Behavioral and Empirical Perspectives on FDI: International Capital Allocation across the Asian Region

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1. Introduction

International capital allocation has long been a primary driver of dynamic economic growth, particularly for emerging economies, and this relationship has nowhere been more fortuitous than in Asia. Together with disciplined commitments to domestic and external economic reform, the region's economies have leveraged foreign savings to achieve growth and modernization beyond the imagining of prior generations. Despite the pervasive influence FDI has had on Asia's growth experience, the precise benefits of foreign investment remain challenging to quantify and the process of international capital allocation very difficult to predict. Given the nearly universal appeal of FDI as a growth catalyst, however, it would clearly be desirable for policy makers to better understand its fundamental determinants. As Asia transits from a loose federation of emerging economies to a more fully integrated and mature economic region, the need to understand multilateral investment dynamics will only increase.

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During the region's evolution toward greater multilateralism, one of the most dramatic events has been the emergence of private agency across a web of supply networks and value chains, heavily mediated by FDI. Beneath an official veneer of negotiated trade agreements, there is now a remarkably diverse and dynamic mosaic of private commercial linkages that draw the region's economies into concerted value creation. These linkages are often part of global networks where tens, hundreds, even thousands of intermediate products change hands along extended value-added chains. The result is unprecedented geographic diffusion of economic activity, growth, and innovation, coexisting with and often transcending official networks of diplomacy and trade negotiation. With better understanding of these complex linkages, policy makers can more effectively pursue policies that facilitate dynamic and sustainable growth. Broadening the basis for such activities can only amplify their benefits, distribute them ever more widely, and reduce risks of excessive economic concentration and instability.

In this paper, we advance FDI research by combining the new GTAP VI database and a global forecasting model with a new capital flow modelling component. The latter consists of independent data on foreign capital stocks and flows, calibrated to a sub-model that permits experimentation with diverse specifications of FDI behaviour. This hybrid approach has reinforced our understanding of the research challenges in this area. Having said that, however, it also yields illuminating evidence on the underlying relationships between Heckscher-Ohlin endowments and more modern considerations such as human capital, productivity, endogenous growth, competitive strategy, and the complex economic roles of institutional behavior. Our results indicate that all these factors have played a role in Asia's remarkable growth experience, to different degrees in different countries. Moreover, each has its own relationship to investment incentives, and policy makers must understand those relationships to attract and capture the many benefits FDI can offer.

2. Historical Trends in Asian FDI

Flows of FDI have seen a dramatic rise in recent years due to increasing openness of host economies. This trend is likely to continue. From only $53.7 billion in 1980, annual FDI outflows reached $1.2 trillion in 2000. (The global recession after that, however, considerably reduced outflows, which dropped by 39% in 2001, a further 17% in 2002, and 15% in 2003, before picking up by 6% in 2004).

Relative to world output and exports, FDI outflows have risen tremendously since the early 1990s (Figures 1 and 2). World FDI outflows increased almost five times from 1990 to 2000 before falling from 2001 through 2003, while world output and exports grew at more modest paces between 1990 and 2004.

From 1980 to 2000, the growth rate of world FDI outflows surpassed that of world exports. This swift expansion in FDI was more pronounced during 1986-1990, when many host countries began to relax regulations in order to attract FDI, and 1996-2000, when many mergers & acquisitions (M&As) followed in the wake of privatization programs in Latin America and the 1997-98 Asian economic crisis.

Economies in developing Asia received increasingly larger shares of world FDI inflows particularly during the 1990s. From an average of 6.4% in the 1970s, developing Asia's share in total FDI inflows increased to 18.5% in the 1990s. FDI inflows to developing Asia grew from only $694 million in 1970 to $144 billion in 2000, representing an average growth rate of 19.5% per year, before declining in 2001.

M&As have become important, particularly following the Asian financial crisis, as sharp local currency depreciations and liquidity constraints increased the availability of target firms. M&As in developing Asia rose more than 129 times by value between 1987 and 2001, from only $256.1 million to $33.1 billion. In descending order of size, Hong

Kong, China; Republic of Korea (Korea); People's Republic of China (PRC); Singapore; and Indonesia were the top five recipients of M&A flows between 1997 and 2003.

The preferences of foreign investors for individual country destinations have shifted over time. While Europe and North America continue to be major recipients of FDI, the People's Republic of China (PRC) has emerged as another favored destination. Malaysia, Argentina, Thailand, Portugal, and New Zealand, which were among the 20 largest FDI recipients during 1991-1993, were replaced by Germany, Ireland, Brazil, Switzerland, and Japan during 2001-2003.

Among the favored Asian destinations for FDI, there has not been much change. Indonesia, Philippines, and Viet Nam, three of the top 10 FDI destinations in the early 1990s, dropped from the list and were replaced by India, Kazakhstan, and Azerbaijan in the early 2000s. Meanwhile, Hong Kong, China; Singapore; Korea; and Thailand overtook Malaysia as preferred FDI destination.

Among the countries in developing Asia, the top 10 recipients of FDI inflows in 2001-03 accounted for about 97% of total FDI in the region, with the top three recipients alone accounting for 79% (Table 1). Azerbaijan, however, which is only number 10 in the list of top developing Asian FDI recipients, had the highest ratio of FDI to GDP, reflecting the importance of new FDI in its hydrocarbons development. On the other hand, four out of the top 10 FDI recipients in developing Asia have FDI to GDP ratios lower than the average for developing Asia of 2.7%. This means that FDI to developing Asia is heavily concentrated—only 10 out of 35 economies for which data are available have FDI shares equal to or exceeding their shares of GDP in developing Asia.

While the total value of FDI inflows to the top 10 Asian destinations surged during the last decade, developing Asia's share in the world total dropped from 19.5% in 1991-93 to 14.3% in 2001-03. At the per capita level, average FDI inflows have shown remarkable increases in some Asian economies. In Singapore and Hong Kong, China,

for instance, per capita inflows more than doubled between 1991-93 and 2001-03. The choice of time period matters, as some years show more remarkable increases than others. In Hong Kong, China, for example, per capita FDI inflows increased from only $574 in 1990 to $9,232 in 2000 – an expansion of 16.2 times. In Azerbaijan, total annual inflows reached 90% of gross fixed capital formation in 2001-03. In other Asian economies, FDI amounts to only about 30% of gross fixed capital formation (Table 2).

It is important to note that it is increasingly difficult to characterize and typify foreign investment. In most economies, it enters practically all sectors. It originates from industrial and developing economies. It may take the form of long-term greenfield investment or short-term, opportunistic M&As. It ranges from the global investments of the world's largest corporations to smaller cross-border investments. The distinction between foreign and domestic investment is increasingly blurred, especially when a country's diaspora is actively involved. A world of increasingly seamless national boundaries also connotes highly fluid capital whose national characteristics are often difficult to discern.

2.1. Impact of Foreign Direct Investment

Supporters of FDI contend that in addition to helping overcome local capital constraints, foreign investors introduce a combination of other highly productive resources into the host economy. These include production and process technology, managerial expertise, accounting and auditing standards, and knowledge of international markets, advertising, and marketing. The challenge for the host economy is to benefit from the multinational enterprise (MNE) presence, and to appropriate as much as possible of the increased income accruing from the resultant productivity growth without deterring further investment. The large literature on FDI impacts concludes that the host

economy benefits are quite uneven, both across and within countries.[1] This suggests that host country policies are an important factor in the distribution of these benefits. Of particular relevance are policy influences on the commercial environment, institutional quality, and productive capabilities.

Distinguishing characteristics of FDI are its stability and ease of service relative to other forms of external finance, such as commercial debt or portfolio investment, as well as its nonfinancial contributions to production and sales processes. Aside from increasing output and income, potential benefits to host countries from FDI inflows include the following (Brooks et al 2004):

(i) **Foreign firms bring superior technology.** The extent of benefits to host countries depends on the extent of technological spillovers to domestic and other foreign-invested firms, as well as the extent to which domestic owners of the factors of production or consumers reap the gains from greater productivity. The potential benefits from adopting or adapting to new technology or techniques (including marketing techniques) encourage human capital development to exploit those benefits.

(ii) **Foreign investment increases competition in the host economy.** The entry of a new firm in a nontradable sector increases industry output and may thereby reduce the domestic price, leading to a net improvement in welfare. Local marketing and learning by doing also spur domestic market development and welfare improvements.

(iii) **Foreign investment typically results in increased domestic investment.** Bosworth and Collins (1999) found that about half of each dollar of a capital inflow translates into an increase in domestic investment. Their findings suggest a foreign resource transfer equal to 53–69% of the inflow of financial capital. However, when the capital inflows take the form of FDI, there is a near one-for-one relationship between the FDI and increased domestic investment.

[1] See Fan (2003), Lim (2001), and Moran (2002) for recent literature surveys.

(iv) **Foreign investment yields advantages in terms of export market access arising from foreign firms' economies of scale in marketing or ability to gain market access abroad.** Besides their contributions through joint ventures, foreign firms can serve as catalysts for other domestic exporters. The probability that a domestic plant will export is positively correlated with proximity to multinational firms (Aitken et al. 1997). One implication is that governments may encourage potential exporters to locate near each other by creating export processing zones or promoting clusters, or by conferring special benefits such as duty-free imports of inputs, subsidized infrastructure, or tax holidays, to help reduce costs for domestic firms in breaking into foreign markets. Such interventions should be considered in the broader context of their effects on incentives for resource allocation in other sectors as well.

(v) **Foreign investment can aid in bridging a host country's foreign exchange gap.** In standard two gap analysis, there may exist insufficient savings to support capital accumulation to achieve a given growth target, and insufficient foreign exchange to purchase imports. Often investment requires imported inputs for which domestic savings are insufficient or face barriers in being converted to foreign exchange to acquire imports. Then domestic savings alone may be insufficient to guarantee growth, while capital inflows can help ensure that foreign exchange will be available to purchase imports for investment.

Even for countries with relatively easy access to international capital markets (such as Korea) or with substantial holdings of foreign reserves (such as the PRC or India), the nonmonetary benefits of FDI, such as (i)–(iv) above, still make it an attractive source of investment.

The general conclusion in the empirical literature is that FDI confers net benefits on the host economy. The capital stock is augmented, productivity rises, and some (often much) of the increase is appropriated by domestic factors of production. These

benefits appear to be especially important in connecting the host country to the global economy, and in the area of technology transfer. Nevertheless, analysts still disagree about the magnitudes, channels, and lags associated with these transfers.

As trade has been liberalized, the old “tariff factory” model of FDI has given way to a new FDI-led, export-oriented paradigm. This is sometimes characterized as a switch from “rent-seeking” to “efficiency-seeking” FDI (see e.g. Blonigen et al:2004, and Blonigen and Figlio:1998). The contemporary challenge for developing countries is to develop a new approach to managing FDI. In a globalizing world, competition for FDI is no longer about rents but instead focuses on the establishment of an enabling, business-friendly commercial environment, consistent with national development objectives. In this context, a useful paradigm is the so-called “four Is”: incentives, institutions, infrastructure, and information (Hill 2004 and Brooks 2005). That is, as economies open up, these four factors are key determinants not only of the overall rate of economic growth but also of the magnitudes and productivity of capital flows.

Most countries offer incentives to attract FDI. These often include tax concessions, tax holidays, tax credits, accelerated depreciation on plants and machinery, and export subsidies and import entitlements. Such incentives aim to attract FDI and channel foreign firms to desired locations, sectors, and activities. At the same time, most countries have also regulated and limited the economic activities of foreign firms operating within their borders. Such regulations have often included limitations on foreign equity ownership, local content requirements, local employment requirements, and minimum export requirements. These measures are designed to transfer benefits arising from the presence of foreign firms to the local economy. This ‘carrot and stick’ approach has long been a feature of the regulatory framework governing FDI in host countries (McCulloch 1991).

Tax breaks and subsidies are common, but generally influence investment location decisions only at the margin (see e.g. Hines:1996, Dagan:2000, and Desai et al:2004). More important to most potential investors are the size and expected growth rate of the market to be served, the long-term macroeconomic and political stability of the host country, the supply of skilled or trainable workers, and the presence of modern transportation and communications infrastructure. Once these criteria are satisfied, then financial incentives may influence the investor's choice of suitable sites.

More importantly, such incentives often create distortions and inefficiencies. By distorting the relative costs for other sectors and investment projects that are not targeted for incentives, such schemes typically discriminate against smaller and domestic investors, as well as areas of actual or potential comparative advantage that are not recognized as such by policymakers. Perhaps of greatest concern, over time these actions contribute to the development of a governance system that lacks transparency and accountability (JBICI 2002). Imperfect competition, which leads to FDI as opposed to exports, raises issues of national sovereignty and the need for competition policy, as well as rent-seeking behavior among countries. Government action can enhance a host country's success in attracting FDI by significantly reducing the uncertainty, asymmetric information, and related search costs faced by foreign investors, as well as transaction costs—especially the amount of time and number of steps involved in acquiring approval.

Too often, policies ostensibly designed to maximize the net benefits of FDI for recipient economies have resulted in subscale manufacturing plants, frequently through mandated joint ventures that are not allowed to source inputs freely and contribute little to the technological, social, or economic development of the country (Carr et al:2001). Arrangements between foreign investors and host country authorities that block other new entrants from the industry or that inhibit alternative cheap sources of supply are also

common but are generally not in the best interests of the host country. A host country will offer fewer incentives, and benefit less, when foreign investment is directed toward serving small and protected domestic markets. The benefits to the host economy are greatest when international companies can exploit economies of scale both locally and globally, and are continually driven to update their technology and managerial practices in order to remain competitive (Blonigen et al:2005, Markusen:1998, Markusen and Maskus:2002).

A central issue is whether investment promotion measures alter the allocation of resources in production and trade, or just influence the distribution of rents between firms and host countries (Blonigen et al:2004). Both suppliers and recipients of FDI may gain from the liberalization of investment measures. Foreign investors may benefit from new investment opportunities resulting from liberalized investment regulations, while host countries may benefit from increased FDI inflows and greater market discipline resulting from this. Since many developing countries compete with one another to offer foreign investors generous tax, infrastructure, and financial incentives, it is important to note that the scaling down of investment incentives could yield additional revenue for the host country governments (see e.g. Blonigen et al:2004, Blonigen and Davies:2005).

Moran (2002) has provided much evidence to show how counterproductive and damaging domestic content requirements and joint venture requirements can be for host country development. He also demonstrates just how beneficial for host country growth and development it can be to adopt a policy of leaving wholly owned subsidiaries unfettered by local content mandates.

The core of the debate on the use of these policies is typically referred to as the 'development dimension.' In this context, the term 'development' includes elements of self-sufficiency, national pride, and, perhaps most importantly, employment. It also has a technology transfer dimension, where FDI is supposed to induce the transfer of

advanced technology to developing countries. Protection may induce an expansion of output and employment in certain sectors, but this expansion often carries a substantial cost for the society implementing such a policy.

Notwithstanding their diversity, almost all developing Asian economies have adopted progressively more open policies toward FDI during the past decade or two, and this trend appears likely to continue. This more open posture has been accompanied by the adoption of more liberal trade regimes, a process that has had profound implications for the motives for, and impact of, foreign investment. These changes have been so rapid in some cases that the policy framework has been unable to keep pace.

The upsurge in FDI to developing countries in the 1990s was largely caused by the unilateral liberalization of their FDI policies and regulatory regimes. Theoretical and empirical evidence provides strong support for the proposition that neutral policies designed to enhance the efficiency of investment are better suited to attracting foreign investment and enhancing its contribution to development than interventionist methods (Bora 2001).

Thus, there appears to be increasing acceptance that liberal policy regimes for most industries bring the highest benefits to host countries. FDI policies can be put in place at both the national and international level. At present, however, they are predominantly national rather than international. There is still much disagreement on forming and implementing a multilateral framework on investment.

3. Modeling FDI in a Global CGE Framework

3.1. Aggregate Determinants of Inbound FDI

Microeconomic determinants of FDI are so numerous that they have defied empirical generalization. A large literature exists on individual characteristics of the foreign investment decision, depending on the perspective of firms discussed above, i.e. whether they are outsourcers, market seekers, etc. These approaches are ably surveyed from a theoretical perspective by Markusen and several co-authors (1995, 1998, 2000, 2001, 2002), Helpman et al (1984, 2003), Brainard (1993), Raff and Srinivasan (1998), and Raff and Kim (1999). Empirical and industry case studies from these many perspectives include Lipsey (1999), Kleinert (2001, 2003), Head and Ries (2001), Andersson and Fredriksson (2000), and Barrell and Pain (1996), Wheeler and Mody (1992). While there are many detailed insights in this work, a general perspective on the main drivers of FDI is still lacking.

As a practical empirical response to this problem, other authors have put forth a variety of gravity models, essentially predicting FDI on the basis of historical correlations with other macroeconomic aggregates (see e.g. Anderson and Wincoop:2003). In this section, we discuss how this approach can be incorporated into a global CGE framework and present a few scenarios to illustrate its use. To implement such a specification in a mutli-country framework is relatively parsimonious, including only the primary drivers of inbound investment for each recipient country. These can be characterized in a generic three-variable functional form

$$Z = \alpha P^{\varepsilon_P} R^{\varepsilon_R} G^{\varepsilon_G} \qquad (3.1)$$

where

Z denotes a monotone index of the level of inbound FDI

P is a price index for capital consumption or a forward price of savings

R is an index of local relative to global real interest rates

G is an index of local real GDP growth

To assess the significance of these components in an Asian context, we estimated a logarithmic version of this model as follows

$$\log Z = \log \alpha + \varepsilon_P \log P + \varepsilon_R \log R + \varepsilon_G \log G$$

Where Z denotes the USD volume of inbound FDI, G denotes the compound (1+r) annual growth rate of real GDP. Using annual data for twelve Asian countries, we experimented with a variety of proxies for P and R. We were unsuccessful in identifying variables to represent P, but for R the most useful proxy was the ratio of average domestic interbank rates to LIBOR. As the following regression results indicate, however, even this proxy was not statistically significant.

Generally speaking, our results indicate that variations in FDI are most dependent on initial conditions (national fixed effect coefficients), with high degrees of statistical significance for both and a very high R-square for pooled data. From a multi-country modelling perspective, the fixed effects are simply national calibration parameters and the GDP growth effect can be incorporated into dynamic transition equations. Note in these results that China was used as the omitted condition or intercept. As intuition would dictate, the remaining fixed effects are negative because of China's status as the largest recipient of inbound FDI.

Unfortunately, there is little empirical evidence here to support model calibration. Like the price level variable, we find our real interest rate proxy contributes insignificantly to either FDI levels (FDI) or rates of change (logFDI). Growth of GDP, on the other hand, is significant in predicting the level of FDI, but not its rate of change. The reason for this can

be seen in the following four scatter plots. Figure 3 compares FDI levels and the log of composite (1+r) GDP growth over the sample, and there is an obvious magnitude bias from China's massive FDI flows. This, coupled with China's above average growth rate, explains the role of log(GrGDP) in explaining sample variation for FDI levels. When FDI is re-scaled in logarithmic terms (Figure 4), this scale bias is substantially reduced, and fixed effects are sufficient to pick up the outlier economy.

In the case of rate of return proxies, the results are even more ambiguous. When compared to FDI levels, logR is insignificant for most of the sample, although Figure 5 indicates it might be significant in a sub-sample including China. When examining elasticity effects, the results are completely indeterminate. When explaining log(FDI), the implied elasticity with respect to R/RW is actually negative, contradicting basic Fisherian investment theory, and nearly significant.

More work with these data, particularly devising new proxies and experimenting with different lag structures, may better elucidate the macro drivers of FDI. Meanwhile, however, we accept both the intuition behind these three determinants and the need to better understand the mechanisms through which FDI works to affect growth and income distribution. To this end, we carried out a series of experiments with range values of elasticities for two of the explanatory variables, logR and LogG. We discuss the details of the simulation design in section 5.

3.2. FDI Behaviour from a Simulation Perspective

In the absence of definitive econometric evidence regarding FDI behaviour, a simulation framework may be able to elucidate the primary interactions between initial conditions and outcomes using a variety of alternative behavioural specifications. In this

section we use a global CGE model to examine how the ultimate effects of trade policy would vary under different hypothetical patterns of FDI behaviour. Given the importance of private capital flows to the modern process of globalization, it is hardly surprising that trans-boundary investment behaviour can influence the effects of trade liberalization very strongly. Indeed, it is apparent even in this preliminary analysis that shifting FDI patterns can make the difference between success and failure for countries joining regional FTAs and larger trade reform initiatives.

The model we use is the Structural ADB General Equilibrium (SAGE) model, a multi-country, dynamic CGE calibrated to the GTAP VI database (see the annex below). SAGE includes an option for endogenous determination of FDI flows, based on the same logic as the estimating equation of the previous section. While we were unable to estimate the elasticities in this relationship with available data, it is still possible to analyse the economic implications of this specification of FDI behaviour with counterfactual elasticity values.

To do this, we conducted four experiments based on a scenario of global trade liberalization (GBL). Beginning with the Baseline dynamic calibration, we run the model forward assuming all tariffs and export subsidies are removed over the period 2005-2010. This scenario has the predictable results for global efficiency gains and growth, and then forms a policy reference for four FDI scenarios based on the following elaboration of equation 3.1 above[2]:

$$\frac{Z_r}{GDP_r} = \lambda_r \left[\alpha_r \left(\frac{P^w}{P} \right)^{\varepsilon_P} \left(\frac{TR_r}{WRR} \right)^{\varepsilon_P} (1+\gamma_r)^{\varepsilon_G} \right] + (1-\lambda_r) Z_{r,t-1} \quad (3.2)$$

[2] See van der Mensbrugghe (2002, 2005) for details.

where for country r, Z denotes total investment, P^w/P denotes the relative price of future consumption, TR/WRR is a the domestic to global rental rate, and γ is the growth rate of real GDP. This specification explains domestic aggregate investment shares as a product of three components. The first is based on a forward discount rate, the second on an inter-country relative rate of return, and the third on an accelerator mechanism. The accelerator component includes both the growth rate of GDP and the lagged investment term in 3.2.

The benchmark values of FDI-related elasticity parameters are listed in Table 5. Using the GBL policy scenario, we run three sets of simulations to examine the possible impact of FDI on the economy through each of the component mechanisms. To control for each component, we hold it at baseline value and reduce the other two by one or two orders of magnitude.[3] The lagged investment parameter was set to 0.5 in all experiments. This biases the results in favour of the accelerator effect, but it was deemed necessary to maintain reasonable macro-stabiity in the solutions and is more consistent with the stylized facts regarding the macroeconomics of investment behaviour.

Table 1: Elasticity Values for FDI Simulations

Scenario		Forward Discount Rate	Elasticity Relative Rental Rate	Growth Rate of GDP
FDIGBL	Endogenous FDI under GBL	10.00	.50	10.00
FDR	Forward Discount Rate	10.00	.01	.10
RRW	Domestic Relative Rate of Return	.10	.50	.10
GGDP	Growth Rate of GDP	.10	.01	10.00

[3] In some cases, the choice of these values was informed by the FDI literature and constrained in some cases by model convergence considerations. For example, zero values were inadmissible for this reason. For references to related work on FDI elasticities, see e.g. Loayza et al (2002) and Masson et al (1998).

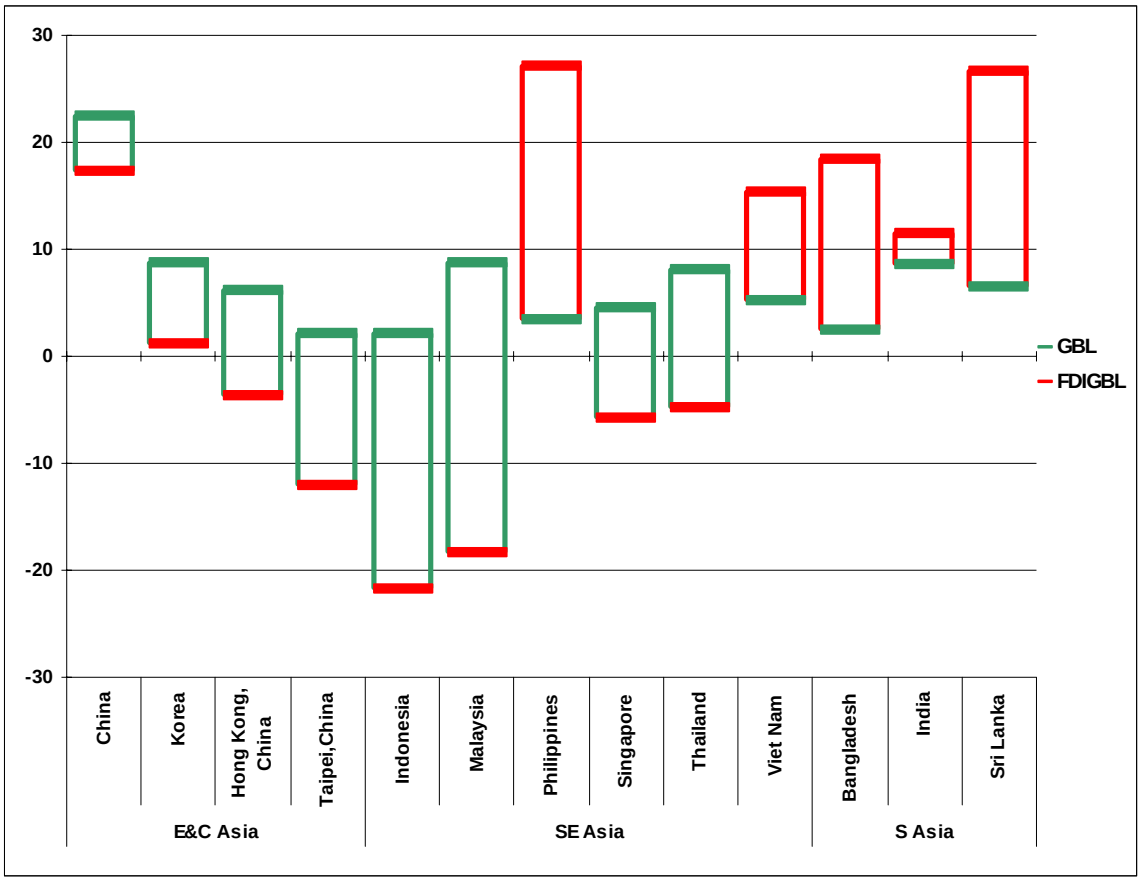
Running the model forward with endogenous FDI yields a very complex adjustment process. Because an individual country constraint has been redefined as a multilateral constraint (i.e. resources can be directly transferred), the growth benefits of the GBL scenario can now be shifted between countries. For this reason, the national effects of tariff reform are no longer monotone, i.e. there are winners and losers from multilateral trade reform. This case has often been made in defense of capital account controls, but our results do not necessarily support these arguments.

Table 2 shows equivalent variation aggregate income (EV) for each Asian country under a globalization reference (GBL) and the four other scenarios, with results in each expressed as percentage changes from Baseline values in 2025. The most arresting feature of this table is of course the negative results (positive results are depicted in green), yet it is also important to notice that country results both exceed and fall short of the GBL scenario, depending on the country and scenario. Thus some kind of growth transfer process appears to arise from the capital movement, which is precisely what one might expect in a zero-sum, productivity-static framework like the present one.

Table 2: Equivalent Variation Aggregate Income
(percent change from Baseline in 2025)

		Scenario				
		1	*2*	*3*	*4*	*5*
Region	**Country**	**GBL**	**FDIGBL**	**FDR**	**RRW**	**GGDP**
E&C Asia	**China**	22.38%	17.24%	24.70%	28.80%	13.13%
	Korea	8.78%	1.11%	2.34%	2.32%	1.13%
	Hong Kong, China	6.18%	-3.77%	0.25%	-0.68%	-3.46%
	Taipei,China	2.03%	-12.17%	-10.37%	-10.90%	-12.00%
SE Asia	**Indonesia**	2.06%	-21.78%	-23.54%	-22.20%	-23.78%
	Malaysia	8.65%	-18.35%	-19.18%	-17.71%	-20.05%
	Philippines	3.37%	27.06%	9.35%	14.28%	19.52%
	Singapore	4.44%	-5.80%	-2.38%	-4.52%	-4.08%
	Thailand	8.01%	-4.84%	-11.74%	-7.88%	-9.95%
	Viet Nam	5.15%	15.35%	6.50%	6.55%	16.59%
S Asia	**Bangladesh**	2.38%	18.38%	11.67%	12.48%	18.14%
	India	8.59%	11.44%	7.35%	7.06%	12.55%
	Sri Lanka	6.45%	26.59%	21.02%	22.62%	24.53%
	Mean	6.81%	3.88%	1.23%	2.32%	2.48%
	Standard Deviation	5.33%	16.53%	14.52%	15.10%	16.01%

Figure 1: EV Income Growth Relative to Baseline
(GBL with and without endogenous FDI,
percent changes from Baseline in 2025)

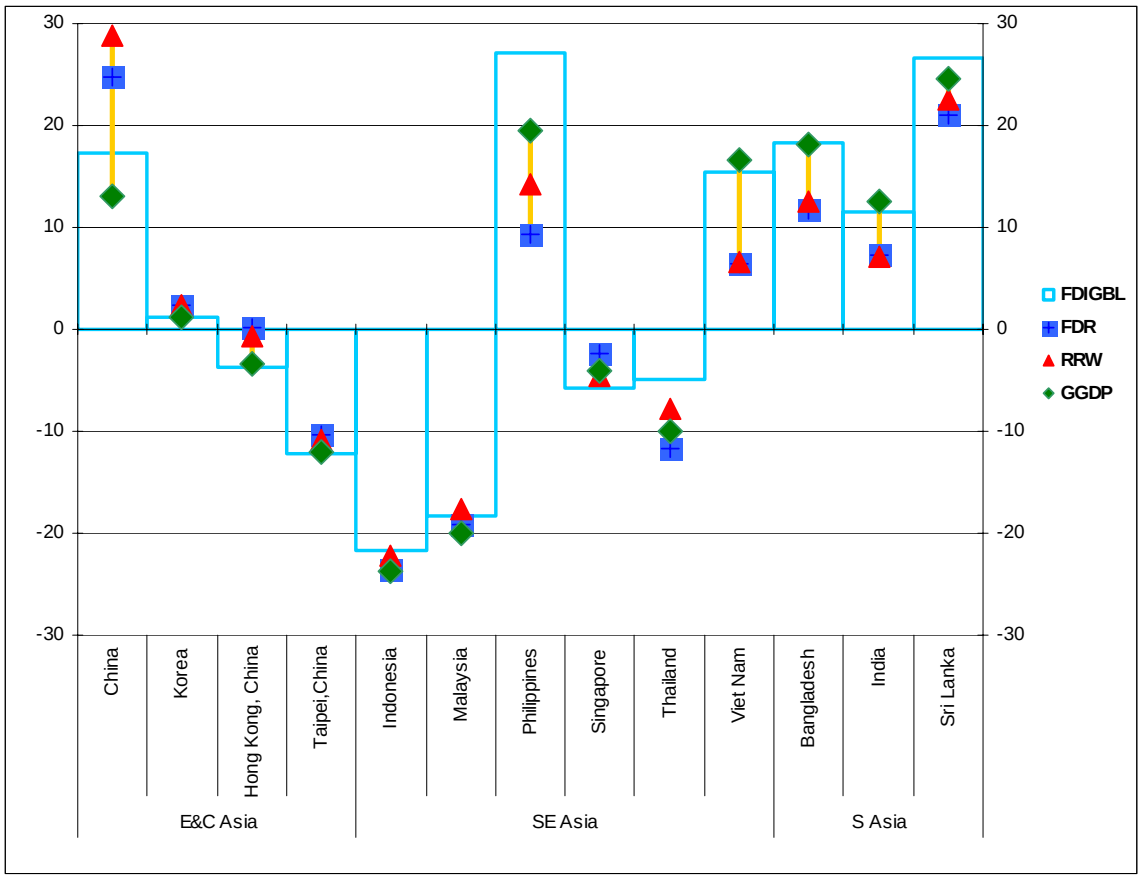


One might reasonably expect efficient capital allocation to raise average productivity and even have positive local savings effects, both of which would mitigate or even eliminate the tradeoffs observed here, but we run these experiments without those benefits in order to more clearly identify the roles of the three FDI drivers in expression 3.2. To better understand these components, compare first the GBL and combined endogenous FDI scenario (FDIGBL). These results are depicted in Figure 1, and we see that endogenous FDI reduces the EV growth benefits of multilateralism in five countries while increasing it in eight. Two of the former group still experience positive EV gains against the Baseline, but the other three actually see income decline with trade liberalization. For the winners, the gains can be substantial, adding more than 15 percentage points to EV

growth and in some cases doubling or tripling gains from globalization without international capital mobility.

When we decompose the three drivers of endogenous FDI determination, a more complex picture emerges. Figure 2 shows aggregate EV changes for the four endogenous FDI scenarios. It is difficult to generalize about either the individual roles of the three components or their relationship to the composite experiment (FDIGBL). However, a few observations can be instructive, even if they apply only to significant subsets of the countries analysed.

Figure 2: EV Results for Endogenous FDI
(percent changes from Baseline in 2025)



Firstly, both the interest rate components (FDR and RRW) are highly correlated, as would be expected. Secondly, the accelerator and interest rate components work in somewhat offsetting directions. This is to say that the accelerator "pulls up" against interest rates when investment flows have a positive effect, but "pulls down" when the effects are negative (the result for Thailand is mixed. Again, this is consistent with conventional macroeconomic intuition, where interest rate sensitivity moderates Keynesian components of the business cycle. In the present case, market rental rates vary dramatically across the endogenous FDI scenarios, as indicated in Table 3. As economic growth rises within a given economy, market determined rates can be expected to rise and temper that growth. This table presents simple averages (i.e. not GDP weighted) averages and variation in domestic rental rates. Here we see a strong indication that limited capital market competition raises both average returns and their absolute and relative variation across countries.

Table 3: Domestic Average Rental Rates
(percent change from Baseline in 2025)

		Scenario				
		1	*2*	*3*	*4*	*5*
Region	**Country**	**GBL**	**FDIGBL**	**FDR**	**RRW**	**GGDP**
E&C Asia	**China**	11.81%	23.26%	32.26%	42.95%	11.05%
	Korea	7.91%	19.24%	18.00%	19.42%	18.41%
	Hong Kong, China	3.56%	18.40%	12.55%	15.10%	16.85%
	Taipei,China	2.24%	38.82%	32.91%	34.84%	38.17%
SE Asia	**Indonesia**	2.35%	30.24%	32.13%	30.38%	33.24%
	Malaysia	7.59%	86.17%	90.03%	85.56%	91.91%
	Philippines	2.85%	-15.82%	-5.52%	-9.78%	-10.47%
	Singapore	2.20%	19.34%	9.66%	16.00%	13.99%
	Thailand	5.48%	16.27%	22.46%	18.37%	21.68%
	Viet Nam	12.34%	-2.24%	8.16%	7.66%	-3.18%
S Asia	**Bangladesh**	0.09%	-30.19%	-19.70%	-21.50%	-29.54%
	India	1.81%	-5.91%	3.08%	3.19%	-7.17%
	Sri Lanka	0.26%	-29.34%	-23.38%	-25.91%	-26.59%
	Mean	4.65%	12.94%	16.36%	16.64%	12.95%
	Standard Deviation	4.08%	31.12%	28.73%	29.15%	31.61%

From a real growth perspective, it appears that capital flows re-inforce superior growth rates. Endogenous FDI creates international competition for an essential growth resource, and domestic rental rates reflect a kind of shadow price on this resource constraint within each economy. In the interest rate sensitive scenarios, capital flows respond to these signals, and accelerate expansion for economies with high baseline growth rates (Figure 4).

Table 4: Real GDP
(percent change from Baseline in 2025)

		Scenario				
		1	*2*	*3*	*4*	*5*
Region	**Country**	**GBL**	**FDIGBL**	**FDR**	**RRW**	**GGDP**
E&C Asia	**China**	14.59%	10.23%	17.01%	25.14%	8.52%
	Korea	3.59%	-3.74%	-3.18%	-3.72%	-3.36%
	Hong Kong, China	1.88%	-10.95%	-6.39%	-8.33%	-9.85%
	Taipei,China	1.85%	-13.25%	-11.59%	-12.16%	-13.07%
SE Asia	**Indonesia**	1.52%	-15.10%	-16.21%	-15.46%	-16.29%
	Malaysia	2.28%	-21.69%	-22.59%	-21.76%	-22.76%
	Philippines	6.36%	3.97%	4.36%	3.54%	4.76%
	Singapore	2.39%	-11.60%	-5.93%	-10.01%	-8.33%
	Thailand	5.29%	-1.32%	-4.43%	-2.70%	-3.56%
	Viet Nam	3.32%	11.78%	4.40%	4.61%	12.59%
S Asia	**Bangladesh**	6.01%	13.57%	9.39%	9.99%	13.12%
	India	12.41%	12.45%	12.48%	12.22%	13.03%
	Sri Lanka	6.72%	12.96%	11.23%	11.66%	12.31%
	Mean	5.25%	-0.98%	-0.88%	-0.54%	-0.99%
	Standard Deviation	4.11%	12.58%	11.91%	13.22%	12.51%

Still, it is clear from detailed inspection of these results that the accelerator component is dominant. Table 5 shows how closely real GDP results conform to EV. Even more strongly, relative (between-country) real GDP growth in Table 5 mirrors the left-hand variable in expression 3.2, Investment as a share of GDP. Of course the lagged investment component of Z/GDP in expression 3.2 biases the result in this direction, but this is also the most empirically defensible component of macro investment behaviour (a staple of macro econometric models). Even after discounting for this element, the accelerator effect still

dominates directly and indirectly (through its effect on interest rates). Countries that respond relatively slower to globalization will see capital diverted from them to those who respond faster. The interesting fact is that this happens regardless of Baseline growth rates. As Figure 5.1 in the annex indicates, the PRC has the highest average Baseline rate, yet when FDI is endogenous the league table shifts in favour of China, Philippines, Viet Nam and South Asia.

Table 5: Relative Real GDP Growth Across Countries
(Table 4 values, normalized by mean and standard deviation in each scenario)

Region	Country	GBL	FDIGBL	FDR	RRW	GGDP
E&C Asia	China	2.27	.89	1.50	1.94	.76
	Korea	-.40	-.22	-.19	-.24	-.19
	Hong Kong, China	-.82	-.79	-.46	-.59	-.71
	Taipei,China	-.83	-.98	-.90	-.88	-.97
SE Asia	Indonesia	-.91	-1.12	-1.29	-1.13	-1.22
	Malaysia	-.72	-1.65	-1.82	-1.60	-1.74
	Philippines	.27	.39	.44	.31	.46
	Singapore	-.70	-.84	-.42	-.72	-.59
	Thailand	.01	-.03	-.30	-.16	-.20
	Viet Nam	-.47	1.01	.44	.39	1.09
S Asia	Bangladesh	.18	1.16	.86	.80	1.13
	India	1.74	1.07	1.12	.96	1.12
	Sri Lanka	.36	1.11	1.02	.92	1.06

Given the complexity of the macro-adjustment process, and indeed its ambiguous effects on capital allocation and growth patterns, it is reasonable to look more carefully at the endogenous growth effects associated with FDI. It has already been emphasized in this paper that FDI confers dynamic benefits in terms of (domestic and internal) market expansion and productivity growth. In the following two sections, we assess the empirical significance of these with the SAGE simulation framework.

3.3.FDI and Market Expansion

A large part of the FDI literature deals with international capital flows in support of global supply networks. Here FDI enables propagation of production linkages by establishing new upstream or downstream capacity for existing enterprises, either as wholly owned subsidiaries or in joint ventures. In all these cases, one distinctive characteristic of the new production facility is that it is created with established market linkages, in contrast with autonomous new enterprises who must initiate market linkages for themselves. For this reason, FDI is often thought to accelerate market growth and intra-industry trade for recipient countries. In this section, we present a few experiments to indicate how these growth externalities could influence Asian FDI recipients.

Consider an individual country receiving FDI. At the individual enterprise level, FDI might interact some with significant established upstream, downstream, or both linkages. Thus creation of this new capacity would stimulate absorption and/or output, regardless of whether the origin or destination are in the domestic market or abroad. To get a sense of the potential significance of this network effect, we consider only import and export stimulus. This is a reasonable beginning, since much FDI is targeted at export promotion.

It is difficult to overstate the significance of private agency and supply networks in the global economy. Modern globalization is more than many countries trading much more national production outside their boundaries. It is now a world wide web of interconnected asset ownership and contractual ties that bind assets and capital flows. The top 500 multinational enterprises alone now mediate about half of global trade and 20 percent of global GDP within their organizational structures. Nearly 80 percent of US-Japan bilateral trade is between wholly owned subsidiaries and 50 percent of China's exports to the US are

from US subsidiaries. In this process, FDI is expanding markets and markets are expanding FDI.

As was already observed, however, enterprise level modelling is beyond the scope of the present work and in any case lacks definitive theoretical or empirical precedence. Instead, we focus the present discussion on aggregate interactions to give a sense of the relative magnitudes at the national level. Thus we assume that the market expansion effect of FDI is confined to trade, and we will further assume for simplicity that the effect is purely bilateral. In other words, we posit a relationship of the form

$$\hat{T}_{ij} = -\varepsilon_{ij}\hat{K}^{F}$$

where T_{ij} denotes trade costs from country i to j, K^F denotes the domestic stock of foreign capital,

$$\hat{T}_{ij} = \frac{\Delta(T_{ij} + T_{ji})}{T_{ij} + T_{ji}}$$

and

$$\hat{K}_{F} = \frac{FDI_{ij}}{K^{F}}$$

Because we currently lack information on FDI by origin, in the following experiments we consider only the aggregate relationship

$$\hat{T}_{i} = -\varepsilon_{i}\hat{K}^{F}$$

for country i's total trade costs and the average trade cost elasticity of foreign capital inflows.

Table 6: Equivalent Variation Aggregate Income
(percent change from Baseline in 2025)

		Scenario			
		1	*2*	*3*	*4*
Region	**Country**	**GBL**	**TC**	**FDIGBL**	**FDITC**
E&C Asia	**China**	22.38%	50.12%	17.24%	51.02%
	Korea	8.78%	25.07%	1.11%	9.87%
	Hong Kong, China	6.18%	33.86%	-3.77%	19.86%
	Taipei,China	2.03%	62.17%	-12.17%	-6.91%
SE Asia	**Indonesia**	2.06%	132.57%	-21.78%	-16.57%
	Malaysia	8.65%	56.07%	-18.35%	-1.42%
	Philippines	3.37%	13.51%	27.06%	68.00%
	Singapore	4.44%	35.59%	-5.80%	12.55%
	Thailand	8.01%	87.61%	-4.84%	28.37%
	Viet Nam	5.15%	22.77%	15.35%	204.89%
S Asia	**Bangladesh**	2.38%	8.17%	18.38%	30.56%
	India	8.59%	14.49%	11.44%	20.55%
	Sri Lanka	6.45%	16.43%	26.59%	44.80%
	Mean	6.81%	42.96%	3.88%	35.81%
	Standard Deviation	5.33%	35.44%	16.53%	56.03%

Table 6 present the EV results from four scenarios. Two reference countrerfactuals (globalization with and without endogenous capital flows) are evaluated with and without taking account of market expansion effects. The most salient feature of these results is that market expansion effects are uniformly positive, even reversing net losses half the cases where capital mobility would otherwise be detrimental to domestic growth. This conclusion bears out prior research we have done on trade costs (:2005), and supports the notion that structural barriers are an important impediment to realizing the benefits from more liberal trading arrangements. For countries with capital insufficiency and substantial structural trade barriers, like Viet Nam, the combined effect can be very significant, increasing the gains from globalization by a factor of 40.

3.4. FDI and Productivity Growth

Economists and policy make generally recognize the importance of FDI as a channel of technological diffusion for economic development. However, empirical evidence on the precise mechanisms bywhich FDI spurs domestic productivity growth is quite weak. A cross-country study by Blomström et al (1992) found that FDI had a positive impact on the growth rate in their higher income country sample, but not in their low income group. This suggests that there is a threshold level of income above which the country can take advantage from the technological diffusion of FDI. Borensztein, de Gregorio and Lee (1998) analyzed the growth effect of FDI in a panel data set of 69 developing countries during the period of 1970-89 and found an important interaction between FDI and human capital. Only those countries that have a certain level of human capital accumulation can exploit the FDI spillover. They found that a permanent increase in FDI equivalent to 1 percent of GDP, in a country with an average educational attainment of 0.91 years of secondary schooling, would increase the growth rate by 0.6 percent a year. Using panel data of 20 developed countries and 20 developing countries, Xu (2000) directly estimated the impact of FDI on manufacturing productivity and reached similar conclusions of a positive relation between FDI and productivity growth above a threshold of human capital level. However, a recent growth regression by Carkovic and Levine (2002) showed little influence of FDI on economic growth. They argue that the many macroeconomic studies that find a positive link between FDI and growth do not fully control for endogeneity, country-specific effects, and inclusion of lagged dependent variables in growth regressions. After controlling for these statistical problems, the authors find that FDI inflows do not exert an independent influence on economic growth

As Görg and Strobl (2001) show, most cross-sectional econometric work is based on country or industry level data, where the direction of causality is not clear and therefore can not allow one to make reliable conclusions about the effects of FDI on domestic productivity. A number of studies have used firm level data to investigate the productivity spillover effects of FDI and the results are generally mixed. Haddad and Harrison (1993), Aitken and Harrision (1999) and Djankov and Hoekman (2000) found non-significant or negative spillovers in micro panel data for Morocco, Venezuela and the Czech Republic, respectively. In developed countries, the picture is more optimistic. Haskel, Pereira and Slaughter (2002) and Keller and Yeaple (2003) are recent studies which use firm level panel data and find positive spillover effects for the UK and the US.

The mixed evidence from the existing micro level empirical studies arise partly because these studies focused on measuring horizontal spillovers of FDI, i.e. the positive technological externalities from FDI to domestic firms operating in the same sector, through the movement of workers within industries, competition effects, imitation effects, etc. However, there is also inter-industry vertical spillovers through backward (from buyer to supplier) or forward (from supplier to buyer) linkages. As multinationals have an incentive to prevent technological leakage that would enhance the performance of their local competitors in the same industry, but at the same time might want to transfer knowledge to their local suppliers, spillovers from FDI are more likely to be vertical in nature. The importance of such vertical linkages was emphasized theoretically by Rodriguez-Clare (1996) and Markusen and Venables (1999), while Javorcik (2004) and Blalock and Gertler (2004) provide empirical evidence.

Using firm-level panel data from Lithuania, Javorcik (2004) found positive productivity spillovers through backward linkages. Her results suggested that a rise of ten

percent in the foreign presence in downstream industries is associated with a 0.38 percent increase in output of each domestic firm in the upstream sector. Similarly, Blalock and Gertler (2004) found that firm output increased over 0.87 percent as the share of foreign ownership downstream rose by ten percent in Indonesia.

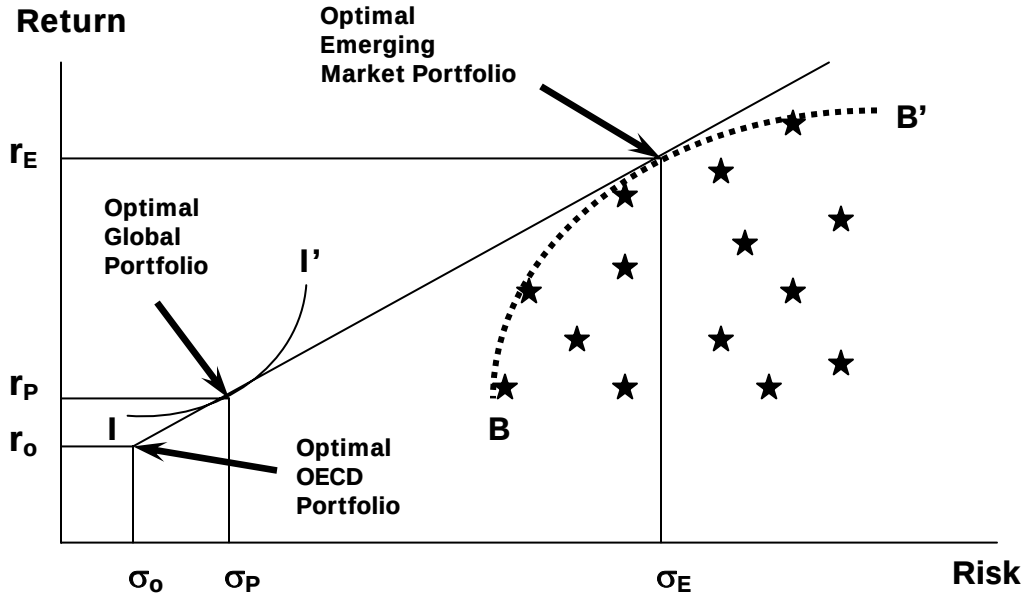
Empirical linakage between investment and economic performance is a significant challenge across the finance literature, and in response to this a variety of demand side (capital) supply side theories have developed. The most prominent of these are the Capital Asset Pricing Model (CAPM) and Arbitrage Pricing Theory (ABT). Both approaches focus on equilibrium rates of return and rely on assumptions about market efficiency to predict real side responses to capital movements. Their most attractive feature is that the implement a top-down investment allocation perspective and rely on aggregate market (return and risk) variables to explain complex underlying adjustment processes. Not incidentally, these theories are also the main drivers of investment allocation across modern financial markets.

Given the lack of definitive empirical results to link inbound FDI and productivity, we therefore adopt a behavioural simulation approach based on modern portfolio theory. In particular, rather than positing a strict causal relationship between FDI inflows and productivity changes, we assume that domestic productivity in destination countries responds endogenously to investor criteria for rates of return. This approach corresponds to the real side perspective on CAPM and ABT (see e.g. Dixit and Pindyck:1994 and Chriss:1998), with domestic capital productivity acting as a proxy for the real rate of return on FDI.

To motivate this approach, we begin by characterizing the FDI decision as one between two generic categories of investment destination, OECD and non-OECD economies. The former can be considered to be a more homogeneous group, significantly

integrated with highly liquid international equity, debt, and foreign exchange markets. The non-OECD group, however, are a more diverse universe of investment prospects, with lower levels of international capital market integration and generally higher levels of variance (risk) in real returns. From this simplified perspective, a typical foreign investor faces an investment choice depicted in Figure 9 below. The point (σ_o,r_o) denotes average risk (standard deviation of returns) and return for OECD economies. In contrast, non-OECD returns are generally higher risk and perhaps higher return. Individual economy risk-return combinations are depicted schematically but stars. Seen from an aggregate capital market perspective, international investors can combine these non-OECD alternatives into portfolios represented by the convex set whose efficient boundary is given by BB' in the diagram. For each OECD point and boundary BB', there is an optimal portfolio of non-OECD investments, represented by (σ_E,r_E), where the E refers to "emerging market" or non-OECD economies.

Figure 9: Risk and Return Profiles for Global FDI



How the international investment community chooses to blend these two investment categories will depend on their preferences toward risk and return (e.g. the indifference curve II'). This can be determined, for example, by the national inbound FDI drivers like those given in expression (3.2) above. In any case, we assume for the present that aggregating these across emerging economies yields a blended portfolio with share α_E of total global investment allocated to emerging markets. The return and risk for such a portfolio would then be given by

$$r_P = (1-\alpha_E) r_O + \alpha_E r_E \tag{3.3}$$

and

$$\sigma_P^2 = (1-\alpha_E)^2 \sigma_O^2 + \alpha_E \sigma_E^2 + 2\alpha_E (1-\alpha_E) \sigma_O \sigma_E \rho_{OE} \tag{3.4}$$

where ρ_{OE} denotes the correlation of returns in OECD and non-OECD economies. As a practical matter, we assume a weak form of the Efficient Markets Hypothesis and calibrate the portfolio shares to baseline values and simulate the aggregate allocation process using the three macro drivers (expression 3.2) at the inbound national level.

The next step with the portfolio approach is linking FDI and domestic productivity. To do this, we use the basic principle of ABT, which imply that domestic returns reflect efficient arbitrage between investor's required returns and productivity growth. More specifically, assume for the moment that a representative emerging market economy offers a prospective return r_E on new inbound foreign investment. The basic tenets of ABT then imply that new foreign investment will contribute to domestic rates of return as follows

$$r_t = (1-\alpha_{FDI}) r_{t-1} + \alpha_{FDI} r_E \tag{3.5}$$

Where r_t denotes the domestic aggregate rate of return in time t and α_{FDI} denotes the share of foreign owned capital in the total domestic capital stock. To implement this approach with the CGE model, we assume that total investment is determined by the three macro drivers, we apply the emerging market premium to all new capital, and capital productivity adjusts endogenously with respect to an exogenous emerging market interest rate r_E.

$$r_t = (1 - \alpha_{FDI}) r_{t-1} + \alpha_{FDI} r_E \qquad (3.6)$$

With regard to risk, we assume heterogeneity but fixity of initial conditions. That is, the initial data incorporate information about relative risk across countries, but we incorporate no additional risk information in the dynamic scenarios.

Table 7: Equivalent Variation Aggregate Income
(percent change from Baseline in 2025)

		Scenario			
		1	*2*	*3*	*4*
Region	**Country**	**GBL**	**ATP**	**FDI111**	**APT111**
E&C Asia	***China***	22.38%	67.47%	17.24%	198.46%
	Korea	8.78%	10.11%	1.11%	3.35%
	Hong Kong, China	6.18%	9.40%	-3.77%	7.18%
	Taipei,China	2.03%	3.07%	-12.17%	-11.27%
SE Asia	***Indonesia***	2.06%	57.51%	-21.78%	-26.30%
	Malaysia	8.65%	61.94%	-18.35%	-58.63%
	Philippines	3.37%	19.78%	27.06%	215.37%
	Singapore	4.44%	9.50%	-5.80%	-0.87%
	Thailand	8.01%	43.35%	-4.84%	6.02%
	Viet Nam	5.15%	9.37%	15.35%	158.80%
S Asia	***Bangladesh***	2.38%	27.29%	18.38%	151.23%
	India	8.59%	58.50%	11.44%	455.37%
	Sri Lanka	6.45%	40.19%	26.59%	194.29%
	Mean	6.81%	32.11%	3.88%	99.46%
	Standard Deviation	5.33%	23.66%	16.53%	145.69%

Results in Table 7 are analogous to those of the previous subsection, except that here we consider globalisation, with and without endogenous FDI, taking account of international emerging market arbitrage. In particular, the APT scenario considers simple global tariff abolition when emerging market Asian economies (names underlined) are required to return a premium on new investment that is 10% above baseline average rates of return. This return is achieved in the SAGE model with endogenous increases in factor productivity, simulating the mechanism of capital market discipline thought to govern emerging market investment allocation.

Compounded over the time interval we consider, the induced productivity effects exert a strong growth effect, both within the emerging economies and across the region. Countries whose baseline data include high growth rates, large FDI shares, or low productivity levels are most effected in the case with exogenous capital flows. On average, terminal year EV income growth is about five times higher with capital market discipline in these cases.

The case of endogenous capital flows is more complex, but individual differences are also more dramatic. Unlike trade cost reductions, adverse effects can be reversed, reduced, or even amplified (emerging economies only). When an economy benefits from endogenous FDI, however, this is always amplified by the companion productivity effect. For emerging economies, this effect is dramatic, increasing EV percentage gains by up to tenfold. These results make it clear that, to the extent that it is a driver of emerging market capital allocation, the arbitrage effect can be a potent growth stimulus.

4. Conclusions and Extensions

International capital mobility has been an essential component of modern globalization and a strong catalyst for growth in many emerging market economies. For Asia in particular, FDI has played a prominent role in the majority of dynamic and sustained success stories, supplementing domestic savings and transferring a variety of technical and market externalities to accelerate modernization and outward orientation. The development process across Asia is only partially complete, however, and the next phase of regional growth will need to propagate successful experiences across a more diverse set of initial conditions. To take full advantage of the transformative role that FDI can play in this process, a better understanding of the fundamentals of international capital allocation is essential.

This paper reviews the literature on FDI determinants from and regional perspective, followed by application of a variety of empirical approaches to elucidating these issues. Firstly, we estimate a simple macroeconomic model of determinants using country specific data on three alternative drivers of inbound FDI, discount rates, domestic relative rental rates, and real domestic GDP growth. Our findings here are quite inconclusive, with statistically significant results only for real GDP.

Ambiguous econometric results lead us to apply a simulation framework to the same kind of specification in an effort to assess to potential significant of each of the three drivers. For plausible elasticity values (borrowed from the investment literature), we find again that real GDP is the primary determinant of regional capital allocation when FDI is endogenous. In the context of globalization scenarios for multilateral tariff reduction, this apparently induces transfers of growth impetus between economies, making former

winners from globalization into losers. To the extent that accelerator effects may be amplified by FDI, it is essential to get better estimates of these effects.

Looking beyond the empirical evidence on macro drivers of FDI, we use the SAGE modelling framework to examine how FDI might be linked to trading efficiency and domestic productivity. Here we see that, for moderate levels of efficiency and productivity effects, growth dividends in the Asian region can be very substantial. In particular, our findings echo earlier work indicating that structural barriers to trade are now much more significant impediments to regional integration and expansion that nominal protection. We also find, to the extent that regional capital allocation follows principles of modern portfolio theory, capital-productivity linkages can accelerate growth dramatically.

As Asian regional savings and investment flows rise to unprecedented levels, it becomes ever more important to improve our understanding of FDI-growth linkages. The results presented here offer guidance about new directions for more detailed research in this important policy area. If the forces at work are as momentous as some believe, then growth need not be a fixed-sum game and all could benefit from more efficient regional resource allocation. To ascertain the potential of such win-win scenarios, more experimental study of the FDI-growth nexus is needed.

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6. Annex - Overview of the Model and Data

6.1. Model Specification

The complexities of today's global economy make it very unlikely that policy makers relying on intuition or rules-of-thumb will achieve anything approaching optimality in either the domestic or international arenas. Market interactions are so pervasive in determining economic outcomes that more sophisticated empirical research tools are needed to improve visibility for both public and private sector decision makers. The preferred tool for detailed empirical analysis of economic policy is now the Calibrated General Equilibrium (CGE) model. It is well suited to trade analysis because it can detail structural adjustments within national economies and elucidate their interactions in international markets. The model is more extensively discussed in an annex below and the underlying methodology is fully documented elsewhere, but a few general comments will facilitate discussion and interpretation of the scenario results that follow.

Technically, a CGE model is a system of simultaneous equations that simulate price directed interactions between firms and households in commodity and factor markets. The role of government, capital markets, and other trading partners are also specified, with varying degrees of detail and passivity, to close the model and account for economywide resource allocation, production, and income determination.

The role of markets is to mediate exchange, usually with a flexible system of prices, the most important endogenous variables in a typical CGE model. As in a real market economy, commodity and factor price changes induce changes in the level and composition of supply and demand, production and income, and the remaining endogenous variables in the system. In CGE models, an equation system is solved for prices that correspond to

equilibrium in markets and satisfy the accounting identities governing economic behavior. If such a system is precisely specified, equilibrium always exists and such a consistent model can be calibrated to a base period data set. The resulting calibrated general equilibrium model is then used to simulate the economywide (and regional) effects of alternative policies or external events.

The distinguishing feature of a general equilibrium model, applied or theoretical, is its closed form specification of all activities in the economic system under study. This can be contrasted with more traditional partial equilibrium analysis, where linkages to other domestic markets and agents are deliberately excluded from consideration. A large and growing body of evidence suggests that indirect effects (e.g., upstream and downstream production linkages) arising from policy changes are not only substantial, but may in some cases even outweigh direct effects. Only a model that consistently specifies economywide interactions can fully assess the implications of economic policies or business strategies. In a multi country model like the one used in this study, indirect effects include the trade linkages between countries and regions which themselves can have policy implications.

The model we use for this work is a version of the LINKAGE 5 model developed at the World Bank by Dominique van der Mensbrugghe, implemented in the GAMS programming language, and calibrated to the GTAP (version 6) global database.[4] The result is a sixteen-country/region, twelve-sector global CGE model, calibrated over a twenty-five year time path from 2001 to 2025. Apart from its traditional neoclassical roots, an important feature of this model is product differentiation, where we specify that imports is differentiated by country of origin and exports are differentiated by country of destination (e.g., de Melo and Tarr, 1992). This feature allows the model to capture the

[4] The original model is fully documented in van der Mensbrugghe (2005).

pervasive phenomenon of intra industry trade, where a country is both an importer and exporter of similar commodities, and avoids tendencies toward extreme specialization.

6.2. Model Calibration

The model is calibrated to country and regional real GDP growth rates, obtained as consensus estimates from independent sources (DRI, IMF, Cambridge Econometrics). These Baseline growth rates are displayed in Figure 5.1 below, using a "league table" format that takes account of the effect of population growth on per capita incomes. Using exogenous rates of implied TFP growth, the model computes supply, demand, and trade patterns compatible with domestic and global equilibrium conditions. Equilibrium is achieved by adjustments in the relative prices of domestic resources and commodities, while international equilibrium is achieved by adjusting trade patterns and real exchange rates to satisfy fixed real balance of payments constraints. The general process is schematically represented in the Figure 5.2.

Figure 5.1: Baseline Real GDP Growth Rate, Including Population Growth
(average percent change over 2005-2025)

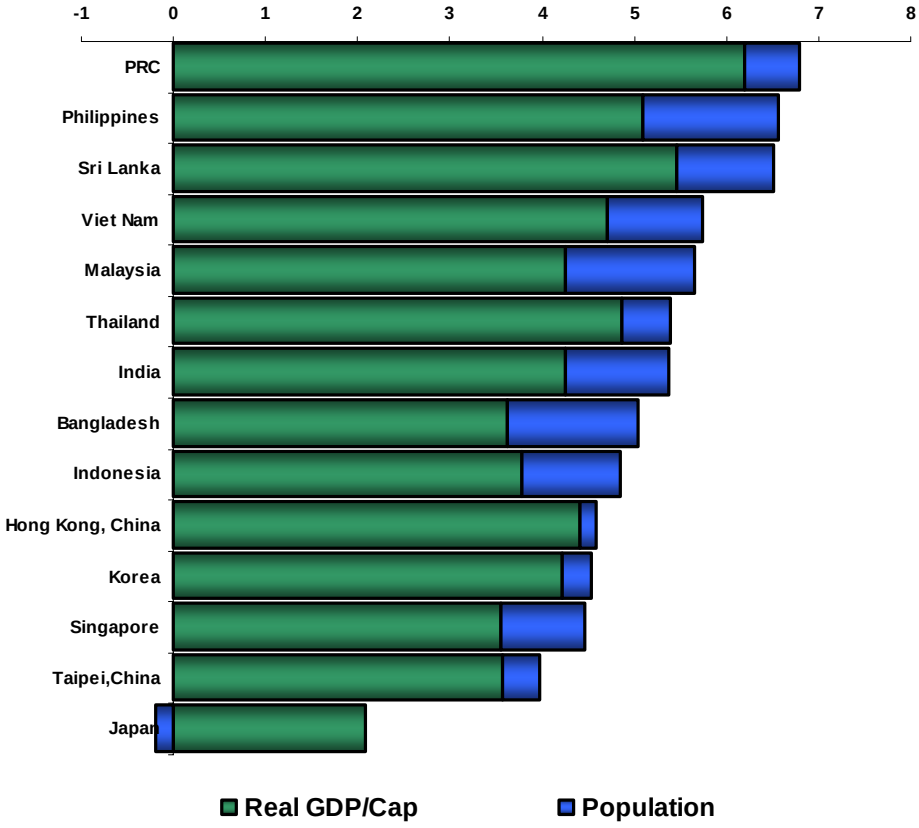
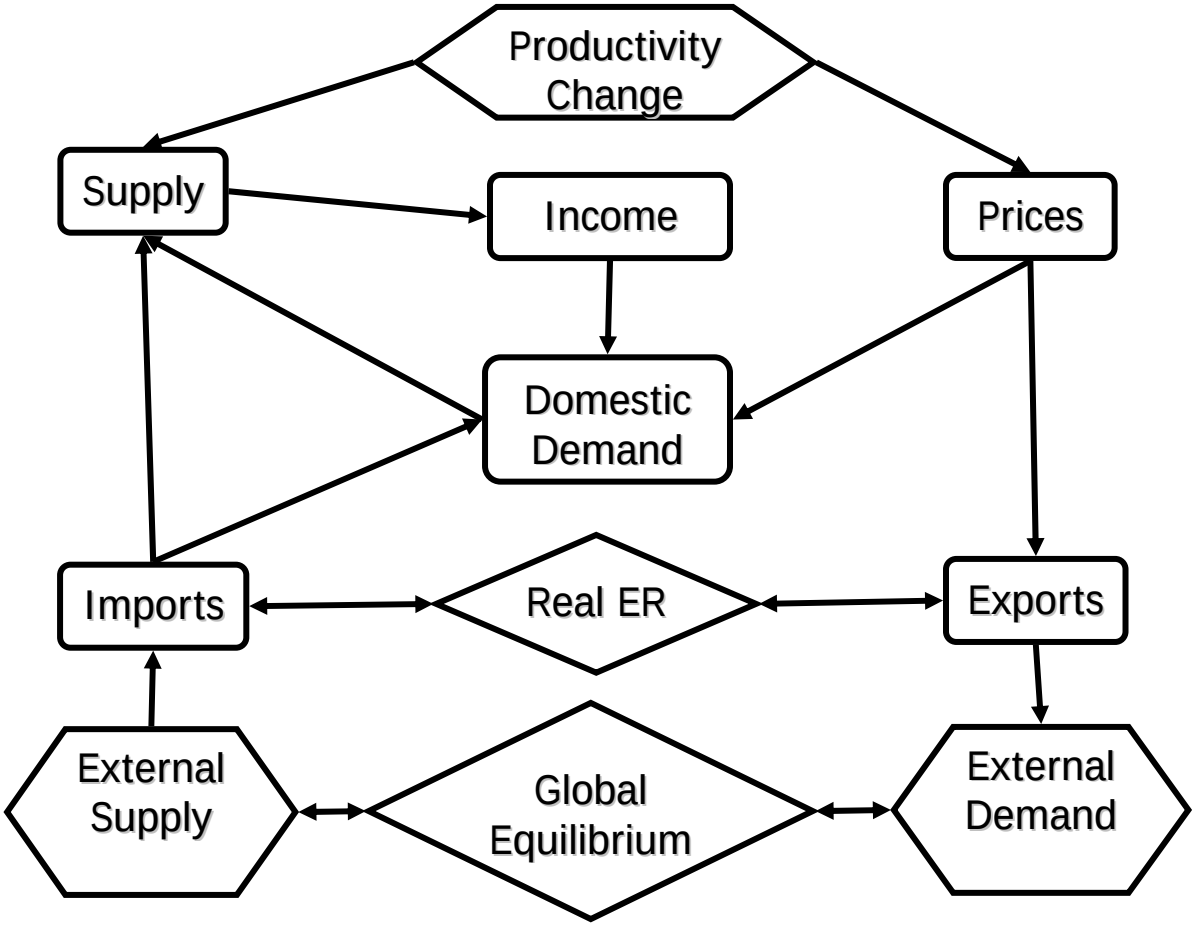


Figure 5.2: General Equilibrium Calibration Mechanism



6.3. Notes on the Adjustment Process

The calibration procedure highlights the two salient adjustment mechanisms in the model (as well as the real economies), domestic and international prices. General equilibrium price adjustments are generally well understood by professional economists but, in the multilateral context, the role of exchange rates can be a source of confusion. Generally, in a neoclassical model like this one, there are no nominal or financial variables and the function of the exchange rate is only to equalized real purchasing power between different economies.

Because models like this to not capture the aggregate price level or other nominal quantities, there is no nominal exchange rate in the sense of traditional macroeconomics or finance. Since there is no money metric in the model, all prices are relative prices, and the exchange rate (the composite relative price of foreign goods) is no exception. If there were financial assets in the model, one could define a nominal exchange rate as the relative price of two international financial assets (money, bonds, etc.). Without them, the exchange rate is defined in terms of real international purchasing power, i.e. the relative price of tradeable to nontradeable goods. In a multi-sector setting, the real exchange rate is defined as the ratio of an index of the value of all tradeables (on world markets) to an index of the value of all nontradeables.

Since any tax (or other price elevating distortion) on an import is an implicit tax on all tradeable goods, trade liberalization causes tradeable goods prices to fall and the real exchange rate depreciates. Real exchange rate depreciation also makes exports more competitive, one of the principal motives for unilateral liberalization. The general implication of this is that trade will expand rapidly for a country removing significant import protection, and more rapidly for countries removing more protection. The pattern of trade expansion, and the domestic demand and supply shifts that accompany it, depend upon initial conditions and adjustments among trading partners. At the same time, each country has rising marginal cost in production and diminishing marginal utility in consumption and, with a close multilateral trading system, trade volume changes induce terms of trade effects exactly as intuition would dictate.

Table 1. FDI Inflows in Selected Developing Asian Economies, 2001-03

Economy	% of Total FDI in Developing Asia	Ratio to GDP
China, People's Rep of	52.0	4.0
Hong Kong, China	16.0	9.7
Singapore	10.9	12.1
India	3.8	0.7
Korea, Rep of	3.5	0.6
Kazakhstan	2.5	9.9
Thailand	2.3	1.7
Malaysia	2.1	2.2
Taipei,China	2.0	0.7
Azerbaijan	1.7	25.3

Source: UNCTAD FDI Database September 2004.

Table 2. Top 10 Destinations for FDI in Developing Asia, 1991-93 and 2001-03

Rank	Host Economy	1991-93	Rank	Host Economy	2001-03
Annual FDI Inflows (US$ million)					
1	China, People's Rep of	14,296	1	China, People's Rep of	51,042
2	Malaysia	4,974	2	Hong Kong, China	15,673
3	Hong Kong, China	3,946	3	Singapore	10,725
4	Singapore	3,926	4	India	3,707
5	Thailand	2,002	5	Korea, Rep of	3,459
6	Indonesia	1,754	6	Kazakhstan	2,498
7	Taipei,China	1,022	7	Thailand	2,228
8	Philippines	857	8	Malaysia	2,077
9	Korea, Rep of	744	9	Taipei,China	2,002
10	Viet Nam	592	10	Azerbaijan	1,635
FDI Inflows (as % of Gross Fixed Capital Formation)					
1	Vanuatu	53.1	1	Azerbaijan	90.0
2	Viet Nam	32.0	2	Singapore	43.8
3	Solomon Islands	26.5	3	Kazakhstan	43.3
4	Singapore	23.1	4	Tajikistan	42.5
5	Malaysia	22.8	5	Hong Kong, China	40.0
6	Fiji Islands	17.4	6	Mongolia	28.3
7	Lao PDR	15.2	7	Vanuatu	27.3
8	Hong Kong, China	13.2	8	Cambodia	16.4
9	Cambodia	12.9	9	Viet Nam	13.4
10	Papua New Guinea	12.1	10	Fiji Islands	12.9
FDI Inflows Per Capita (US$)					
1	Singapore	1,215	1	Singapore	2,577
2	Hong Kong, China	677	2	Hong Kong, China	2,314
3	Malaysia	261	3	Tuvalu	1,079
4	Vanuatu	167	4	Azerbaijan	200
5	Solomon Islands	51	5	Kazakhstan	168
6	Taipei,China	49	6	Taipei,China	89
7	Fiji Islands	47	7	Vanuatu	86
8	Thailand	35	8	Malaysia	85
9	Papua New Guinea	30	9	Korea, Rep of	73
10	Maldives	29	10	Maldives	42

Sources: UNCTAD FDI Database September 2004; ADB Key Indicators 2004.

Table 3: FDI Regressions

Equation: reg fdi logR logGrGDP kor twn hkg idn mys phl sgp tha vnm bgd ind lka

```
      Source |       SS       df       MS              Number of obs =      78
-------------+------------------------------           F( 14,    63) =   73.23
       Model |  1.3054e+10    14   932411577           Prob > F      =  0.0000
    Residual |   802123492    63  12732118.9           R-squared     =  0.9421
-------------+------------------------------           Adj R-squared =  0.9292
       Total |  1.3856e+10    77   179946566           Root MSE      =  3568.2

------------------------------------------------------------------------------
         FDI |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        logR |   1816.127   2176.382     0.83   0.407    -2533.026    6165.279
    logGrGDP |   107507.1   43425.21     2.48   0.016     20728.77    194285.5
         kor |  -46095.11   2108.189   -21.86   0.000    -50307.99   -41882.23
         twn |  -49871.46   2264.367   -22.02   0.000    -54396.43   -45346.48
         hkg |  -42254.03   2249.505   -18.78   0.000    -46749.31   -37758.75
         idn |   -49690.7   2446.088   -20.31   0.000    -54578.82   -44802.58
         mys |   -46187.1   2138.156   -21.60   0.000    -50459.86   -41914.33
         phl |  -47120.48   2309.259   -20.41   0.000    -51735.17    -42505.8
         sgp |  -42336.87   2448.275   -17.29   0.000    -47229.35   -37444.38
         tha |  -44690.94   2204.846   -20.27   0.000    -49096.98   -40284.91
         vnm |  -47143.44   2146.111   -21.97   0.000     -51432.1   -42854.78
         bgd |  -47957.01    2207.56   -21.72   0.000    -52368.46   -43545.55
         ind |   -44963.4    2167.88   -20.74   0.000    -49295.57   -40631.24
         lka |  -47996.92    2401.47   -19.99   0.000    -52795.88   -43197.97
       _cons |   45154.94   2145.056    21.05   0.000     40868.38    49441.49
------------------------------------------------------------------------------
```

Equation: reg fdi logGrGDP kor twn hkg idn mys phl sgp tha vnm bgd ind lka

```
      Source |       SS       df       MS              Number of obs =      78
-------------+------------------------------           F( 13,    64) =   79.19
       Model |  1.3045e+10    13  1.0035e+09           Prob > F      =  0.0000
    Residual |   810989389    64  12671709.2           R-squared     =  0.9415
-------------+------------------------------           Adj R-squared =  0.9296
       Total |  1.3856e+10    77   179946566           Root MSE      =  3559.7

------------------------------------------------------------------------------
         FDI |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    logGrGDP |   102336.3   42878.74     2.39   0.020     16676.15    187996.4
         kor |  -45906.83   2091.102   -21.95   0.000    -50084.29   -41729.37
         twn |  -50249.13   2213.405   -22.70   0.000    -54670.91   -45827.35
         hkg |  -42764.75   2159.507   -19.80   0.000    -47078.86   -38450.64
         idn |  -48789.94   2189.814   -22.28   0.000    -53164.59   -44415.28
         mys |  -46375.94   2121.096   -21.86   0.000    -50613.32   -42138.56
         phl |  -46500.71   2181.366   -21.32   0.000    -50858.49   -42142.93
         sgp |  -43294.78   2157.339   -20.07   0.000    -47604.56      -38985
         tha |  -45126.55   2137.072   -21.12   0.000    -49395.84   -40857.26
         vnm |  -47550.69   2084.919   -22.81   0.000    -51715.79   -43385.58
         bgd |  -47469.45    2123.78   -22.35   0.000    -51712.18   -43226.71
         ind |  -44524.07   2097.984   -21.22   0.000    -48715.27   -40332.86
         lka |  -47181.18   2188.289   -21.56   0.000    -51552.79   -42809.57
       _cons |   45592.05   2075.174    21.97   0.000     41446.41    49737.68
------------------------------------------------------------------------------
```

Table 4: FDI Elasticity Regressions

Equation: logFDI logR logGrGDP kor twn hkg idn mys phl sgp tha vnm bgd ind lka

```
      Source |       SS       df       MS              Number of obs =      65
-------------+------------------------------           F( 13,    51) =   20.93
       Model |  158.649624    13  12.2038172           Prob > F      =  0.0000
    Residual |  29.7340597    51  .583020778           R-squared     =  0.8422
-------------+------------------------------           Adj R-squared =  0.8019
       Total |  188.383684    64  2.94349506           Root MSE      =  .76356

------------------------------------------------------------------------------
      logFDI |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        logR |  -.9106291   .5019144    -1.81   0.076    -1.918264     .097006
    logGrGDP |   16.88279   11.14914     1.51   0.136    -5.500035    39.26562
         kor |  -3.207413   .4760129    -6.74   0.000    -4.163049   -2.251777
         twn |  (dropped)
         hkg |  -2.034895   .5077449    -4.01   0.000    -3.054235   -1.015555
         idn |  -3.979752   .7145343    -5.57   0.000     -5.41424   -2.545265
         mys |  -3.521003   .4640808    -7.59   0.000    -4.452684   -2.589322
         phl |  -3.763287   .5090549    -7.39   0.000    -4.785258   -2.741317
         sgp |  -2.448458   .5418926    -4.52   0.000    -3.536353   -1.360563
         tha |  -3.166567   .4813388    -6.58   0.000    -4.132895   -2.200239
         vnm |  -4.474914   .4639033    -9.65   0.000    -5.406239   -3.543589
         bgd |  -4.403957   .4811483    -9.15   0.000    -5.369902   -3.438011
         ind |  -2.220983   .4699593    -4.73   0.000    -3.164466     -1.2775
         lka |  -5.046396   .5316096    -9.49   0.000    -6.113646   -3.979145
       _cons |   10.33753   .5076863    20.36   0.000     9.318304    11.35675
------------------------------------------------------------------------------
```

Equation: logFDI logGrGDP kor twn hkg idn mys phl sgp tha vnm bgd ind lka

```
      Source |       SS       df       MS              Number of obs =      65
-------------+------------------------------           F( 12,    52) =   21.46
       Model |  156.730479    12  13.0608732           Prob > F      =  0.0000
    Residual |  31.6532047    52  .608715476           R-squared     =  0.8320
-------------+------------------------------           Adj R-squared =  0.7932
       Total |  188.383684    64  2.94349506           Root MSE      =   .7802

------------------------------------------------------------------------------
      logFDI |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    logGrGDP |   19.49777   11.29658     1.73   0.090     -3.17047    42.16601
         kor |  -3.270825   .4850763    -6.74   0.000    -4.244202   -2.297448
         twn |  (dropped)
         hkg |   -1.76354    .495794    -3.56   0.001    -2.758424   -.7686568
         idn |  -4.540919   .6581624    -6.90   0.000    -5.861618    -3.22022
         mys |  -3.426042   .4711715    -7.27   0.000    -4.371517   -2.480568
         phl |  -4.073672   .4898987    -8.32   0.000    -5.056726   -3.090619
         sgp |  -1.975308   .4853677    -4.07   0.000     -2.94927   -1.001347
         tha |  -2.947845   .4761556    -6.19   0.000    -3.903321   -1.992369
         vnm |  -4.270531   .4598275    -9.29   0.000    -5.193242   -3.347819
         bgd |  -4.648148   .4720098    -9.85   0.000    -5.595305   -3.700991
         ind |  -2.441053   .4639334    -5.26   0.000    -3.372003   -1.510102
         lka |   -5.45503   .4920369   -11.09   0.000    -6.442374   -4.467686
       _cons |   10.11758   .5037472    20.08   0.000     9.106742    11.12843
------------------------------------------------------------------------------
```

Table 5. Benchmark values of the FDI parameters

Parameter	Value
Determents of FDI	
Forward discount rate	5.0
Relative real interest rate	0.1
Real GDP growth rate	10.0
FDI-productivity nexus	
Emerging Market ROR Premium	0.10
FDI-trade expansion	
Elasticity of trade cost to domestic stock of FDI	-0.10

Table 6. Impacts on Real GDP (% change)

	High Elas. to interest rate	High Elas. to GDP growth	Low productivity spillover effect	High productivity spillover effect	Low trade expansion effect	High trade expansion effect
USA	0.0	-0.1	0.0	0.2	-0.3	1.1
EU	0.1	-0.4	-0.2	0.5	-0.3	0.8
Japan	0.0	0.0	0.0	0.2	-0.4	1.3
Australia & New Zealand	0.2	-0.1	0.0	0.1	-0.5	0.9
Korea	0.3	0.3	-0.1	1.1	-0.8	4.5
Hong Kong, China	-1.7	0.8	-0.5	0.9	-1.4	3.1
Taipei,China	0.0	0.2	0.2	-0.2	-1.1	2.4
P.R.China	-0.6	2.4	0.1	1.4	-0.8	7.2
Singapore	-9.0	1.7	0.1	0.1	-3.9	11.7
Malaysis	2.0	1.8	0.6	-1.2	-2.4	7.1
Indonesia	0.4	0.4	0.3	-0.4	-0.5	1.7
Thailand	1.9	1.0	-0.6	1.3	-1.7	4.6
The Philippines	0.5	0.1	0.0	0.1	0.0	0.5
Viet nam	-2.1	1.0	0.0	0.1	0.9	-1.4
India	0.1	0.1	0.0	2.2	1.2	4.3
Bangladesh	0.0	0.0	0.0	1.0	0.3	2.1
Sri Lanka	0.3	0.2	0.0	-0.1	-1.1	1.2
L. America	0.2	-0.1	-0.1	0.1	-0.5	0.6
ROW	0.4	0.0	-0.2	0.5	-0.4	1.1

Table 7. Impacts on Share of Foreign Capital (% in total capital)

	High Elas. to interest rate	High Elas. to GDP growth	Low productivity spillover effect	High productivity spillover effect	Low trade expansion effect	High trade expansion effect
USA	0.0	-0.1	0.0	0.0	0.0	-0.1
EU	0.1	-0.4	0.0	-0.1	0.1	-0.2
Japan	0.0	0.0	0.0	0.0	0.0	0.0
Australia & New Zealand	0.2	-0.1	0.0	-0.1	0.1	-0.3
Korea	0.2	0.1	0.0	0.0	0.1	-0.2
Hong Kong, China	-0.6	0.2	0.2	-0.4	0.6	-1.4
Taipei,China	0.0	0.0	0.0	0.0	0.1	-0.2
P.R.China	-0.4	1.0	0.0	-0.1	0.3	-0.7
Singapore	-3.3	0.5	0.1	-0.1	0.8	-1.9
Malaysis	0.2	0.0	-0.1	0.3	0.9	-1.8
Indonesia	0.1	0.0	0.0	0.0	0.0	-0.1
Thailand	0.8	0.2	0.1	-0.2	0.3	-0.7
The Philippines	0.5	0.0	0.0	0.0	0.0	0.0
Viet nam	-2.3	1.2	-0.1	0.2	-0.5	1.1
India	0.0	0.1	0.0	0.0	0.0	0.0
Bangladesh	0.0	0.0	0.0	0.0	0.0	0.0
Sri Lanka	0.4	0.2	0.0	0.0	0.1	-0.1
L. America	0.3	-0.2	0.0	-0.1	0.1	-0.2
ROW	0.3	0.0	0.0	-0.1	0.1	-0.2

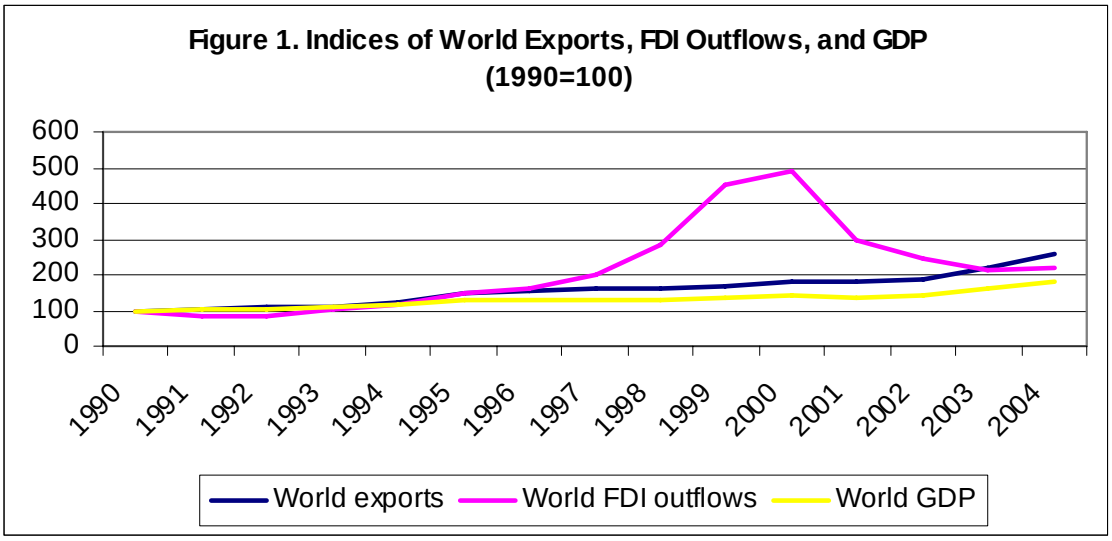
Table 8. Impacts on Exports (% change)

	High Elas. to interest rate	High Elas. to GDP growth	Low productivity spillover effect	High productivity spillover effect	Low trade expansion effect	High trade expansion effect
USA	0.0	0.0	0.0	0.4	-8.2	17.4
EU	0.0	-0.8	-0.9	1.7	-4.6	8.0
Japan	0.2	-0.3	0.1	0.4	-9.2	22.5
Australia & New Zealand	0.0	0.1	0.0	0.5	-5.0	11.3
Korea	1.9	1.0	-0.1	10.4	-1.4	34.3
Hong Kong, China	-1.5	0.9	-1.4	2.7	-4.4	10.0
Taipei,China	0.0	0.2	0.5	-0.7	-4.7	9.6
P.R.China	-1.1	3.8	0.4	1.3	-14.2	42.5
Singapore	-15.7	4.2	0.3	0.1	-27.6	104.2
Malaysis	2.1	1.9	2.5	-5.1	-3.7	9.0
Indonesia	0.4	0.7	0.9	-1.3	-5.3	12.2
Thailand	3.3	1.8	-1.2	2.7	-7.2	19.3
The Philippines	0.5	0.9	-1.0	2.6	-15.5	71.2
Viet nam	-4.8	2.4	-2.8	6.0	-14.6	36.2
India	0.7	1.1	0.2	3.1	-6.3	25.2
Bangladesh	0.2	0.5	0.2	1.3	-6.7	18.3
Sri Lanka	1.3	1.0	-0.1	0.2	-6.9	16.5
L. America	0.5	-0.8	-0.6	1.1	-5.3	9.3
ROW	1.2	0.0	-0.6	1.7	-6.7	15.0

Table 9. Impacts on Imports (% change)

	High Elas. to interest rate	High Elas. to GDP growth	Low productivity spillover effect	High productivity spillover effect	Low trade expansion effect	High trade expansion effect
USA	0.0	0.0	0.0	0.6	-11.2	29.1
EU	0.4	-1.7	-0.9	1.8	-9.3	20.8
Japan	0.1	-0.3	0.2	1.0	-15.7	46.8
Australia & New Zealand	0.4	0.0	0.1	0.6	-10.5	28.3
Korea	2.3	2.1	-0.1	4.3	-12.4	45.1
Hong Kong, China	-2.6	2.3	-0.9	2.4	-12.4	34.2
Taipei,China	-0.3	0.7	0.5	-0.4	-9.7	23.9
P.R.China	-2.6	6.5	0.4	1.4	-21.6	70.8
Singapore	-16.0	4.3	0.3	0.1	-27.3	106.7
Malaysis	2.3	3.3	2.9	-5.7	-9.0	23.3
Indonesia	0.1	1.7	1.0	-1.0	-10.7	29.6
Thailand	4.6	2.7	-1.1	3.1	-12.9	40.2
The Philippines	0.8	0.9	-0.7	2.9	-16.4	81.3
Viet nam	-6.8	3.7	-1.9	4.0	-18.6	52.9
India	0.7	1.8	0.2	2.4	-12.2	43.6
Bangladesh	0.1	0.9	0.2	1.5	-10.7	30.6
Sri Lanka	2.3	1.7	-0.1	0.3	-11.5	29.6
L. America	1.3	-0.3	-0.5	1.8	-9.9	26.1
ROW	1.9	0.1	-0.5	2.2	-11.2	31.1

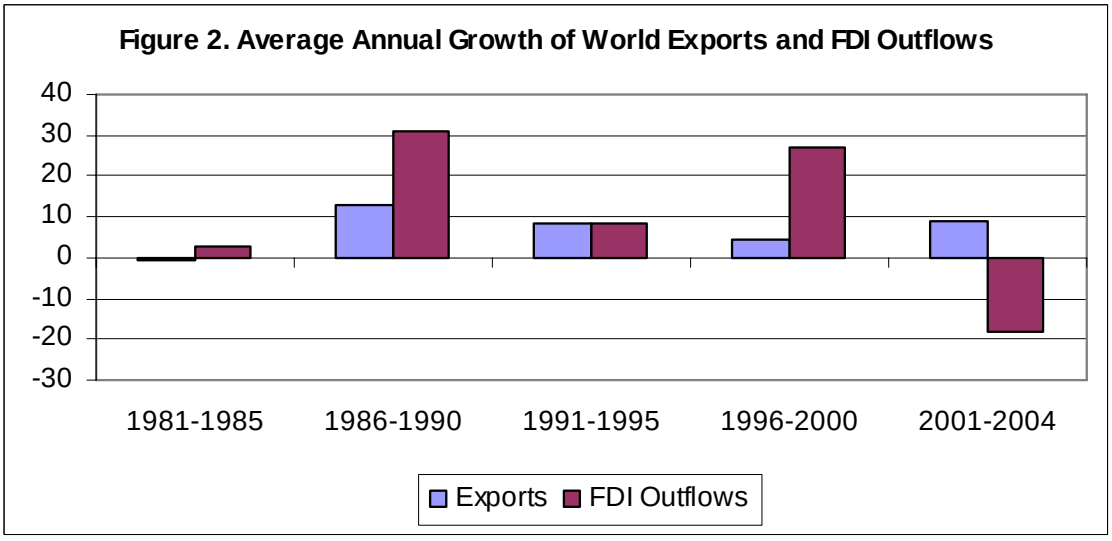
Figure 1. Indices of World Exports, FDI Outflows, and GDP (1990=100)



Note: Data for 2004 are preliminary.

Sources: Exports and GDP - IMF WEO Database April 2005; FDI Outflows - UNCTAD FDI Database September 2004.

Figure 2. Average Annual Growth of World Exports and FDI Outflows



Note: Data for 2004 are preliminary.

Sources: IMF WEO Database April 2005; UNCTAD FDI Database September 2004.

Figure 3: FDI and Log(GDP growth)

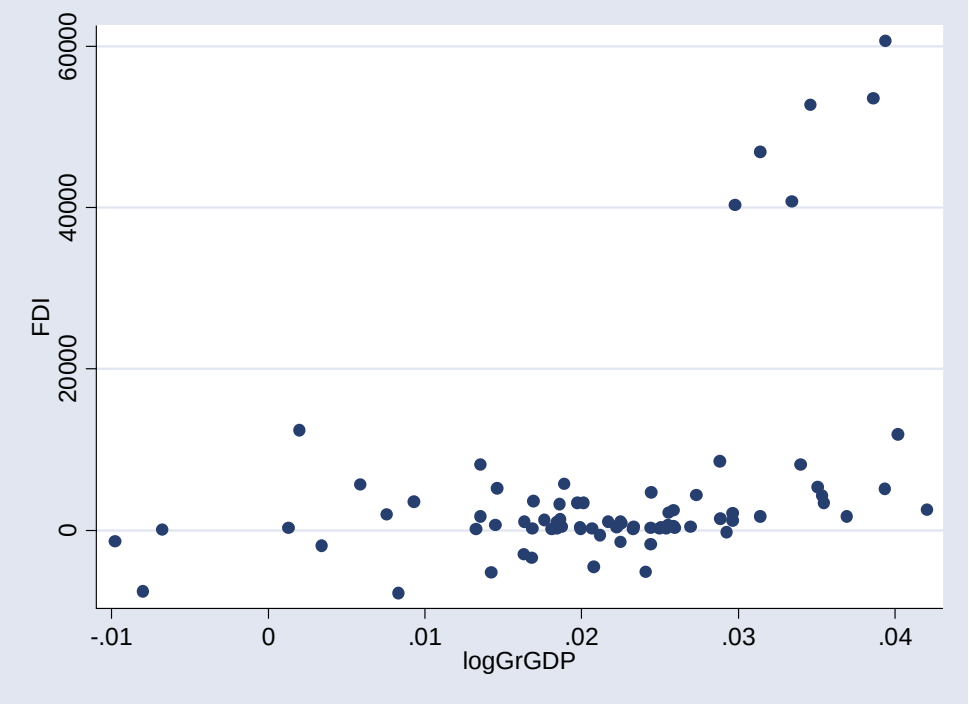


Figure 4: Log(FDI) and Log(GDP growth)

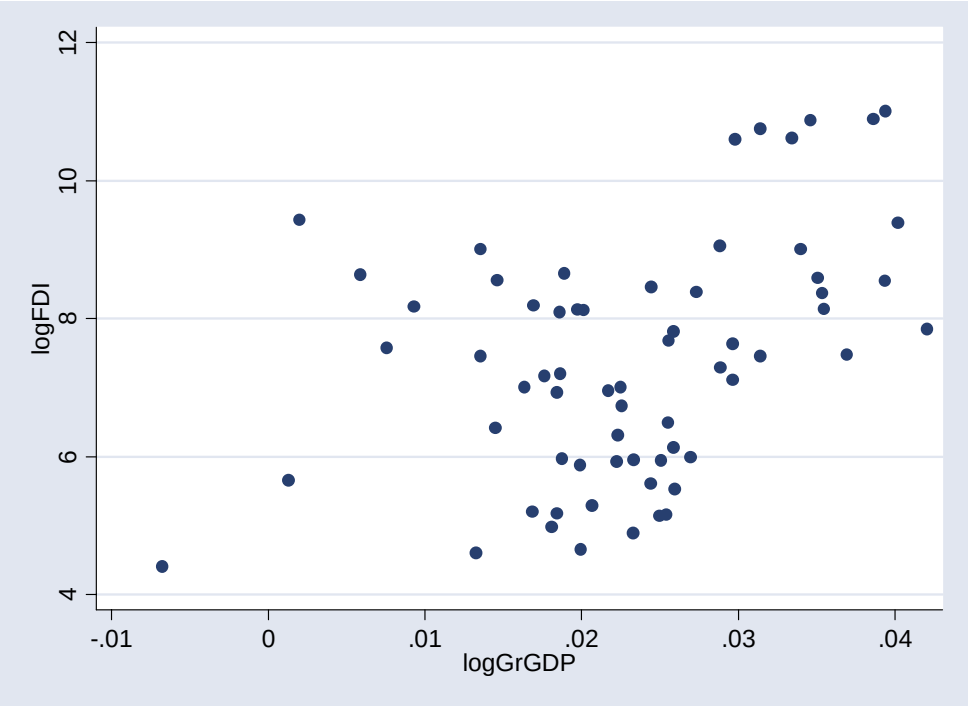


Figure 5: FDI and Log(R/RW)

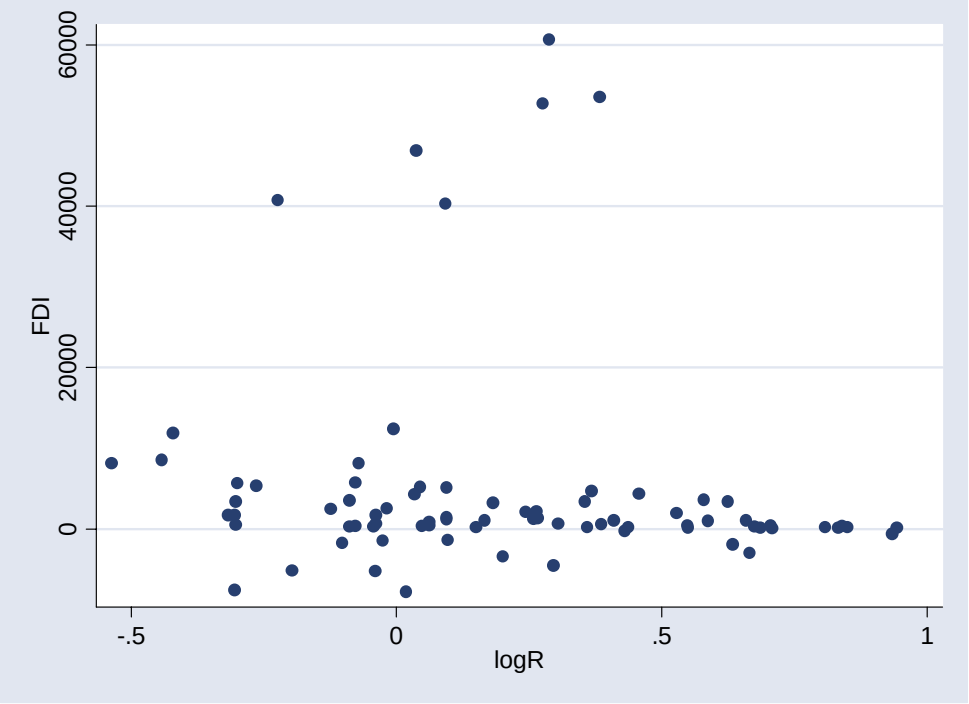
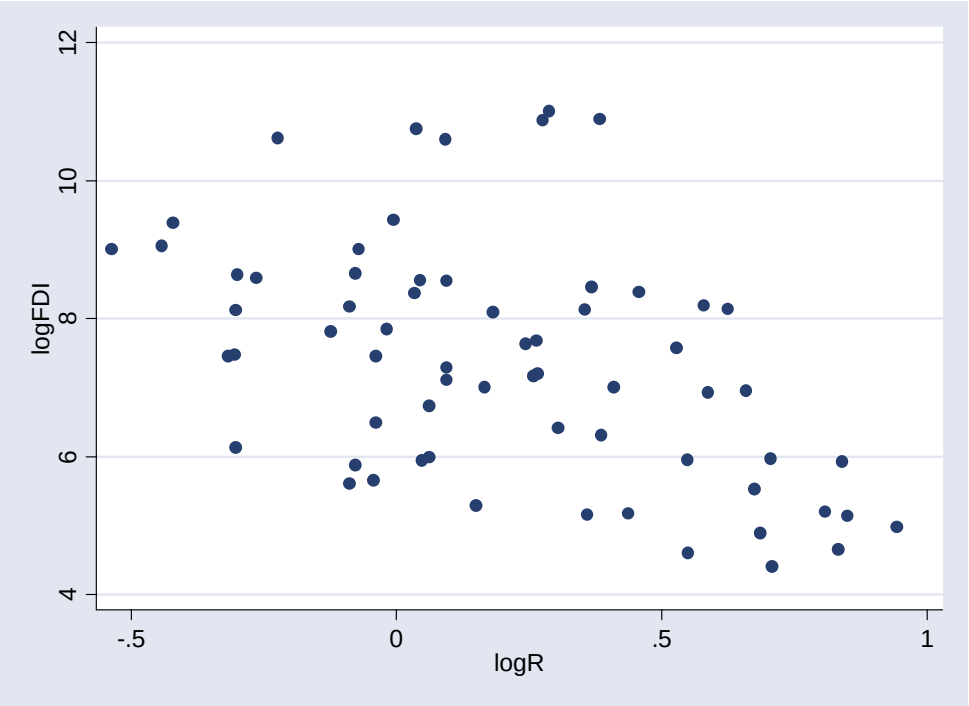


Figure 6: Log(FDI) and Log(R/RW)


logFDI
12
10
8
6
4
-.5
0
.5
1
logR