1%, since the corresponding value of *F (critical)* with degrees of freedom (2, 26) is 5.53. Therefore, we conclude that model (3) does not adequately represent the relationship between Y and T, and we need two separate equations to do so. In other words, it is reasonable to conclude that the Indian GDP data series has undergone a structural change in the year 1992.

The regression results for the other three countries are given below:

China: Period covered:1975-2004. Presumed year of structural change: 1993.

Model (1): $\alpha_1 = 45.421$, $\alpha_2 = 15.329$, $R^2 = 0.933$, 1 $SSE_1 = 8135.99$, $df = 16$.

Model (2): $\beta_1 = -2325.35$, $\beta_2 = 120.156$, $R^2 = 0.972$, $SSE_2 = 58976.22$, $df = 10$.

Model (3): $\gamma_1 = -8.704$, $\gamma_2 = 15.964$, $R^2 = 0.904$, $SSE_3 = 60912.99$, $df = 28$.

F (*test_value*) = 260.296. F (*critical*) with degrees of freedom (2, 23) is 5.53.

Malaysia: Period covered:1975-1997. Presumed year of structural change: 1986.

Model (1): $\alpha_1 = -2.482$, $\alpha_2 = 2.508$, $R^2 = 0.964$, $SSE_1 = 26.132$, $df = 9$.

Model (2): $\beta_1 = -93.586$, $\beta_2 = 7.136$, $R^2 = 0.960$, $SSE_2 = 303.736$, $df = 10$.

Model (3): $\gamma_1 = -17.327$, $\gamma_2 = 3.710$, $R^2 = 0.856$, $SSE_3 = 2336.143$, $df = 21$.

F (*test_value*) = 57.775. F (*critical*) with degrees of freedom (2, 19) is 5.93.

Singapore: Period covered:1975-1997. Presumed year of structural change: 1986.

Model (1): $\alpha_1 = -3.004$, $\alpha_2 = 1.483$, $R^2 = 0.963$, $SSE_1 = 9.320$, $df = 9$.

Model (2): $\beta_1 = -111.891$, $\beta_2 = 7.624$, $R^2 = 0.972$, $SSE_2 = 242.817$, $df = 10$.

Model (3): $\gamma_1 = -28.959$, γ_2 3.860, $R^2 = 0.834$, $SSE_3 = 3000.415$, $df = 21$.

F (*test_value*) = 103.55. F (*critical*) with degrees of freedom (2, 19) is 5.93.

In all the four cases, the economies have undergone structural changes: India in 1992, China in 1993, and Malaysia and Singapore, both in 1986. Note that for Malaysia and Singapore we did not include the period from 1998 to 2004 in the regression analysis. From Figure 1, we see that the economies of Malaysia and Singapore have suffered a discontinuity in 1998 because of the Asian financial crisis. But the subsequent recovery does not yet show a regular pattern. Therefore, to avoid any bias, the data from 1998 to 2004 is excluded from the analysis. At this point we would like to raise a theoretical question: Should we have used the logarithms of the GDP in place of the actual values in the foregoing analysis? We see in all the 12 regression models, the value of R^2 is relatively high. Among the 12 values of R^2, ten are higher than 0.9, and the other two, higher than 0.83. In general, regression models with these R^2 values are considered to be good fits for the data. Therefore, we believe that there is no need to resort to the use of logarithms in deriving the regression results. Also, we would like to point out another liberty we have taken with the data. We have chosen to use the GDP data series in current US$, rather than the one in constant US$. The reason for this deviation from the commonly accepted practice is that the break points are more readily identifiable in the former than the latter. Though the test results with the latter data are not as significant as the ones with the former, our conclusions regarding the break-points are generally valid.

Measuring the Impact of FDI on GDP

In measuring the impact of FDI on GDP, we use a lag of one year. We expect the FDI that has come into the host country this year to contribute to an increase in the GDP from next year onwards. Note that FDI inflows in any year represent, in general, the increase in FDI inward stock as defined in the World Investment Reports. Since FDI is reported in current US$, we use the GDP data also measured in current US$ to maintain consistency. We define a new variable *DGDP* as the difference between the GDP of the current year and next year: *DGDP* (t) *GDP* (t+1) – *GDP*(t) = t = 1993,1994,..., 2003. Then, we plot the values of *DGDP* against the values of *FDI* for the years 1993 through 2003 to see if there is any relation between them. The scatterplots in Figure 2 seem to indicate that the variables *DGDP* and *FDI* are not related in of any of the four cases. We also use the following simple linear regression to identify the relationship between *DGDP* and *FDI* : Equation: $DGDP(t) = \alpha + \beta^* FDI(t)$

The values of the parameters generated by E-Views are given in Table 1.

Table 1: Results for the Simple Linear Regression Equations of vs. *DGDP FDI*

Country	R^2 -value	Coefficient	t -statistic	p -value
China	0.2000	$\alpha = -23.948$	– 0.222	0.829
		$\beta = 3.903$	1.499	0.168
India	0.1776	$\alpha = 15.645$	0.868	0.408
		$\beta = 7.264$	1.394	0.197
Malaysia	01452	$\alpha = 16.394$	1.619	0.139
		$\beta = -3.237$	– 1.236	0.247
Singapore	0.1552	$\alpha = 13.343$	1.803	0.105
		$\beta = -0.836$	– 1.286	0.231

Figure 2: DGDP vs. FDI for China, India, Malaysia and Singapore (from 1993 to 2003)

From table 1 we see that in all four cases, the values of R^2 are low, and the p values are higher than 0.05. These results indicate that *FDI* is not a useful predictor in estimating the value of *DGDP*. But the economies of all the four countries were affected adversely by the Asian financial crisis, though not all by the same degree. Also, China and India are not as developed as Malaysia and Singapore. Could these factors help us explain the relationship between the variables *DGDP* and *FDI* ? We turn to panel data analysis to answer this question.

In panel data terminology, the current data set has four (i.e., $n = 4$) cross-sections or countries, and covers eleven (i.e., $T = 11$) time periods (Greene, 2003). Specifically, note that $i = 1$ for China, $i = 2$ for India, $i = 3$ for Malaysia, and $i = 4$ for Singapore. We will analyze four different regression models that are pertinent to the current problem. Since we use E-Views software to generate the solutions, we will follow the convention used in E-Views to specify the four equations.

Model (1) – Pooled equation:

$DGDP\ (i,\ t) = \alpha + \beta^{*}\ FDI\ (i,t) + \varepsilon_{ij}$. i = 1, 2,3, 4, *and* t = 1,2,...,11.

$\alpha = -0.442$, t-statistic = – 0.0554, p -value = 0.9561

$\beta = 3.165$, t-statistic = 8.593, p -value = 0.000, $R^2 = 0.637$

Model (2) – Equation with cross-section fixed effects:

$DGDP\ (i,\ t) = \alpha_1 + \beta^{*}\ FDI\ (i,t) + \varepsilon_{ij}$. i = 1, 2,3,4, *and* t= 1,2,...,11.

$\beta = 2.764$, t-statistic = 2.217, p -value = 0.0325

$\alpha_1 = 22.618$, $\alpha_2 = 29.453$, $\alpha_3 = -5.329$, $\alpha_4 = -25.116$

F -statistic = 5.576, and p -value = 0.0028. $R^2 = 0.746$

Model (3) – Equation with period fixed effects:

$DGDP\ (i,t) = \gamma_\tau + \beta^{*}\ FDI\ (i,t) + \varepsilon_{ij}$. i = 1, 2,3, 4, *and* t= 1,2,...,11.

$\beta = 3.197$, t-statistic = 9.683, p -value = 0.000

$\gamma_1 = 16.619$, $\gamma_2 = 19.184$, $\gamma_3 = 1.670$, $\gamma_4 = -14.871$, $\gamma_5 = -45.735$

$\gamma_6 = -18.869$, $\gamma_7 = -12.367$, $\gamma_8 = -15.655$, $\gamma_9 = -8.375$, $\gamma_{10} = 21.873$

$\gamma_{11} = 46.656$

F -statistic = 2.1295, and p -value = 0.0514. $R^2 = 0.782$

Model (4) – Equation with simultaneous effects of cross-sections and periods.

$DGDP\ (i,t) = \lambda_0 + \beta^{*}\ FDI\ (i,t) + \alpha_1 + \gamma_1 + \varepsilon_{ij}$. i = 1, 2,3, 4, *and* t= 1,2,...,11.

$\beta = 3.257$, t-statistic = 2.892, p -value = 0.0072

$\lambda_1 = 1.769$, $\alpha_1 = 4.247$, $\alpha_2 = 29.709$, $\alpha_3 = -5.344$, $\alpha_4 = -28.612$

$\gamma_1 = 17.823$, $\gamma_2 = 20.239$, $\gamma_3 = 2.634$, $\gamma_4 = -13.958$, $\gamma_5 = -44.961$

$\gamma_6 = -17.937$, $\gamma_7 = -11.518$, $\gamma_8 = -14.818$, $\gamma_9 = -7.569$, $\gamma_{10} = 22.686$

$\gamma_{11} = 47.378$

F -statistic = 5.15, and p -value = 0.0001. $R^2 = 0.890$

Note that from a mathematical point of view (Gujarati, 2003), we have two extra parameters in model (4). However, the E-Views software system provides the values of all the parameters as given above. First, we must note that the values of R^2 for the four models used in the panel data analysis are significantly higher than the ones given in table 1, (and they are also statistically significant). From models (2) and (4), we see that the values of the α parameters for China and India are positive, and negative for Malaysia and Singapore. India suffered the least (a high positive value for α_2), and Singapore, the most (a large negative value for α_4). Also, the values of the γ parameters for the years 1993, 1994, 1995, 2002, and 2003 are positive, and for the years 1996 through 2001, negative. As we would expect, the parameter γ_5 corresponding to the year 1997 has the lowest value. Since the crisis occurred in 1997, its effect was felt to the fullest extent in 1998, and consequently, the GDP of Malaysia and Singapore went down significantly in 1998. Before the Asian economies could recover from the financial crisis, the stock market in the United States suffered very steep declines in the years 2000 and 2001 because of the bursting of the dot.com bubble, and the terrorist attacks on the World Trade Center. This, in turn, prolonged the recession of the Asian economies. It can also be seen that the values of the α parameters in model (4) are closer to the ones in model (2) for the country (cross-section) effects, and the values of the γ parameters in model (4) are closer to the ones in model (3) for the period effects. The values of the F -statistic given above for models (2), (3), and (4) correspond to the 'redundant fixed-effects' test, and

they are significant at 5% level. From these results, we see that when the effects of the countries and the periods are included in the analysis, *FDI* does indeed have a positive impact on the*GDP*. Further, from model (4), we can also conclude that a billion dollars of *FDI* has added 3.257 billions of dollars to the economies of the four countries. In fact, this is a very interesting result, because if we looked at only the individual scatterplots in Figure 2 and the corresponding results of the regression equations in table 1, we would have concluded that *FDI* has no effect on the *GDP*. Through panel data analysis, we were able to isolate the effects of the Asian financial crisis across the individual countries and the time periods.

Measuring the Impact of FDI on Exports

As we have in the case of GDP, here also we define a new variable *DEXPORTS* as the difference between the *EXPORTS* of the current year and next year:

DEXPORTS (*t*) *EXPORTS* (*t*+1) – *EXPORTS* (*t*) *t* = 1993,1994,...,2003.

Then, we plot the values of *DEXPORTS* against the values of *FDI* for the years 1993 through 2003 to see if there is any relation between them. The scatterplots in Figure 3 seem to indicate that the variables *DEXPORTS* and *FDI* are not related in any of the four cases.

Figure 3. DEXPORTS vs. FDI for the four countries from 1993 to 2003

We also use the following simple linear regression to identify the relationship between *DEXPORTS* and *FDI* : Equation: *DEXPORTS* (*t*) = α + β* *FDI* (*t*). The values of the parameters generated by E-Views are given in Table 2.

Table 2: Results for the Simple Linear Regression Equations of DEXPORTS vs. FDI

Country	R^2 -value	Coefficient	*t* -statistic	*p* -value
China	0.445	α = – 146.426	– 1.969	0.084
		β = 4.814	2.683	0.025
India	0.189	α = 0.192	0.026	0.979
		β = 3.040	1.449	0.181
Malaysia	0.088	α = 16.499	1.739	0.116
		β = – 2.282	– 0.930	0.377
Singapore	0.213	α = 38.887	2.195	0.056
		β = – 2.431	– 1.561	0.153

From table 2, we see that in all four cases, the values of R^2 are less than 0.5, and the *p* values are also higher than 0.05, except for the case of China. These results indicate that, in general, *FDI* is not a useful predictor in estimating the value of *DEXPORTS*. Again, as in the case of GDP, we turn to panel data analysis to explore the relationship between the variables*DEXPORTS* and *FDI* ? Recall that i = 1 for China, i = 2 for India, i = 3 for Malaysia, and i = 4 for Singapore.

Model (1) – Pooled equation:

DEXPORTS (i,t) = α + β* *FDI (i,t)* + ε_{ij}. i = 1,2,3,4, *and* t= 1,2,...,11.

α = 2.220, *t*-statistic = 0.403, *p* -value = 0.6892

β = 1.238, *t*-statistic = 4.858, *p* -value = 0.0000, R^2 = 0.359

Model (2) – Equation with cross-section fixed effects:

DEXPORTS (i, t) = α + β* *FDI (i,t)* + ε_{ij}. i = 1,2,3,4, *and* t = 1,2,...,11.

β = 2.914 *t*-statistic = 2.945, *p* -value = 0.1463

α_1 = – 68.816, α_2 = 0.578, α_3 = – 2.312, α_4 = – 18.217

F -statistic = 1.095, and *p* -value = 0.3629. R^2 = 0.409

Model (3) – Equation with period fixed effects:

DEXPORTS (i,t) = γ_τ + β* *FDI (i,t)* + ε_{ij}. i = 1,2,3,4, *and* t= 1,2,...,11.

β = 1.214 *t*-statistic = 6.451, *p* -value = 0.000

γ_1 = 7.970, γ_2 = 8.261, γ_3 = – 10.459, γ_4 = – 7.263, γ_5 = – 28.494

γ_6 = – 6.567, γ_7 = – 9.816, γ_8 = – 20.189, γ_9 = 3.393, γ_{10} = 21.782

γ_{11} = 49.863

F -statistic = 4.637, and *p* -value = 0.0004. R^2 = 0.739

Model (4) – Equation with simultaneous effects of cross-sections and periods.

$DEXPORTS\ (i,t) = \lambda_0 + \beta^* FDI\ (i,t)\ \alpha_1 + \gamma_1 + \varepsilon_{ij}$. i = 1,2,3,4, *and* t= 1,2,...,11.

$\beta = 3.111$ t-statistic = 3.776, p -value = 0.0007

$\lambda_0 = -25.150$, $\alpha_1 = -51.788$, $\alpha_2 = 25.025$, $\alpha_3 = -22.027$, $\alpha_4 = 4.736$

$\gamma_1 = 15.122$, $\gamma_2 = 10.722$, $\gamma_3 = -10.908$, $\gamma_4 = -9.321$, $\gamma_5 = -34.943$

$\gamma_6 = -8.043$, $\gamma_7 = 5.754$, $\gamma_8 = -24.649$, $\gamma_9 = -2.064$, $\gamma_{10} = 16.558$

$\gamma_{11} = 41.772$

F -statistic = 4.361, and p -value = 0.0005. $R^2 = 0.783$

In model (2), the value of F -statistic is not significant at 5% level. Therefore, it is reasonable to conclude that there are no individual country effects on the exports. However, the period effects are significant in model (3), indicating the transitory effects of the Asian financial crisis in 1997 and the downturn experienced by the U.S. markets in the years 2000 and 2001. We discard model (4) in favor of model (3), since of that we already concluded that there are no cross-section effects. Again, note that the values of the F -statistic given above for models (2), (3), and (4) correspond to the 'redundant fixed-effects' test. We see from the results of model (3), that when the effects of the periods are included in the analysis, *FDI* does indeed have a positive impact on *EXPORTS*. Further, we can also conclude that a billion dollars of *FDI* has added 1.214 billions of dollars to the exports of the four countries. Again panel data analysis has helped us identify the true effect of *FDI* on *EXPORTS*.

Measuring the Impact of FDI on Imports

As we have done earlier in the case of GDP and Exports, we define a new variable *DIMPORTS* as the difference between the *IMPORTS* of the current year and next year:

DIMPORTS (*t*) *IMPORTS* (*t* + 1) – *IMPORTS* (*t*), t = 1993,1994,... 2003.

Then, we plot the values of *DIMPORTS* against the values of *FDI* for the years 1993 through 2003 to see if there is any relation between them. Again, the scatterplots in Figure 4 seem to indicate that the variables *DIMPORTS* and *FDI* are not related with any of the four cases.

We also use the following the simple linear regression model to identify the relationship between *DIMPORTS* and *FDI* : Equation: $DIMPORTS\ (t) = \alpha + \beta^* = FDI\ (t)$

The values of the parameters generated by E-Views is given in Table 3.

Table 3: Results for the Simple Linear Regression Equations of DIMPORTS vs. FDI

Country	R^2 -value	Coefficient	t -statistic	p -value
China	0.529	$\alpha = -164.618$	– 2.464	0.0359
		$\beta = 5.129$	3.182	0.0111
India	0.193	$\alpha = -1.155$	– 0.117	0.909
		$\beta = 4.177$	1.468	0.176
Malaysia	0.0713	$\alpha = 15.169$	1.279	0.232
		$\beta = -2.549$	– 0.831	0.427
Singapore	0.165	$\alpha = 33.176$	1.831	0.1004
		$\beta = -2.128$	– 1.336	0.214

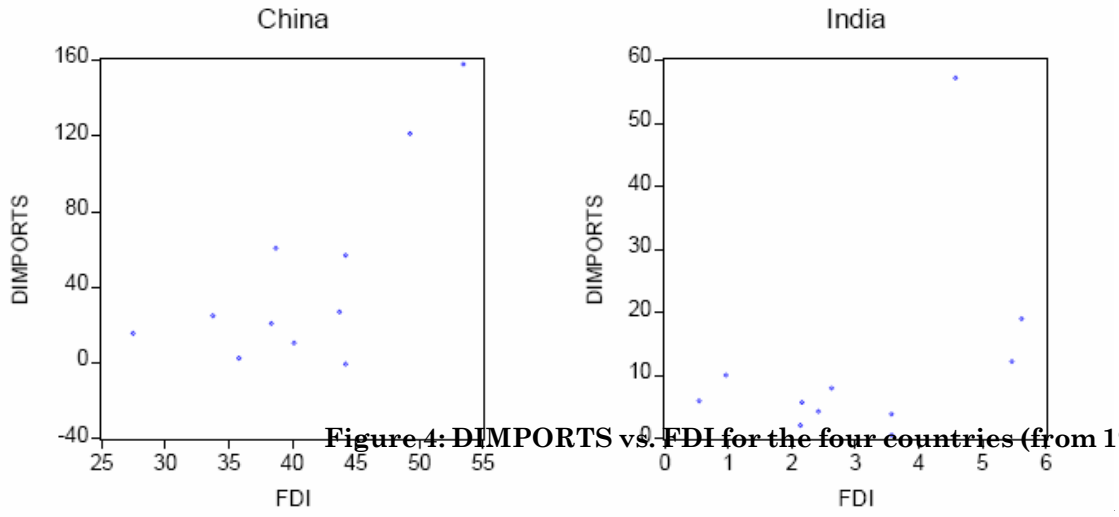

Figure 4: DIMPORTS vs. FDI for the four countries (from 1993 to 2003)

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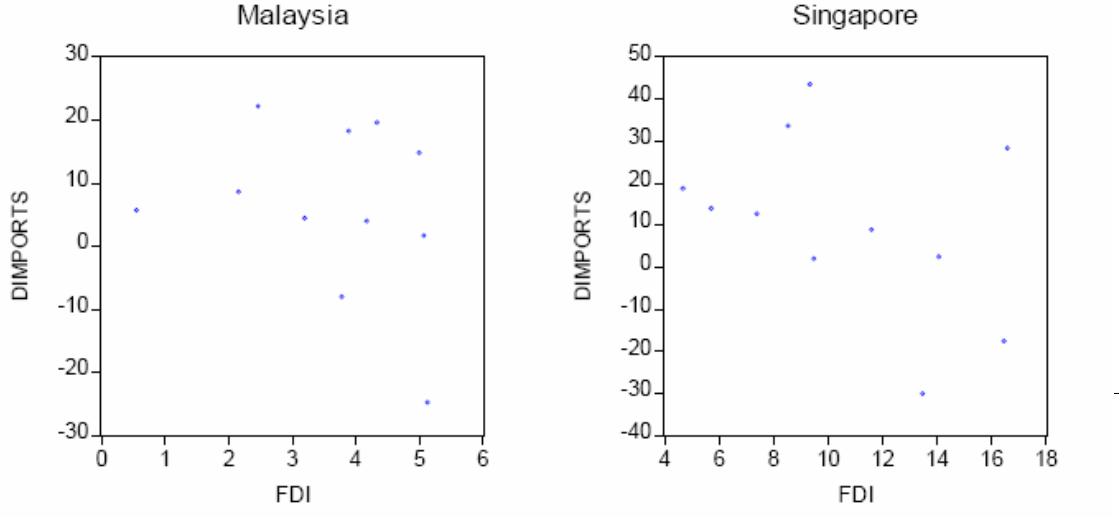
in estimating the value



$\beta = 3.242$ t-statistic = 3.338, p -value = 0.0019

$\alpha_1 = -87.52$, $\alpha_2 = 0.1.713$, $\alpha_3 = -5.794$, $\alpha_1 = -24.189$

F -statistic = 1.898, and p -value = 0.1458. $R^2 = 0.403$

Model (3) – Equation with period fixed effects:

$DIMPORTS\ (i,t) = \gamma_\tau + \beta^* = FDI\ (i,t) + \varepsilon_{i,t}$. i = 1,2,3,4, and t = 1,2,...,11.

$\beta = 1.132$ t-statistic = 4.407, p -value = 0.0001

$\gamma_1 = 3.247$, $\gamma_2 = 8.753$, $\gamma_3 = -10.623$, $\gamma_4 = -11.279$, $\gamma_5 = -31.365$

$\gamma_6 = -1.517$, $\gamma_7 = 11.149$, $\gamma_8 = -18.358$, $\gamma_9 = 1.431$, $\gamma_{10} = 21.899$

$\gamma_{11} = 50.743$

F -statistic = 4.998 and p -value = 0.0000. $R^2 = 0.733$

Model (4) – Equation with simultaneous effects of cross-sections and periods.

$DIMPORTS\ (i,t) = \lambda_0 + \beta^* = FDI\ (i,t) + \alpha_1 + \gamma_\tau + \varepsilon_{i,t}$. i = 1,2,3,4, and t = 1,2,...,11.

$\beta = 3.480$ t-statistic = 4.637, p -value = 0.0001

$\lambda_0 = -32.413$, $\alpha_1 = -64.834$, $\alpha_2 = 33.395$, $\alpha_3 = 25.757$, $\alpha_4 = 5.681$

$\gamma_1 = 13.225$, $\gamma_2 = 12.852$, $\gamma_3 = -10.171$, $\gamma_4 = -12.843$, $\gamma_5 = -38.434$

$\gamma_6 = -2.353$, $\gamma_7 = 7.068$, $\gamma_8 = -22.933$, $\gamma_9 = -4.394$, $\gamma_{10} = -16.369$

$\gamma_{11} = 41.616$

F -statistic = 5.861, and p -value = 0.0005. $R^2 = 0.811$

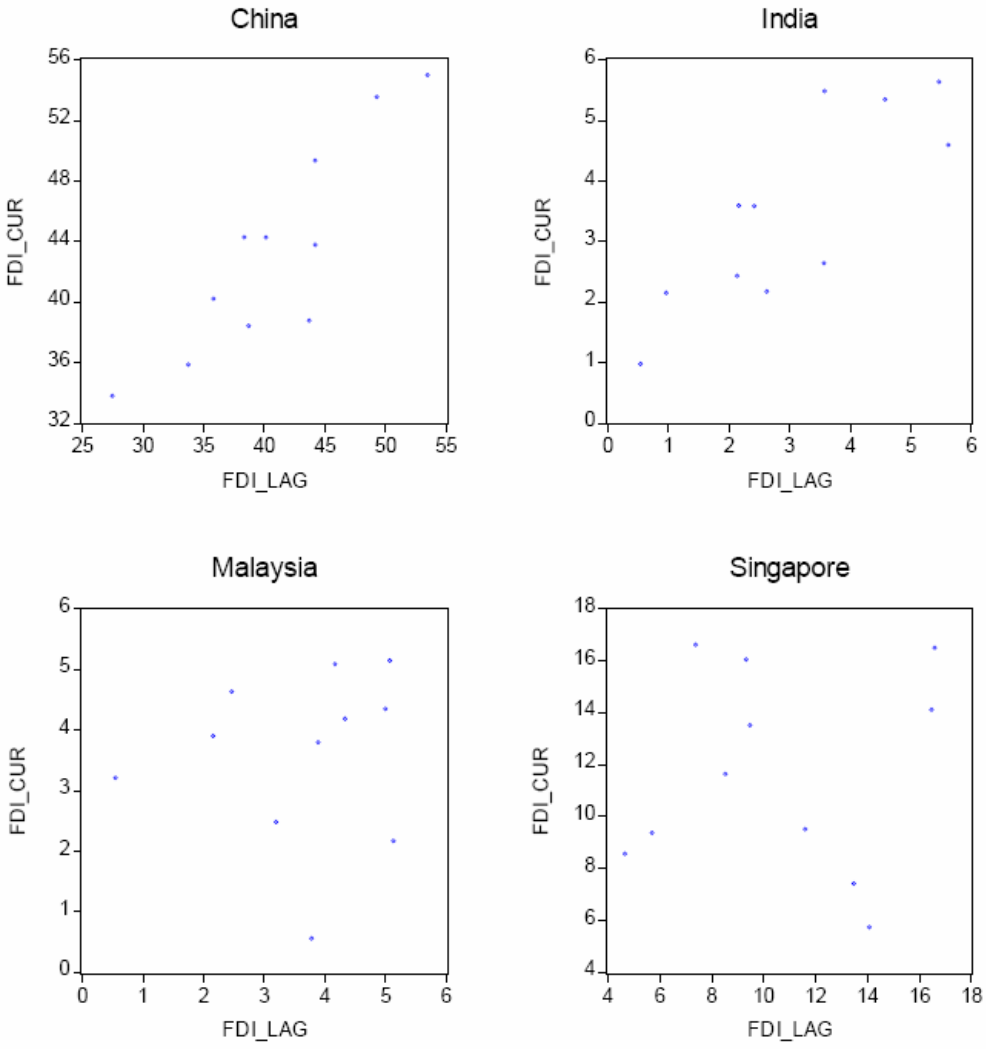
As it was in the case of exports, we see that in model (2), the value of F -statistic is not significant at 5% level in this case too. Therefore, it is reasonable to conclude that there are no individual country effects on the imports as well. However, the period effects are significant in model (3), just as it was with exports. In essence, imports seem to follow the same pattern as exports. We also see from the results of model (3), that when the effects of the periods are included in the analysis, *FDI* does indeed have a positive impact on *IMPORTS*. Further, we can also conclude that a billion dollars of *FDI* has added 1.132 billions of dollars to the imports of the four countries. In other words, *FDI* does not seem to have any effect on the balance of payments position.

Forecasting the FDI inflows – An Autoregressive Approach

Several past studies have concluded that FDI has a positive impact on the GDP of the host country. Our study also confirms that every dollar of FDI can add to 3.26 dollars to the GDP of the host country. Obviously, the government of any host country would be interested in knowing the amounts of FDI their country is likely to receive in the future. In other words, the governments of the host countries would be interested in forecasting the future inflows of FDI. But, it is the multinational corporations, not the host countries, that control the flow of FDI. Of course, there may be cases, where the host country may prohibit entry by a multinational corporation, but we will ignore that scenario here. The fact is that the host countries may create a very favorable environment for FDI, but the MNCs may still take their money elsewhere because of higher returns. For this reason, we may have to treat the FDI inflows to host country as an exogenous variable, although many studies in recent years have indicated a growing endogenous relationship between FDI and GDP. Numerous research papers have

appeared in the literature on the subject of multinational corporations and their investment goals and strategies. However, we have not come across any research that deals with the estimation of future FDI inflows to a host country. Here we adopt a simple autoregressive approach to forecast the future FDI inflows. The bivariate Vector Auto-Regression (VAR) approach used by Hansen and Rand (2006) to study the endogenous relationship between FDI and GDP does lend some support to our model. There are countless variables, such as the labor-force skills on one side, and international competition on the other side, that have an impact on the FDI inflows. Inclusion of all these variables may needlessly complicate the regression model without adding much value. In our autoregressive approach, we let *FDI_CUR* and *FDI_LAG* represent FDI inflows for the current and the previous year. Then the model is: $FDI\_CUR = \alpha + \beta^* FDI\_LAG$.

Then, we plot the values of *FDI_CUR* against the values of *FDI_LAG* for the years 1993 through 2003 to see if there is any relation between them. The scatterplots in Figure 5 indicate that for China and India, there is a relationship between *FDI_CUR* and *FDI_LAG*, while for Malaysia and Singapore, there seems to be no relationship between two variables.



s from 1993 to 2003

We use the following the simple linear regression to identify the relationship between *FDI_CUR* and *FDI_LAG* : Equation: *FDI_CUR* $\alpha + \beta^*$ *FDI_LAG.*

The values of the parameters generated by E-Views is given in Table 4.

Table 4: Results for the Linear Regression Equations of FDI_CUR and FDI_LAG

Country	R^2 -value	Coefficient	t -statistic	p -value
China	0.785	$\alpha = 8.851$	1.452	0.1804
		$\beta = 0.844$	5.742	0.0003
India	0.685	$\alpha = 1.116$	1.834	0.0998
		$\beta = 0.778$	4.426	0.0017
Malaysia	0.0097	$\alpha = 3.236$	2.583	0.0295
		$\beta = 0.096$	0.297	0.773
Singapore	0.0083	$\alpha = 10.797$	3.037	0.014
		$\beta = 0.0857$	0.274	0.790

From table 4, we see that the values of R^2 are relatively high in case of China and India, and rather very low in case of Malaysia and Singapore, confirming our earlier observations. Regardless, we turn to panel data analysis to see if we can learn more about the relationship between the two variables.

We will analyze four different regression models that are pertinent to the current problem. Since we use E-Views software, we will follow the convention used in E-Views to specify the four equations.

Model (1) – Pooled equation:

$FDI\_CUR(i,t) = \alpha + \beta^*\ FDI\_LAG(i,t) + \varepsilon_{ij}$. i = 1,2,3,4, *and* t= 1,2,...,11.

$\alpha = 0.509$, t-statistic = 0.741, p -value = 0.463

$\beta = 1.032$, t-statistic = 32.574, p -value = 0.0000, $R^2 = 0.962$

Model (2) – Equation with cross-section fixed effects:

$FDI\_CUR(i,t) = \alpha_1 + \beta^*\ FDI\_LAG(i,t) + \varepsilon_{ij}$. i = 1,2,3,4, *and* t= 1,2,...,11.

$\beta = 0.650$, t-statistic = 5.852, p -value = 0.0000

$\alpha_1 = 16.790$ $\alpha_2 = 1.501$, $\alpha_1 = 1.185$, $\alpha_1 = 4.764$

F -statistic = 4.328, and p -value = 0.0100 $R^2 = 0.971$

Model (3) – Equation with period fixed effects:

$FDI\_CUR(i,t) = \gamma_\tau + \beta^*\ FDI\_LAG(i,t) + \varepsilon_{ij}$. i = 1, 2,3, 4, *and* t= 1,2,...,11.

$\beta = 1.038$ t-statistic = 31.681, p -value = 0.0000

$\gamma_1 = 2.114$, $\gamma_2 = 1.081$, $\gamma_3 = 0.336$, $\gamma_4 = 1.772$, $\gamma_5 = -3.255$

$\gamma_6 = 0.833$, $\gamma_7 = -0.376$, $\gamma_8 = -0.066$, $\gamma_9 = -0.736$, $\gamma_{10} = 0.905$

$\gamma_{11} = 2.089$

F -statistic = 0.835, and p -value = 0.6245. $R^2 = 0.962$

Model (4) – Equation with simultaneous effects of cross-sections and periods.

$FDI\_CUR(i,t) = \lambda_0 + \beta^* FDI\_LAG(i,t)$ $\alpha_1 = \gamma_1 = \varepsilon_{ij}$, i = 1, 2,3, 4, *and* t= 1,2,...,11.

$\beta = 0.612$, t-statistic = 4.554, p -value = 0.0001

$\lambda_0 = 6.625$, $\alpha_1 = 11.711$, $\alpha_2 = -5.001$, $\alpha_3 = -5.257$, $\alpha_4 = -1.452$

$\lambda_1 = -0.492$, $\lambda_2 = -0.472$, $\lambda_3 = -0.564$, $\lambda_4 = 1.233$, $\lambda_5 = -4.807$

$\lambda_6 = 0.163$, $\lambda_7 = 0.464$, $\lambda_8 = -0.065$, $\lambda_9 = -0.511$, $\lambda_{10} = -1.076$

$\lambda_{11} = 2.905$

F -statistic = 1.601 and p -value = 0.141. $R^2 = 0.978$

In case of models (3) and (4), the values of F -statistic are not significant at 5% level. On the other hand, the value of the F -statistic in model (2) is significant at 2% level. This result tells us that there are cross-country differences that make one country more attractive than the others for FDI. In fact, China is able to attract $15 billion more than India. In other words, the combined effect of all the Chinese policies, whatever they might be, is such that every year MNCs are pouring $15 billions more of FDI into China than into India. Perhaps, this tells Government of India that they should take a second look at several of their policies and regulations regarding the flow of FDI into India.

Here we used a simple autoregressive approach to develop an equation to forecast the FDI inflows. Basically, we treated the FDI as an exogenous variable, because the inflows are not directly controlled by the host countries. Are there other factors that justify this approach? It is not only the developing countries that try to attract FDI, but the developed countries also try to attract FDI to facilitate their own economic growth. The data given in Table 5 provide the details of the FDI outflows and inflows of the OECD countries most of which fall in the category of developed countries (Organization for Economic Cooperation and Development, 2005).

Table 5: Total FDI Outflows and Inflows of OECD Countries.

Year	FDI Outflows $ billions	FDI Inflows $ billions	Difference $ billions
1990	236.516	175.314	61.202
1991	194.067	122.197	71.87
1992	185.522	116.206	69.316
1993	208.175	147.987	60.188
1994	248.464	166.793	81.671
1995	315.423	225.287	90.136
1996	343.152	246.284	96.868
1997	410.296	301.482	108.814
1998	651.722	528.449	123.273
1999	1043.175	890.857	152.318
2000	1235.467	1286.583	-51.116
2001	683.781	631.993	51.788
2002	614.928	561.925	53.003
2003	592.797	458.823	133.974
2004	667.838	406.551	261.287

From Figure 6, it is clear that the FDI inflows to the OECD countries are on declining trend. Indeed the year 2000 seems to be a break-point, indicating a structural change. The multinational corporations are very nimble and react quickly to the changes in the global business arena. The economies of the OECD countries have recovered from the crises of 2000-2001, and all their indicators of economic growth have shown an upward trend in the last three years. Yet the FDI inflows are going down. If we were to use any of endogenous growth models to forecast the FDI inflow to these countries, they would forecast an increase, and not decrease. The reason is that many of the growth models cannot take into account the structural changes. On the other hand, the simple autoregressive model used here would re-adjust to the changes in the pattern of FDI inflows, though the forecasts may be slightly overestimated.

Figure 6: Total FDI in flows to OECD Countries

At this stage, another relavant question is: how do the FDI flows to OECD countries compared to those entering the LDCs? Since the early 1980's, there has been a steady increase in the flow of Foreign Direct Investment (FDI) to the developing countries. From an annual average of $12.6 billion in 1982-85, the amount of FDI entering the less developed countries (LDCs) increased to $51.8 billion in 1992-93, and to $70.0 billion in 1994 (Bergsman and Shen, 1996). This surging trend in the flow of FDI to the LDCs has continued in recent years, as shown in Table 6, extracted from the 2006 report of the World Bank on Global Development Finance (World Bank, 2006). The FDI flows to the developing coumtries were slightly down in 2002 and 2003 because of the recession suffered by the U.S. economy during these years. However, the increase in 2004 has more than compensated for the decreases in 2002 and 2003, and the current trend seems to be pointing to significant increases in the future FDI flows. The graph of FDI flows are shown in Figure 7. From Figures 6 and 7, we see that flows to developing countries are increasing, whereas the flows to developed countries are declining.

Table 6: FDI Flows to Developing Countries

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005
FDI, $billions	168.7	172.4	183.3	168.8	176.9	160.3	161.6	211.5	237.5

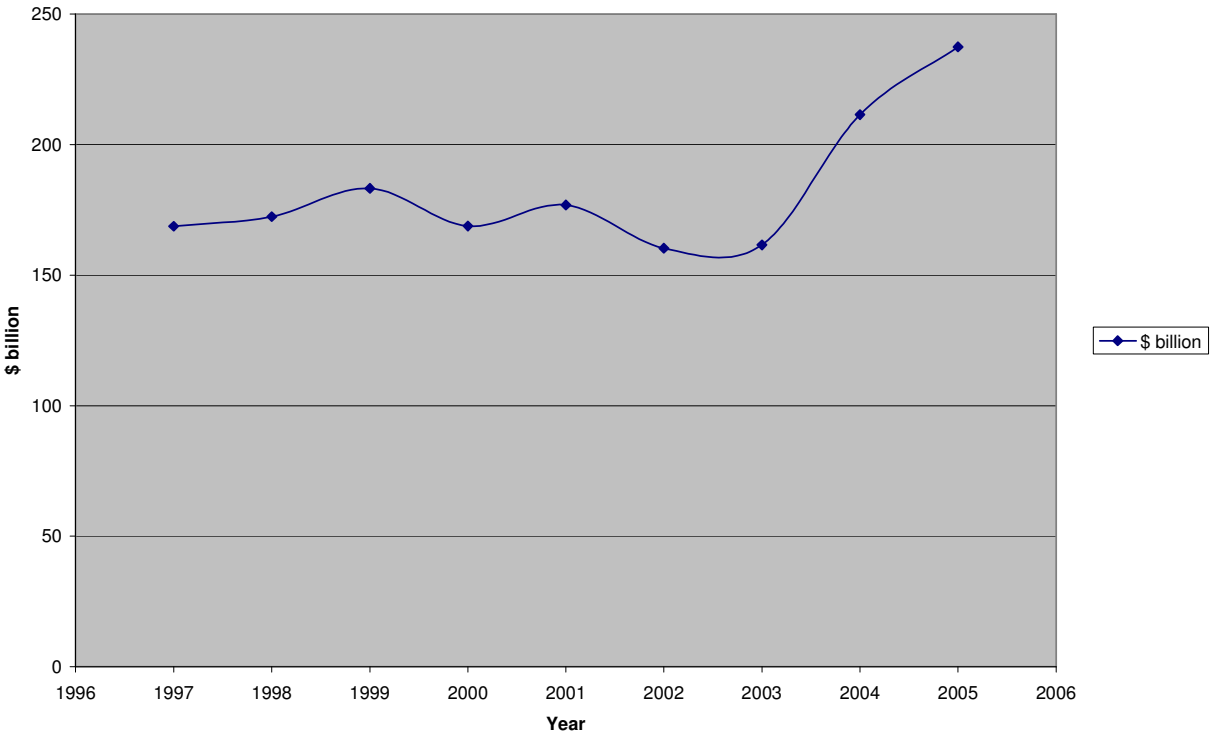


Figure 7: Total FDI in flows to Developing Countries

Conclusions

The interrelations among the variables FDI, GDP, exports, and imports of the four countries China, India, Malaysia, and Singapore are explored in this paper. The primary technique used in the study is panel data analysis. Through an empirical test, the breakpoints that signify structural changes in the four economies are identified. The study confirms that FDI promotes economic growth, and further provides an estimate that one dollar of FDI adds about 3.27 dollars to the GDP of each of the four countries. In the process of developing this estimate, the study also identified the effects of the Asian financial crisis on the GDP of each country, referred to the cross-country fixed effects and period fixed effects in the parlance of panel data analysis. The results of the study also indicate that FDI has no effect on the balance-of-payment positions of these countries, since its contribution to the growth of exports and imports is approximately the same. An autoregressive approach to forecast the FDI inflows is also described in the paper. This approach has yielded a very interesting result. According to the estimates of the forecasting model, China has been able to attract $15 billion more in FDI than India, because of the combined effect of its policies. It may be worthwhile for Government of India to take a second look at some of the policies and strategies adopted by China, if it wants to be a future magnet for FDI.

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