

FDI and Growth

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Abstract

Multinational corporations [MNCs] usually engage in foreign direct investment [FDI] to take cost advantages of producing abroad to negate the need for licensing or subsidiary production. At the macro level, FDI accounts for significant proportions of MNCs total investment and has discernible impacts on economic growth. This is shown theoretically in the growth model where FDI complements domestic capital. Our model predictions tested favourably against panel data analysis of FDI on growth for thirty OECD countries. This paper also contributes in relating micro and macro aspects of the impact of FDI on economic growth and provides empirical support to the existing literature.

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1 Introduction

Foreign direct investment [FDI] occurs when a multinational corporation [MNC], with specific advantages in technology, production process or manage-

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ment style, operates in a foreign country either by licensing arrangements or its subsidiary branch. FDI negates the need to export goods to those markets from home and is one of the major factors of globalisation benefiting both hosts and investors. Most MNCs operate in manufacturing and service industries that include automobile, energy, telecommunication, engineering, insurance and banks, pharmaceuticals and other private services sectors.

FDI has micro and macro dimensions. At micro level any FDI activity is driven by the profit maximising objective of a MNC. It occurs when it is profitable to produce in a foreign country to serve foreign markets - for this the producer has some market power based on its superior know-how or long time experience and customer relations. At macro level it complements domestic investment and helps host countries in the process of capital accumulation and faster growth - as is seen from the experience of South and East Asian countries. Imports of advanced technology management and marketing and production processes not only increase efficiency in production and distribution, but also raise the level of living standards and welfare in both host and foreign countries. The aim of this paper is to assess how FDI has contributed to the investment and growth process of OECD countries.

The major stylized facts about FDI, investment and growth found from analysis of empirical facts as can be seen in Figures 2 to 5 in the appendix are as follows (data tables omitted for space reasons can be obtained upon request):

1. The ratio of inflows to outflows varies by countries and over time. Study of ratios show significant upsurge in FDI inflows in Eastern European countries during this period, particularly in the Czech Republic, Hungary, Poland, Slovakia and Turkey. Among western European countries Ireland, Portugal and Spain have benefited by more inflows than outflows.
2. Output growth rates vary significantly across countries and over time..
3. The ratios of investment to GDP are more uniform over time in a particular country, but vary significantly across the countries between 8 to 30 percent though they are more uniform in comparison to inflows and outflows of FDI.

The major contribution of this paper in this context lies in combining both micro aspects in a strategic model and macro aspects in an endogenous growth model and test empirical supports for conclusions of those models from the panel data of the OECD countries for 1990 to 2004. A growth model with a link between FDI, investment and growth in the next section is followed by the micro economic theory of FDI in section three. The empirical estimates emerging from the analysis of panel data on growth, investment, inflows and outflows of FDI among OECD are discussed in section four. Section five concludes.

2 Impacts of Foreign Capital on Growth

The aggregate FDI amount is obtained when direct investment from all MNCs is added together. FDI not only has physical capital components, but also includes knowledge spill-over effects. It complements domestic investment and promotes growth. This is analysed theoretically in the next section in the context of an endogenous growth model.

While Hymer (1976) and Caves (1982) provided early microeconomic studies about the effects of FDI, Batra and Ramachandran (1980) and Batra (1986) did comparative static analysis within a general equilibrium framework to assess the impacts of subsidy or taxes relating to FDI. Carledon and Torget (1985), Hortmann and Markusen (1987) and Markusen (1995) had strategic models of FDI. Bhagwati and Tironi (1980) presented a theoretical analysis in which tariff reduction could be immiserising when capital is owned by foreigners and labour intensive goods are imported from abroad under free trade arrangements. It is obvious that domestic workers producing labour intensive goods face lower wage rates due to the reduction in prices of goods they make under free trade agreements. Grossman and Helpman (1991) have reversed this argument and shown links between FDI and economic growth rate modelling how MNCs exploit the comparative cost advantage to operate their subsidiaries in foreign countries. They analyse the steady state path of the growth of variety of products produced and the expenditure on those goods in terms of firm specific skills, discount factors of consumers and the elasticity of substitution in production. Barrell and Pain (1997) found firm specific

knowledge based assets to be an important factor behind the growth of FDI in a number of OECD countries. Walz (1997) uses a dynamic general equilibrium model with endogenous technical change and shows how inter-regional knowledge spillover occurs from an advanced to a less developed country and is beneficial for host countries. Wang and Wong (2009) have highlighted the potentially heterogeneous growth effects of different entry modes.

In this section, a dynamic model of FDI, investment and growth is developed to illustrate how foreign capital is complementary to domestic capital as it involves technology transfer and diffusion of new management and processes. Countries aiming to attract foreign capital need to invest. In spirit of endogenous growth theory, the role of foreign capital in growth can be analysed using a standard growth model [see equations (1) to (21) below]. Thus equation (1) states standard utility [U] preferences in terms of consumption [C] while equation (2) states technology in terms of a Cobb-Douglas production function with domestic capital [K] and foreign capital [F] and technology [A]. The infinite horizon utility maximisation problem subject to technology, domestic and foreign capital accumulation and market clearing conditions can be written as:

$$\max U_0 = \int_0^{\infty} e^{-\rho t} U(C_t) dt ; U(C_t) = \frac{C_t^{1-\theta}}{1-\theta} \quad (1)$$

Subject to

$$Y_t = A_t K_t^\alpha F_t^{1-\alpha} \quad (2)$$

Net domestic investment that causes a change in physical capital:

$$\dot{K}_t = I_k - \delta K_{t-1} \quad (3)$$

Net foreign investment similarly causes accumulation of foreign capital:

$$\dot{F}_t = I_F - \delta_f F_{t-1} \quad (4)$$

Market clearing requires in each period requires that total output should equal total demand

$$Y_t = C_t + I_{k,t} + I_{F,t} \quad (5)$$

This infinite horizon constrained dynamic optimisation problem is solved using the current value Hamiltonian function as:

$$J = \frac{C_t^{1-\theta}}{1-\theta} e^{-\rho t} + \nu [I_k - \delta K_{t-1}] + \mu [I_F - \delta_f F_{t-1}] + \omega \left[A_t K_t^\alpha F_t^{1-\alpha} - C_t - I_{k,t} - I_{F,t} \right] \quad (6)$$

where C represents consumption, K capital stock, F amount of FDI, I_K and I_F domestic and foreign investments respectively, A technology, Y output, U utility of representative households; θ , ρ , α , ν , μ , δ , ω are parameters of the model. Symbol θ measures relative rate of risk aversion in the inter-temporal preference of the household; ρ is the discount factor; α the productivity of capital; ν , μ , and ω are shadow prices on domestic capital, foreign capital and the resources of the economy. First order conditions with respect to consumption, domestic and foreign capital and shadow prices are:

$$\frac{\partial J}{\partial C} = C^{-\theta} e^{-\rho t} - \omega = 0 \quad (7)$$

$$\frac{\partial J}{\partial I_K} = \nu - \omega = 0 \quad (8)$$

$$\frac{\partial J}{\partial I_F} = \mu - \omega = 0 \quad (9)$$

$$\dot{\nu} = \frac{\partial J}{\partial K} = 0 \quad (10)$$

$$\dot{\mu} = \frac{\partial J}{\partial F} = 0 \quad (11)$$

These five equations can be used to solve the values of K , F , Y , C , μ and ν to show analytically how such an economy can grow at a constant growth rate over time.

$$\dot{\nu} = \frac{\partial J}{\partial K} = \nu\delta - \omega\alpha AK^{\alpha-1} F^{1-\alpha} \quad (12)$$

$$\dot{\mu} = \frac{\partial J}{\partial F} = \mu\delta - \omega(1-\alpha) AK^\alpha F^{-\alpha} \quad (13)$$

From equation (9) and (10)

$$C^{-\theta} e^{-\rho t} = \nu \quad (14)$$

Taking log both sides

$$-\theta \ln C - \rho t = \ln \nu \quad (15)$$

By differentiating both sides with respect to time:

$$-\theta \frac{\dot{C}}{C} - \rho = \frac{\dot{\nu}}{\nu} \quad (16)$$

Substituting

$$g_c = \frac{\dot{C}}{C} = -\frac{1}{\theta} \left(\frac{\dot{\nu}}{\nu} + \rho \right) = -\frac{1}{\theta} \left(\frac{\nu\delta - \omega\alpha AK^{\alpha-1} F^{1-\alpha}}{\nu} + \rho \right) = \frac{1}{\theta} (\alpha AK^{\alpha-1} F^{1-\alpha} - \rho - \delta) \quad (17)$$

Similarly from $\mu = \omega$

$$\frac{\dot{\nu}}{\nu} = \frac{\nu\delta - \omega\alpha AK^{\alpha-1} F^{1-\alpha}}{\nu} = \delta - \alpha AK^{\alpha-1} F^{1-\alpha} \quad (18)$$

$$\frac{\dot{\mu}}{\mu} = \frac{\mu\delta - \omega\alpha AK^{\alpha-1} F^{1-\alpha}}{\mu} = \delta - (1 - \alpha) AK^{\alpha-1} F^{1-\alpha} \quad (19)$$

$\frac{\dot{\nu}}{\nu} = \frac{\dot{\mu}}{\mu}$ implies

$$\delta - \alpha AK^{\alpha-1} F^{1-\alpha} = \delta - (1 - \alpha) AK^{\alpha-1} F^{1-\alpha} \quad (20)$$

$$\frac{K^{\alpha-1} F^{1-\alpha}}{K^{\alpha-1} F^{1-\alpha}} = \frac{\alpha}{(1 - \alpha)} \text{ or } \frac{K}{F} = \frac{\alpha}{(1 - \alpha)} \quad (21)$$

Thus the ratio of domestic and foreign capital is constant. Putting this value in the production function:

$$Y = AK^\alpha F^{1-\alpha} = AK \frac{K^\alpha}{K} F^{1-\alpha} = AK \frac{F^{1-\alpha}}{K^{1-\alpha}} = AK \left(\frac{1 - \alpha}{\alpha} \right)^{1-\alpha} \quad (22)$$

So, despite the diminishing rate of return on domestic and foreign capital individually, the complementarity between them makes the marginal productivity of domestic capital $[K]$ equal to $A \left(\frac{1-\alpha}{\alpha} \right)^{1-\alpha}$. It does not diminish and may increase with technology. Adding domestic or foreign capital generates economic growth at a constant rate in the manner close to the AK endogenous growth model as:

$$g = \frac{\dot{Y}}{Y} = \frac{\dot{C}}{C} = \frac{\dot{K}}{K} = \frac{\dot{F}}{F} = \frac{\dot{\mu}}{\mu} = \frac{\dot{\nu}}{\nu} = g_A + g_K + (1 - \alpha) \ln \left(\frac{1 - \alpha}{\alpha} \right) \quad (23)$$

Thus the growth rates of technology and capital directly correspond to the growth rate of output. This basic model can be extended by introducing a stochastic shock (z) in technology, $A(z)$; by making technical progress a function of accumulation of foreign or human capital appropriate for multinational firms to operate and invest in the domestic economy, thereby letting them fully realise their potential for increasing returns of scale. Empirical estimation of

this model will be conducted using growth of output (growth), domestic (in-vratio) and ratios of inflows (FDI ratio) and outflows (offwinratio). Openness and tax and interaction between the FDI and per capita income also included to capture other factors missing from the above model.

3 Microeconomic Theory of FDI

The amount of FDI (F) in equation (2) above results from the profit maximising decision of firms. Multinationals engage in FDI and interact strategically with the underlying downward sloping demand functions and firm specific cost functions that are differentiated across countries. Licensing of copyrights or blueprints versus subsidiary based productions are based on microeconomic principles. These motives determine the nature of inflows and outflows or joint ventures between MNCs and firms serving in domestic markets. MNCs move to a foreign country for a number of reasons including the cost advantages in producing there rather than exporting commodities. Particularly:

- ownership (O) of firm specific capital;
- location (L) based advantages of production;
- licensing abroad for reasons of natural resources or customer bases;
- internalisation (I) of benefits of technical know-how by firms doing R & D.

These OLI factors indicate why MNCs have cost advantages in going abroad because of ownership of firm specific factors such as R&D, scientific and technical workers, product novelty and complexity, and marketing expenditures. Also when they have more intangible assets such as management, engineering, marketing, financial services, patents and trademarks. Similarly, tariffs, quota, transportation cost, cheap production and customer base are also key location factors for FDI by a MNC. Internalisation refers to full exploitation of product and processes within the firm rather than by licensing or franchising to firms in other countries. The degree of economies of scale and the structure

of market determine the amount of inflows and outflows and which one of its FDI activities are strategically stable in the long run.

A simple way to analyse the underlying microeconomic theory of FDI activity is to think of a MNC as a monopolist facing two different demand functions at home and abroad. It has firm specific capital, but the two markets differ on the structure of demand and cost conditions. In order for an MNC to open a subsidiary in a foreign market the cost of exporting goods (transportation, tariff and other costs) must be higher than the fixed cost of setting up business in that foreign country. Bargaining on the share of profit for host and MNC has to be further considered in order to determine net benefits to each. In a survey of firms in the Czech Republic, Denmark, Germany, Ireland, Italy, the Netherlands, Portugal, Slovenia, Finland, Sweden, the United Kingdom and Norway the proportion of enterprises carrying out international sourcing state labour cost to be the main motivation of FDI as stated in Table 1.

Table 1: Motivations of multinational corporations for their foreign operation

Reason for FDI	%
Reduction of labour costs	45
Access to new markets	36.5
Strategic decisions taken by the group head	35.7
Reduction of other costs than labour costs	30.7
Other motivation	24.6
Focus on core business	24.1
Improved quality or introduction of new products	19.8
Access to specialised knowledge/ technologies	17.7
Following the behaviour/example of competitors/clients	14.2
Tax or other financial incentives	9.2
Source: Eurostat (SBS), 2005.	

Markusen (1995) nicely illustrated the strategic interaction issues of licensing versus subsidiary production. Taking a two period model of production with given rental fees of license or cost of subsidiary operation and possibility

of defect in the second period. Committing host firms to the licence agreements is difficult. Profits earned by an MNC that sells licence of running the business to a host firm that defects on the agreement in the second period are less than when the MNC runs subsidiary operation in the country. Profits from the subsidiary operation would be less if the licence agreement is implemented without defecting in the second period. This can be summarised as $(R + D - FC < 2M - FC < 2R - FC)$ where R is the rental income from licensing of a partner foreign firm, D is the payments made in case the licensee defects in the second period (this deters the licensee from supplying the market itself after gaining the know-how from the MNC in the first period), FC is the fixed cost of FDI to the MNC, and M is the profit from subsidiary when FDI takes the form of subsidiary operation. Higher probability of cheating on license agreements motivates an MNC to run a subsidiary but it would have preferred licensing than opening a subsidiary if it was guaranteed of full commitment to a license agreement. He concludes that direct investment is more likely in cases where technology has the joint input characteristic of knowledge capital. Thus reduction in the production cost is the main microeconomic evidence for the operation of the multinational corporations of the OECD countries. Here the reduction in the labour costs is the main incentive of the multinational followed by access to markets for strategic decisions, reduction of other costs as can be seen from Table 1.

3.1 A Microeconomic Model of FDI

More recent analysis FDI focuses on investment under uncertainty approach discussed in Dixit and Pidyck (1994) and applied in Arijit and Hek (2011). Faced with a demand shock that moves according to a Brownian motion, foreign firm decides to invest amount F in the host country if the expected profits are positive.

$$E\Pi = E \left[\int_t^\infty \pi_F \alpha Y_s^\eta e^{-rs} ds \right] - \alpha F \quad (24)$$

where Y is demand shock, r is constant interest rate, $0 < \alpha < 1$ is share of FDI in total investment, F is the amount of FDI. Shock to demand is given by

a Winner process z with drift term a_F and the standard deviation of σ_F .

$$dY = a_F dt + \sigma_F Y dz \quad (25)$$

Whether it is profitable to invest depends on the critical level of demand shock \bar{Y} that depends on a host of technology and preference side parameters. Optimisation problem of the firm is given by:

$$V(Y) = \max [{}_E\Pi, (1 + rdt)^{-1} V(Y + dY)] \quad (26)$$

According to Dixit and Pindyk (1994) the Ito's Lemma implies partial differential equation

$$\frac{1}{2}\sigma_F^2 Y^2 V''(Y) + a_F V'(Y) - r_F V'(Y) = 0 \quad (27)$$

and ${}_F V'(Y)$ must satisfy following boundary conditions:

$$V(Y) = \alpha_E \Pi_F(\bar{Y}) \quad (28)$$

$$V'(Y) = \frac{\alpha_E \Pi_F(\bar{Y})}{\partial Y} \quad (29)$$

$$\alpha_E \Pi_F = \pi_l(\alpha) Y^\eta - \alpha F \quad (30)$$

The function that satisfies all above equations is:

$$V(Y) = mY^\beta \quad (31)$$

Inserting this value function in above two equations

$$m\bar{Y}^\beta = \pi_l(\alpha) \bar{Y}^\eta - \alpha F \quad (32)$$

$$\beta m\bar{Y}^{\beta-1} = \eta \pi_l(\alpha) \bar{Y}^{\eta-1} \quad (33)$$

Solving these we get

$$\bar{Y} = \left[\frac{\left(\frac{\beta}{\beta-1}\right) \alpha F}{\pi_l(\alpha)} \right] \quad (34)$$

The parameter β is determined by the quadratic root:

$$\frac{1}{2}\beta(\beta - 1) + a_F\beta - r = 0 \quad (35)$$

$$\beta = \frac{1}{2} - \frac{a_F}{\sigma_F^2} + \sqrt{\left[\frac{a_F}{\sigma_F^2} - \frac{1}{2}\right] + \frac{2r}{\sigma_F^2}} \quad (36)$$

Flow of FDI thus occurs only when the critical conditions are met and rely mainly on the future expectations of profits by the investors in a world that is inherently uncertain as shown by the Brownian motion in this model. Micro motivations of FDI in this model fits well to characterise the analytical aspects of microeconomic justification for the foreign capital (F) from MNCs that was driving growth in our macro model. It is possible to extend it to a dynamic monopoly and price discrimination model, which is skipped here for space reasons.

4 Empirical Literature on FDI and Growth

Among empirical studies on FDI, Wallis (1968) had looked at increase in inflows of FDI from the US to the EU and assessed the importance of FDI in enhancing economic growth. Then Feldstein and Horioka (1980) had estimated impacts of FDI on saving and investment. Desai, Foley and Hines (2005) had found an almost one to one positive relationship between FDI inflows and saving GDP ratios and investment, and negative relation between FDI outflows and reduction in investment among OECD countries in the 1990s. Borensztein et al. (1998) found the need of domestic absorptive capacity to make FDI important factor on economic growth in a study of FDI flows from industrialised countries to 69 developing countries. In a recent study de Mello (1999) used the panel data model to conclude that growth and FDI nexus are sensitive to country specific factors and generally supports a positive relationship between FDI and growth in the long run. Balasubramanyn et al. (1999) use panel data study of 46 developing countries to find support for the Bhagwati hypothesis that the impact of FDI is larger in countries that have adopted export led growth strategies. Similar findings are reported in country specific studies such as Ram and Zhang (2000) and Binh and Haughton (2002). Wang and Zhao

(2008) look at the technology spillover effect across vertically and horizontally integrated firms and industries in China and find ownership of FDI an important variable in assessing externalities of FDI. Many other studies aim to measure the impact of foreign aid on a particular country (Helpman (2006)). Lencik and Morrissey (2006) have shown how the volatility of investment has detrimental impacts on economic growth. More recently, using a sample of 84 countries from 1987 to 2001, it is shown that the effects of greenfield-investment and merger and acquisition (M&A) have different impacts on actual economic growth. It is observed that, in most cases, greenfield-investment raises economic growth whereas M &A can be beneficial only when the host country has adequate human capital [Wang and Wong (2009)]. Taking account of these findings in the literature this section aims to test the predictions of the above theories, particularly the impact of FDI inflows and outflows in investment and growth in 31 OECD countries for the period of 1990 to 2004.

Inflows and outflows relative to total domestic investment were extraordinarily high in Luxembourg (forty times higher) and noticeably higher in the South Korea (two to three times higher) than in other countries.

All variables used here were stationary on the basis of Levin, Lin and Chu test statistics in Eviews as:

Table 2: Common Unit Root Test of Panel Data with Levin, Lin, Chu (LCC) Test

	Test-statistics	Probability
Growth	-10.60	0.00
Investment ratio	-5.01	0.00
Inflow ratio	-2.11	0.02
Outflow ratio	-2.05	0.02
Cross sections: 30; No of observations: 390		

5 Panel Regression Analysis on Impacts of FDI in Growth and Investment

We have obtained the data for our analysis from the OECD database on

FDI available from the economic and social database for the UK (<http://www.esds.ac.uk/International>) for years 1990 to 2004. We regress growth rate of output across OECD countries $y_{i,t}$ on FDI inflow or outflow and other explanatory variables, $x_{i,t}$ as:

$$y_{i,t} = \alpha_i + x_{i,t}\beta + e_{i,t} \quad e_{i,t} \sim IID(0, \sigma_e^2) \quad (37)$$

where parameter α_i picks up the fixed effects that differ among individuals but constant over time, β is the vector of coefficients on explanatory variables, $x_{i,t}$. The random term $e_{i,t}$ takes all other effects. The model is estimated by the least square dummy variable method as:

$$\bar{y}_i = \alpha_i + \bar{x}_i\beta + e_i \quad \bar{y}_i = T^{-1} \sum_i y_{i,t} \quad (38)$$

$$y_{i,t} - \bar{y}_i = (x_{i,t} - \bar{x}_i)\beta + (e_{i,t} - e_i) \quad (39)$$

The estimator of parameters from the mean difference then is given by:

$$\beta_{FE} = \left(\sum_t \sum_i (x_{i,t} - \bar{x}_i)(x_{i,t} - \bar{x}_i)' \right)^{-1} \sum_t \sum_i (x_{i,t} - \bar{x}_i)(y_{i,t} - \bar{y}_i)' \quad (40)$$

$$\alpha_i = \bar{y}_i - \bar{x}_i\beta_{FE} \quad (41)$$

These estimators are unbiased, consistent and efficient. Their significance is tested based standard errors obtained from:

$$cov(\beta_{FE}) = \sigma_e^2 \left(\sum_t \sum_i (x_{i,t} - \bar{x}_i)(x_{i,t} - \bar{x}_i)' \right)^{-1} \quad (42)$$

$$\sigma_e^2 = \frac{1}{N(T-1)} \sum_t \sum_i (y_{i,t} - \alpha_i - x_{i,t}\beta_{FE})^2 \quad (43)$$

The data on GDP and GFCF is taken using the currency for each country and then converting to US dollars using the exchange rate of the national currency to the US dollar. Growth rates of GDP, investment and FDI are computed by the authors. Variables used in this analysis were stationary (Table 2). We do not find any evidence of reverse causality from growth to investment ratio as indicated by Blomstrom et al. (1996).

Results presented in Table 3 to Table 5, estimated using the PcGive, reveal several interesting facts regarding the impact of FDI on growth and investment.

Firstly, the ratio of investment to GDP is a significant determinant of growth rates across OECD countries as shown in Table 3. This is exactly what is expected from the theory of economic growth. Net investment adds to capital accumulation and more capital associated with given labour generates more output. The negative sign in the lagged term shows cyclical pattern of investment ratio. FDI contributes positively to growth. Higher tax rates cause lower growth rates which is very intuitive. Overall fit of the model is good as R^2 is 42 percent.

Table 3: Growth rate of output on investment Ratio in OECD Countries

	Coefficient	Standard Error	t-value	t-prob
Growth	0.30686	0.130	-2.360	0.019
FDI ratio	0.00049	0.000	4.680	0.000
Tax rate	-0.00042	0.000	-2.010	0.045
Invratio	0.86255	0.202	4.270	0.000
Invratio (-1)	-0.85115	0.182	-4.670	0.000
Constant	0.03319	0.014	2.400	0.017
$R^2 = 0.42, \chi^2 = 399.2 [0.000], T = 14, N = 31.$				

Table 4: Determinants of FDI inflows in OECD Countries

	Coefficient	Standard Error	t-value	t-prob
openk	0.047	0.018	2.550	0.011
intract	0.001	0.000	2.440	0.015
Constant	-8.732	3.276	-2.670	0.008
$R^2 = 0.59, \chi^2 = 7.68 [0.021], T = 14, N = 31.$				

Table 5: Determinants of FDI outflows in OECD Countries

	Coefficient	Standard Error	t-value	t-prob
openk	0.051	0.021	2.460	0.014
intract	0.001	0.000	2.320	0.021
Constant	-9.366	3.690	-2.540	0.011
$R^2 = 0.57, \chi^2 = 7.09 [0.029], T = 14, N = 31.$				

Inflows of FDI in OECD countries relates positively to the openness of the country (openk) and the size of the country (interaction of investment ratio and per capita GDP in PPP) as shown in Table 4. Openness (openk) and size (intract) are also significant determinant of outflows as shown in Table 5.

In Table 6 we show that domestic investment ratio falls with a rise in the tax rate (taxrate) but responds positively to share of capital in output (ki) and the ratios outflows to investment (offwinratio) and are a bit lower for countries with higher per capita income (GDP_PPP). All these findings correspond to the neoclassical theory of capital accumulation and are consistent to the findings of Desai, Foley and Hines (2005). Thus, the panel regression analysis clearly reveals very little influence of FDI outflows on aggregate investment ratios and but good influence on growth rates from analysis of the results as in table 3.

Table 6: Contribution of FDI Inflows and Outflows to Domestic Investment in OECD Countries

	Coefficient	Standard Error	t-value	t-prob
Invratio (-1)	0.881728	0.01695	52.00	0.019
ki	0.000476	0.00011	4.170	0.000
Tax rate	-0.000185	0.00009	-2.110	0.045
offwinratio	0.000212	0.00007	3.190	0.000
GDP_PPP	-0.00000	0.00000	-2.160	0.000
Constant	0.020043	0.00567	3.540	0.017
$R^2 = 0.89, \chi^2 = 1068 [0.000], T = 14, N = 31.$				

Foreign investment substitutes domestic investment a bit and there is some justification on popular sentiments against foreign capital in this empirical analysis. The contribution of FDI to economic growth is direct and indirect. Inflows or outflows make economy more sensitive to the foreign capital, hence domestic firms have to be more competent. This enhances economic growth. Similarly the amount of investment and the growth rate are influenced through indirect channels. This is clear from the result in table 7 where inflows seem to influence growth rates in the similar way as the domestic investment having both positive and cyclical effects. Country size and investment interaction effect (intract) is positive but tax GDP interaction term is negative as expected.

Table 7: Contribution of FDI inflows and outflows to growth rate of output in OECD Countries

	Coefficient	Standard Error	t-value	t-prob
growth(-1)	0.214	0.110	1.940	0.053
infinnvratio	0.006	0.002	3.760	0.000
infinnvratio (-1)	-0.004	0.001	-4.520	0.000
infinnvratio (-3)	-0.002	0.001	-2.070	0.039
intract	0.000	0.000	-3.170	0.002
intract (-1)	0.000	0.000	3.350	0.001
tax*GDP	0.001	0.000	2.790	0.006
tax*GDP (-1)	-0.001	0.000	-2.890	0.004
invratio	1.558	0.380	4.100	0.000
invratio(-1)	-1.576	0.357	-4.410	0.000
Constant	0.045	0.016	2.750	0.006
$R^2 = 0.49, \chi^2 = 233.2 [0.000], T = 14, N = 31.$				

We also tried to disentangle the country and time specific effects of FDI on investment and growth rates across OECD countries. When controlled for time specific and country specific factors, outflows had negative impacts on domestic investment ratio but the corresponding impacts of inflows were not very significant (Table 8). Country specific and time specific factors were more dominant in determining the investment ratio or growth rates than inflows or outflows of FDI. Countries with more liberal FDI policies such as Ireland, South Korea, Slovakia and Spain had positive impacts of FDI on growth rate than in other OECD countries. FDI contributed positively on growth rates from 1994 to 2001 but had either positive or negative effects on growth in other years.

These time and country specific effects are found to be consistent with the stylized facts relating to the growth rates of output, investment ratios and inflows and outflows of FDI.

6 Conclusion

In this paper, the microeconomic effects of FDI have been illustrated with an example of a multi-plant MNC that faces a different structure of demand and costs between home and foreign countries with strategic consideration of licensing or subsidiary production in foreign countries. On the macro side, the total FDI aggregated over MNCs accounts for a significant proportion of total investment and has a significant impact on economic growth. This growth effect is shown theoretically using an endogenous growth model with FDI in which foreign capital complements domestic capital and contributes to both investment and growth rate of output. Our model predictions have been tested using panel data growth regressions for 30 OECD countries over 1990 to 2004. Our analysis establishes positive impacts of FDI inflows and negative impacts of FDI outflows on investment and economic growth. The impacts of time and country specific effects are found to be consistent with the stylized facts relating to growth rates of output, investment ratios and inflows and outflows of FDI. The empirical results illustrated in this paper are comparable to Desai et al. (2005).

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A Appendix

Note for Figures: X axis represents countries in OECD starting 1990; starting from Australia to the USA, and 31st is EMU. Y axis measures growth rate of output in Figure 1, investment ratio in Figure 2, ratios of total inflow and outflows to total investment in Figures 3 and 4 respectively.

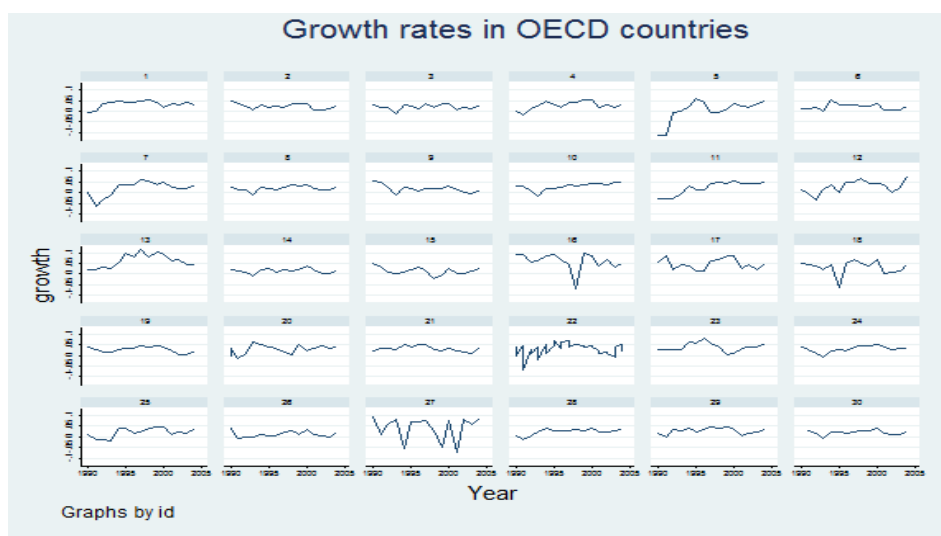


Figure 1: Growth rates 1990 to 2004

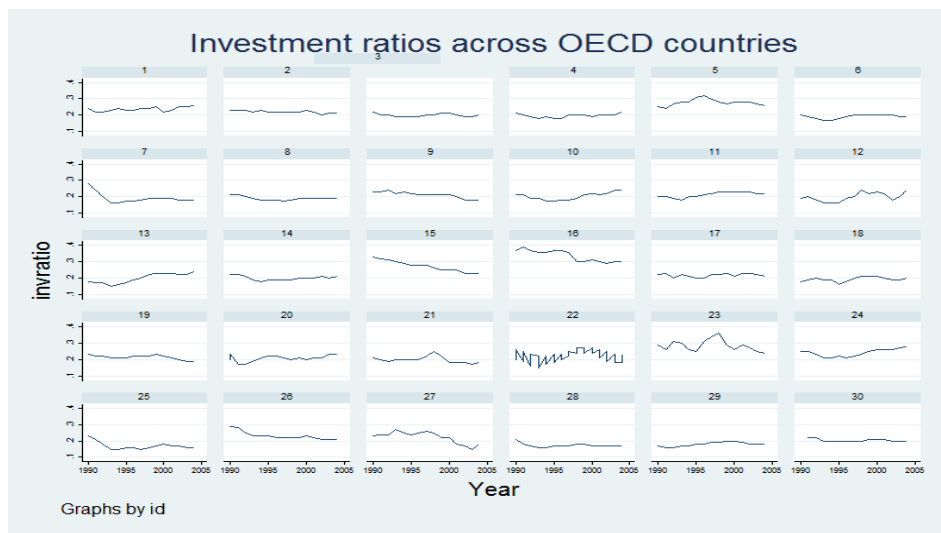


Figure 2: Investment ratios 1990 to 2004

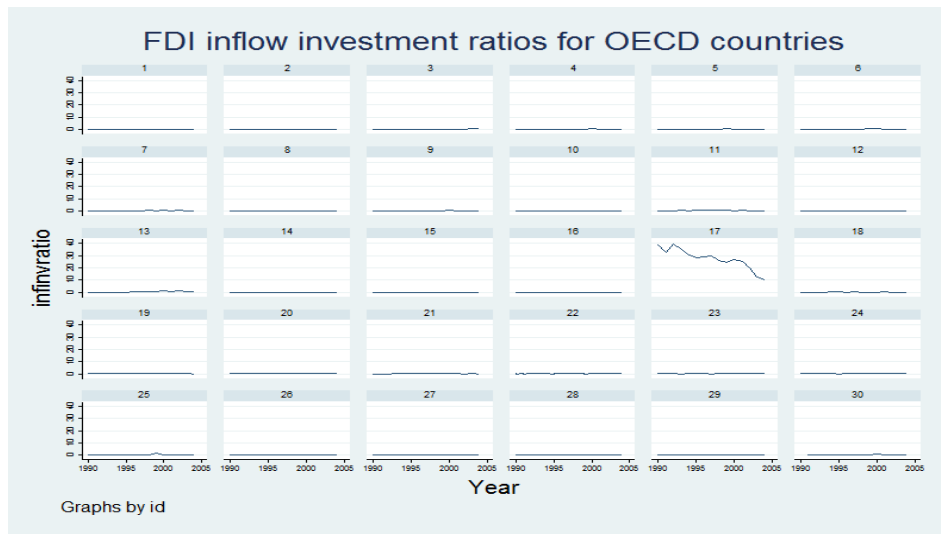


Figure 3: Ratios of FDI inows to investment 1990 to 2004

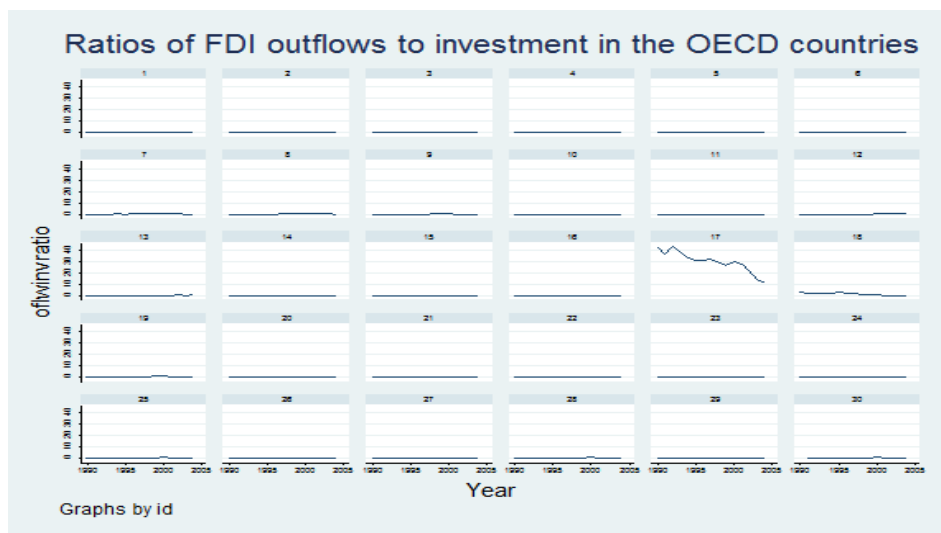


Figure 4: Ratios of FDI outows to investment 1990 to 2004

Table 8: Impact of FDI inflows and outflows in growth rate of output in OECD:

Panel Data Regression

Variable	Coefficient	t-prob	Variable	Coefficient	t-prob
infinvratio	0.0681	0.00	offwinvratio	0.1065	0.00
Constant	0.0262	0.00	Constant	0.0270	0.00
AUT	-0.0071	0.00	AUT	-0.0102	0.00
BEL	-0.0293	0.00	BEL	-0.0376	0.00
CAN	-0.0082	0.00	CAN	-0.0164	0.00
CZE	-0.0348	0.00	CZE	-0.0250	0.00
DNK	-0.0195	0.00	DNK	-0.0267	0.00
FIN	-0.0153	0.00	FIN	-0.0328	0.00
FRA	-0.0140	0.00	FRA	-0.0285	0.00
DEU	-0.0120	0.00	DEU	-0.0169	0.00
GRC	0.0004	0.70	GRC	0.0008	0.35
HUN	-0.0231	0.00	HUN	-0.0087	0.00
ISL	-0.0027	0.00	ISL	-0.0119	0.00
IRL	0.0105	0.08	IRL	0.0209	0.00
ITA	-0.0140	0.00	ITA	-0.0173	0.00
JPN	-0.0111	0.00	JPN	-0.0142	0.00
KOR	0.0004	0.00	KOR	0.0306	0.00
MEX	0.0320	0.00	MEX	0.1385	0.00
NLD	-0.0044	0.00	NLD	-0.0374	0.00
NZL	-0.0158	0.00	NZL	-0.0158	0.00
NOR	-0.0006	0.00	NOR	-0.0060	0.00
POL	-0.0019	0.03	POL	-0.0063	0.00
PRT	-0.0085	0.00	PRT	-0.0118	0.00
SVK	0.0038	0.00	SVK	0.0111	0.00
ESP	-0.0039	0.00	ESP	-0.0101	0.00
SWE	-0.0261	0.00	SWE	-0.0387	0.00
CHE	-0.0209	0.00	CHE	-0.0428	0.00
TUR	0.0126	0.00	TUR	0.0132	0.00
GBR	-0.0135	0.00	GBR	-0.0339	0.00
USA	-0.0018	0.00	USA	-0.0059	0.00
EMU	-0.0262	0.00	EMU	-0.0455	0.00
$R^2 = 0.49, \chi^2 = 17.19 [0.000], T = 15, N = 30.$					