Effects of Foreign Direct Investment on Economic Growth: An Endogenous Model*

Md.Kamal Uddin**

Abstract

As a consequence of endogenous growth theory, FDI has a newly -perceived potential role in the growth process, which is examined in this paper. It is observed that sustainable growth of the developing economies depends on the extent of the adoption and implementation of new technologies through FDI that are already in use in leading countries. Effective policies towards enhancing learning efforts of domestic firms, reducing distortions and X-inefficiency, Market-stimulating technology policies and better competitive environment may faster the catch-up process.

Keywords : FDI, Technological progress, Contagion model, and developing economies.

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**Graduate Student, Osaka School of International Public Oolicy, Osaka University

I. INTRODUCTION

Economic growth is a process, which among different aspects contains rapid rate of structural transformation-that includes shift from agriculture to manufacturing to service, changing trade pattern, and government economic polices. Growth theories have different explanations regarding the origin and continuation of growth. Economists accept that technological change contributes powerfully to long-run sustainable economic growth. Yet we know surprisingly little about the determinants of technological change, including the relative contributions of different economic agents to the change process, the empirical sensitivity of the process to economic incentives, the extent of market failure surrounding decisions affecting investments in new knowledge, technology, and also acquiring foreign technology. This case becomes severe when we talk about technological progress of developing economies, which at the early stage of economic development have lack of machinery, skills and institutional support to handle technologies. As technology has evolved rapidly, the technological gap between the developed and developing countries said to be increasing. Until recently, some economists have tended to view technology as a "black box" that affected the economic system but that was itself driven largely by exogenous economic forces, such as advance of science. Pioneering work by Schmookler, Griliches, Arrow and others showed that this was not true; more recently (1980s) New Growth Theory of Romer, Lucas, Grossman and Helpman, and others, has placed technology squarely within the economic system. However, economic analyses of technological progress confront many sorts of problem like measurement, interrelation among economic agents and so on. So it would be worth doing to study how these theories work and how technological progress of developing countries can be explained in the framework of endogenous growth theory.

Globalization and liberalization of developing economies have resulted in a remarkable upsurge in FDI flows in the 1990s. FDI flows to developing countries increased more than sixfold from 1990 to 1998, and their share of global FDI flows has risen from 25 percent in 1991 to an estimated 42 percent in 1998. The increase in FDI inflows to developing countries accounts for 65 percent of the increase in the average annual level of global FDI flows between 1986-91 and 1992-97 (Global Development Finance 1999).

Direct and indirect benefits of FDI to economic growth are well reported in the literatures. The main objective of this study is to develop a model with FDI in the framework of endogenous growth theory that can explain the process of economic growth and technological progress of developing economies.

This study consists of the following sections. Section 2 explains briefly different features of FDI, contribution of FDI to economic growth and international diffusion of technologies. In the third section, a model is proposed in the framework of endogenous growth theory, which can explain the process of technological diffusion and economic growth of developing economies. In the last section, concluding remarks are provided.

2. Foreign Direct Investment, Endogenous Technological Change and Economic Growth

Technology is one of the most decisive factors for industrial competitiveness. Mastery of technological change is seen to pose great problems for developing countries, which, at the initial stage of industrial development, lack the machinery, low level of human capital, skills and institutional support to handle the technologies that are relatively standard in developed countries. Concerning strategy for technological development, there are two measures: (a) promotion of indigenous R&D efforts, and (b) introduction of foreign technology which so far have been adopted by most developing nations. In the former case, enough experience, skilled engineers, monopoly profit-seeking large firms and government support are indispensable which are said to be insufficient in developing countries. On the other hand, R&D intensity for low technology sectors is comparatively lower which also discourages developing nations to take own R&D initiatives. However, overdependence on technology imports, particularly those, which don't provide any learning inputs, will not provide a benefit to developing country in the long run.

2.1. FDI and Economic Growth:

R&D spillovers play prominent role in the explanation of productivity growth and productivity convergence across countries. By benefiting from foreign R&D knowledge, countries can grow faster and converge to the productivity of the most advanced countries. International R&D spillovers are transmitted in a number of ways. Trade in

goods and services, foreign direct investment, international alliance between firms, such as licensing agreements and joint ventures, international migration of scientists and engineers, imitation, and international communication, such as conferences are some of the transmission mechanisms. Informal means such as overseas training, hiring, returnees is also widely used by developing countries. However the three broad categories of acquiring foreign technology and know-how are imitation, FDI and licensing. A study of Buckley and Casson [1976] shows that the foreign direct investment is the most effective way to transfer technology to a developing country.

In addition to providing finance, FDI helps promote growth in developing economies by facilitating the transfer of technology, increasing labor force skill, promoting competition, and increasing exports. These "spillover effects" translate into greater productivity growth in the economy as a whole (World Bank 1997). In a sample of 69 developing countries, Borensztein, de Gregorio, and Lee [1998] found that a 1 percentage point rise in the ratio of FDI to GDP increased the rate of per capita growth of the host country by 0.8 percent. Wacziarg [1998] estimated that each percentage point share of FDI in GDP was associated with an increase in per capita GDP of 0.3-0.4 percent. According to Sun [1998], FDI accounted for 17 percent of China's GDP growth during the 1983-95 period.

Perhaps the most significant channel through which FDI contributes to productivity growth is increased access to technology, through market transactions such as joint ventures, licensing, and goods trade. Multinationals also improve labor skills through on-the-job training, seminars, and formal education. Some studies have shown that productivity growth was higher in foreign-owned firms (Djankov and Hoekman [1998]), and multinational enterprises are active in sectors that use relatively high levels of skilled workers (Feenstra and Hanson [1997]). Athukorala and Menon [1995] show that FDI to Malaysia facilitated technology transfer and improved the skills of the labor force.

2.2. Endogenous Growth Theory and FDI

R&D spillovers play a crucial role in modern theories of endogenous growth. Since knowledge is somewhat public good, the benefits of R&D stretch far beyond the limits of the original R&D performer. A fairly substantial amount of empirical work has provided evidence for the existence of domestic R&D spillovers (Griliches-1992, and

Nadiri-1993). These spillover effects are not necessarily contained within national boundaries. With growing importance of international trade, FDI, and international knowledge diffusion, a countries production structure and productivity growth depend, not only on the accumulation of its own R&D capital, but also on the R&D activities in other economies. We stress the role of multinational companies as bearers of innovations and ideas (Romer, 1993), providing a channel for the diffusion of knowledge-based, firm specific assets throughout developing country. We concentrate on FDI rather than capital flows in general because it is intimately connected to the transfer of technologies among nations.

If growth determinants are taken as endogenous, and FDI is thought of as a composite bundle of capital stocks, know-how and technology there are different ways in which FDI can be expected to affect in theoretical models (Balasubramanyam *et al.*, [1996]). The endogenous growth theory developed by Romer, Lucas, Grossman and Helpman, Barro and Sala-I-Martin has encouraged research into the channels through which FDI can be expected to promote growth in the long run. The basic shortcoming of conventional neo-classical growth models, as far as FDI is concerned, is that long run growth can only result from technological progress and/or population/labor force growth, which are both considered to be exogenous. FDI would only affect output growth in the short run and, in the long run, under the conventional assumption returns to capital inputs, the recipient economy would converge to its steady state, as if FDI had never taken place, leaving no permanent impact on output growth. The only vehicle for growth-enhancing FDI would be through permanent technological shock. One important characteristic of endogenous growth models is that long run growth can be affected by policy actions of government. In conventional neo-classical growth theory, policy variables would only have a short-term impact on growth, and the success of FDI promoting policies would be short-lived. If growth is endogenized, policy can be more certain to induce permanent increase in the rate of output growth by making the recipient economy more appealing to foreign investment.

2.3. Determinants of FDI

Global and national factors, economic and political/strategic factors, and sometimes interactions between them, all combine to make complex any analysis of the determinants of foreign capital flows to developing countries. These determinants are often

grouped into demand-side and supply side factors. The demand side determinants include political stability, labor cost, market size, regional economic integration and investment incentives offered by the host country. The supply-side determinants consist of economies of scale, oligopoly reaction, product life cycle, intangible assets, and internalization. Empirical studies show that both demand and supply side determinants are important. Goldberg [1972] explains FDI in the following functional form: FDI = $f(\delta Y)$. Empirical study of Lucus [1993] shows that FDI inflows are estimated to be less elastic with respect to the costs of capital (including tax) than to wages, and to be more elastic with respect to aggregate demand in export markets than domestic demand.

FDI inflows in developing countries tend to "crowd in" other investment and are associated with an overall increase in total investment (World Investment Report, 1992). A cross-country regression for the period 1970-89 concluded that 1 percentage point rise FDI increase domestic investment by 0.5-1.3 percent (Borensztein et. all 1998). It seems that the growth path of FDI can be explained with the changing pattern of FDI. When an economies enjoy higher growth of FDI , it means that the determining factors (both demand and supply side) are playing positive role in this respect. Considering the role of determining factors implicitly, we can define growth of FDI as.

For empirical purposes, we can write the above function as

$\delta K_f = \alpha + \beta K_f$, where $FDI = K_f$

Using the data of FDI from 1975 to 1997 (World Development Indicators-1999) of respective countries, we find following results, which support our proposition that growth pattern of FDI, can be explained with the inflow of FDI.

Countries	Constant	K_f (FDI)	R2
India	-.93833 (-.028837)	.31240 (7.9528)	.76899
Pakistan	-60.5921 (-2.0738)	.55063 (6.0676)	.65959
Bangladesh	-6.6684 (-1.6629)	.73568 (6.092)	.64982
Thailand	-151.07 (-1.1227)	.33575 (3.1517)	.33185

* t-value is shown in the bracket

3. Contagion Model: Endogenous Growth Model with FDI

In the light of our discussion, let us think an endogenous model with FDI that can show the process of economic growth and technological progress of developing nations. To keep the model simple, labor is taken as unity and no depreciation on capital is considered. Let's take it as "Contagion Model" The production function is taken as follows:

$$Y=AK_d^{\beta}K_f^{1-\beta} \tag{1}$$

Here K_d is domestic capital and K_f is foreign capital broadly taken as FDI. If we think Rebelo's K is representing a broad measure of capital we could read this model as a particular version of Rebelo's AK model. The key assumption is that the production function is constant returns to the domestic and foreign capital together, but the domestic capital alone has diminishing returns. It is assumed as explained above that FDI has superior technology and has spillovers effect on domestic sector. In the aggregate, the existence of various forms of externality, which increase the efficiency level of host country, prevents the unbounded decline of the marginal productivity of capital. We have the following domestic capital accumulation.

$$\dot{K}_d=AK_d^{\beta}K_f^{1-\beta}-c \tag{2}$$

K_f increases in developing economy with contagious effect. At the initial point, a developing country may find it difficult to attract huge inflow of FDI. However, when some progress is made, the rate of growth of foreign capital might be increased manifolds within short time as MNCs may find that country as an attractive host economies. This contagion effect of inflow of FDI has been observed in the Southeast Asia in the late 1980s and 1990s. However, we can't expect that the inflow of FDI will continue forever. If a country becomes successful in industrialization, after a certain point, the growth of foreign capital (not all kinds) may tends to be zero. We can observe this phenomenon in many economies. For example, at the early stage of higher economic growth, many developed countries borrowed foreign technology through other channels and FDI, and the growth rate of foreign capital was relatively higher. Newly Industrialized Countries (NICs) also show the same trend. In view of the above-mentioned situation, let's take the growth path of K_f in the following way:

$$\dot{K}_f=F(K_f), \tag{3}$$

We assume the solution of equation (3) has the following functional form:

$$K_f(t)=g(t)$$

The solution of $K_f(t)$ can be shown in figure (4.1)

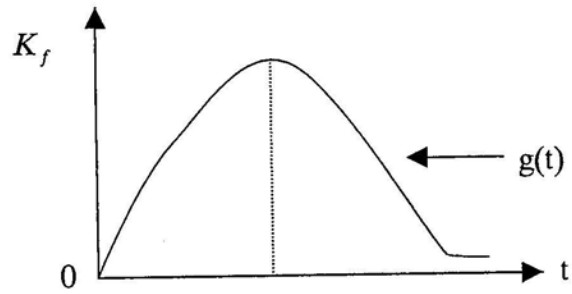

Figure-4.1

Our modified production function becomes

$$Y=AK_d^{\beta}[g(t)]^{1-\beta} \qquad (1)'$$

which can be written as

$$Y=B(t)K_d^{\beta} \qquad (4)$$

where $B(t)=A[(g(t)]^{1-\beta}$

Demand related phenomena of the recipient economy could be explained through Hamiltonian. We consider a representative agent maximizes utility with the dynamic capital accumulation constraint of equation of (2). Our Hamiltonian function becomes as follows:

$$\text{Max. H}=e^{-\rho t}\left[\frac{c^{1-\sigma}-1}{1-\sigma}\right]+\lambda[B(t)K_d^{\beta}-c]$$

The first order conditions are given by the following equations:

$$\frac{\delta \text{H}}{\delta c}\equiv e^{-\rho t}c^{-\sigma}=0 \qquad (5)$$

$$\frac{\delta \text{H}}{\delta K_d}=\dot{\lambda}=-\lambda\beta K_d^{\beta-1} \qquad (6)$$

$$\frac{\beta \text{H}}{\beta \lambda}=B(t)K_d^{\beta}-c \qquad (7)$$

$$\text{TVC}\equiv Lim_{t\to\infty}\lambda(t)K_d(t)=0 \qquad (8)$$

Now we will try to find the steady state value of the different factors. We know that in the steady state condition all variables should grow at the same rate. We can define the steady state as follows:

$$\frac{\dot{K}_d}{K_d}=\frac{\dot{c}}{c}=\gamma=\text{Growth Rate}$$

Using equation (5) to (8), we can get the steady state growth rate as:

$$\dot{c}/c=\gamma=\frac{1}{\sigma}[\beta B(t)K_d^{\beta-1}-\rho] \tag{9}$$

Dividing both sides of dynamic capital accumulation constraint of equation of (2) by K_d taking log and time derivatives and necessary substitution, we can find that $\dot{K}_d/K_d=\dot{c}/c=\gamma$, where γ is growth rate of the recipient economy.

Our contagion model is an endogenous growth model with CR production function. Differentiating the aggregate production function of (1)' with respect to K_d, we can write the marginal productivity of capital MPK_d as

$$MPK_d=\beta B(t)K_d^{\beta-1}$$

Substituting this value in equation (9), we have the growth equation as

$$\gamma=\frac{1}{\sigma}[MPK_d-\rho] \tag{10}$$

To get endogenous growth, we must have $(MPK_d-\rho)>0$. The following analysis derives the conditions that MPK_d has positive lower bound.

Taking MPK_d as Z, we can write

$$\frac{\dot{Z}}{Z}=\frac{\dot{B}(t)}{B(t)}+(\beta-1)\frac{\dot{K}_d}{K_d}$$
$$=\alpha+(\beta-1)\gamma, \tag{11}$$

where $\alpha=\dfrac{\dot{B}(t)}{B(t)}$ and $\gamma=\dfrac{\dot{K}_d}{K_d}$

The conditions for endogenous growth are:

i) initial condition $(t=0)\,Z(0)>\rho, \beta B(0)K_d(0)^{\beta-1}>\rho$,

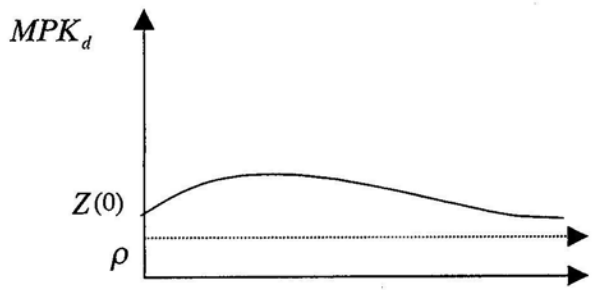

Figure-4.2

and

ii) $\frac{\dot{Z}}{Z}=\alpha+(\beta-1)\gamma>0$ for all t

The workings of MPK_d which satisfies the conditions for endogenous growth is shown in figure (4.2)

If we have α (in equation-10) is large enough to offset the negative effect of $(\beta-1)\gamma$, positive sustainable growth is always possible in the economy. γ -is always growing with the influence of domestic efficiency level and inflow of FDI with superior technology. In the model, we only consider the complementary aspect of FDI. However, we will not have explosive growth in the economy as the growth rate of FDI gradually decreases (equation-3) and economy may become capital exporting country. The MPK_d has its lower bound to keep the growth positive in the long run. The MPK_d is influenced by the inflow of FDI, which gradually increases the productive efficiency level including human capital in the domestic economy. At the same time, the spillovers effect of foreign capital reduce the dumping effect on diminishing return on domestic capital. Findlay [1978] shows that technological progress in a relatively "backward" region is an increasing function of the gap between its own level of technology and that of the advanced region. However, if the gap is too wide to catch-up, then no progress may happen. Finally, we expect β (elasticity of domestic capital) turns to be 1 which ensures sustainable long-run growth without technology borrowing with the influences of indigenous R&D efforts if country success in industrialization.

3.2. Contagion Model and Sustainable Growth

To have positive growth in the long-run, we must have $\beta B(t) K_d^{\beta-1}$ greater than ρ. But the term $B(t)$ is directly influenced with the acquiring capability of foreign technologies by domestic firms. The main policy message emerged from the model is that from a developing countries point of view, opening to FDI from more advanced countries has important beneficial implications. In addition to the well-known effects on income level as well as employment, FDI facilitates domestic technological progress. Policies prohibiting FDI from more advanced countries deprive the developing economies of potential gains in the growth rate and may also lead to an increasing income gap between rich and poor countries in the world.

Our model suggests that main source of sustainable growth is technological change which is highly related with inflow of FDI. The growth path of K_d is sensitive to the

government polices. Some studies show that most of the LDCs policies towards FDI are inconsistent and very complicated which retard inflow of FDI and technology transfer. It is claimed that policy objectives are numerous, but policy instruments are limited. So relaxation of regulations and attractive incentives are needed to keep the growth of K_d to a certain point. Government policies should try to divert the FDI (considering the countries endowment) in those sectors that could easily gain the technological advantage.

3.3. FDI and Total Factor Productivity

It has been observed that total factor productivity (TFP) is highly related to the growth of productive capacity. The sources of TFP growth are i) technological change and ii) technical efficiency. In our model $B(t)$ could be taken as TFP which is influenced by superior foreign technology as well as domestic technical efficiency. Technological change through foreign borrowing can do little to improve productive efficiency if the X-efficiency (many sorts of distortions) is not solved. It's rather difficult to improve the technical efficiency level in developing economies because of distorted market and lack of proper institutions. We should recognize that technological progress and technical efficiency are analytically distinct and may have quite different policy implications. High rates of technological change, on the other hand, can co-exist with deteriorating technical efficiency performance. Relatively low rates technological change can also co-exist with an improving technical efficiency performance, on the other hand. The co-existence of a high rate of technical change and a low rate of change in technical efficiency may reflect the failures in achieving technological mastery and diffusion. As a result, specific policy actions are required to address the difference in the source of variation in productivity.

The World Bank [1986] showed that the level of technology in use is not only determinant of TFP, that potential gains may lie in changes in efficiency of the use of existing technology. This study indicates that the deterioration in technical efficiency performance has dominated technical change, and hence hindered the growth of TFP. To improve TFP performance and hence to sustainable growth in the long run, the government policies should focus on the improvement in technical efficiency performance (reducing X-efficiency).

We also give greater importance to human capital accumulation, which is considered

the engine of growth. Because of simplification we have not introduced human capital in our model, but it can be easily understood that efficiency parameter $B(t)$ is highly sensitive to human capital accumulation factor. The attitude and capability of technology recipients determine the degree and effectiveness of the learning process. Technological progress is always human capital intensive. We can't assume that growth rate of technological progress in an economy to be identical with that of technology transfer by MNCs. It can be said that technological progress takes place only when the host country can improve structures of production by using transferred technology. Thus ability to use transferred technology, namely the quality of human capital, is important to efficiently absorb technology. Kuznets (1968) insists that a country needs social capability to adopt technology, if it exploits the backlog of technology. Minami (1986) points out that Japan's social capability, which includes the development of political and economic organizations, human and social capital was great at the starting point of industrialization. In this context, we can say that government efforts and effective policies towards human capital accumulation would reinforce technological progress in that economy.

Let us consider an example of this type of technological progress. Recent economic growth in Asian countries has been driven by the FDI of many developed countries, particularly the assembling and processing industry, as they set up assembling plants in the developing countries and hire local human resources. For those countries, the introduction of such industries increased employment as well as obtained trade surplus by exporting products. By making use of this process, those countries promoted growth and acquired new technology. This type of industrial development is called "Leapfrogging" which indicates that those countries by passed the acquisition of basic technology or R & D (see Soete [1985], Barro and Sala-I-Martin [1995] and Hobday [1996]). By this theory, the recent development of the household electronic appliances and electronics industries in South Asian economies can be explained.

4. Concluding Remarks: Technology Management and Economic Development

FDI is one of the best vehicles of international technology diffusion. Our model (contagion model) suggests that country's technological progress not only depends on it's

own R & D stock, but also it's trade partners. It is shown with the model that sustainable growth is possible in the developing economies if the country successfully acquire the advanced foreign technology through FDI. The positive impact of FDI on economic growth depends on the quality of the policy environment. The correlation between FDI flows and total factor productivity growth in developing countries with high savings rates (a proxy for good economic policies) was 0.2, whereas in countries with low savings rates the correlation between FDI and productivity growth was negative (World Bank [1999]). In fact, the assimilating capability (R&D spillovers) crucially depends on the education quality of the labor force and other aspects of countries naonal system of innovation. We need to remember that mere presence of MNCs with superior technology would not improve the technological level of developing economies. Minimum threshold stock of human capital, learning efforts of domestic firms, government policies towards FDI and indigenous technology will play crucial role in determining the benefits of host country. It is highly believed that there is X-efficiency in the developing economies, which retard economic growth. Government liberalization policy, human capital development programs and better competitive environments would reduce inefficiencies and may contribute to faster economic growth.

Policy makers should be careful in choosing the instruments of controlling MNCs. Policies leading to an inflow (outflow) of FDI speed up (slow down) the growth process; that is, anything from investment controls for MNCs to specific taxes on profit repatriation of MNCs may hurt the growth of that economies. Effective policies towards enhancing learning efforts of domestic firms, reducing distortions, Market-stimulating technology policies (Lall Sanjaya [1998]) and better competitive environment may faster the catch-up process.

Our model is very simple and extension and improvement are needed. The inflow of FDI is influenced by many factors (such as wage rates, interest, risk factors, maintaining intellectual property rights, etc.) which are not explicitly considered in our present study. Another topic deserving further attention is how policies affect the transfer of technology in the framework of endogenous growth theory. It would be interesting to conduct an empirical evaluation of the proposed model. We hope to address these issues in the future studies.

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