Technological Capability as a Determinant of FDI Inflows: Evidence from Developing Asia & India

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Abstract

During 2006-07, FDI inflows into India were more than double than those in 2005-06. Indeed, during April-January 2006-07, inward FDI into India at US$16.4 billion, was far higher than the annual average inflow of US$2-3 billion during the late 1990s. In recent years, India has also emerged as one of the leading FDI destinations in Asia. On the whole, the pattern of FDI inflows to developing Asia itself has changed significantly over the years. Some leading Southeast Asian economies (for example, Malaysia, Indonesia, Thailand and Philippines) no longer attract as much FDI as they used to in the past. This is in sharp contrast to some East and Southeast Asian economies that continue to draw large FDI (for example, China, Hong Kong and Singapore).

In the above context, this paper attempts to explain the country-wise variations in the pattern of FDI flows to developing Asian economies by empirically identifying location-specific features influencing such flows. The paper argues that some countries in the region, which have developed long term sources of comparative advantages in the form of superior technological capabilities and supporting infrastructure have consistently attracted greater volumes of export-oriented FDI. These attributes are also crucial for explaining the steady improvement in FDI flows to India. The paper finds that with production processes becoming increasingly complex and technology-intensive, developing countries like India, must devote greater attention to the development of R&D and frontier technologies, failing which, they might lose out in the race for FDI.

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Foreword

This paper contributes to the empirical literature on determinants of FDI by addressing the question: Why do some developing countries from Asia continue to receive more FDI, while others from the region have fallen behind? It finds R&D-based innovative capacities, and the ability to apply such capacities through modern IT-based techniques, as the two key determinants explaining FDI inflows to developing Asian economies. These traits are found significant for inward FDI in India too with more technology-intensive sectors receiving greater FDI.

The findings of the paper suggest that in the absence of strong technological foundations and well-developed communications infrastructure, liberal policies alone are not enough for drawing FDI, once initial advantages, like cheap labour, fizzle out. For developing countries like India, strong thrust on R&D and innovative skills is needed for attracting FDI in technology-intensive exports. Therefore, policy actions would have to go further than a broad-based opening up of sectors to FDI, and increasing the limit of such investment in these sectors, for sustained inflows of FDI.

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April 20, 2007

I.   Introduction[1]

For capital-scarce developing economies, foreign direct investment (FDI) implies access to not only capital, but also advanced technology and know-how, managerial expertise, global marketing networks and best-practice systems of corporate governance. FDI inflows are non-debt creating and more 'stable' than portfolio flows that are guided by short-term risk-return payoffs and are prone to quick reversals in the event of adverse expectations. Thus, following withdrawal of most restrictions on cross-border movement of capital in a globalized world, almost all developing countries have adopted liberal policies towards FDI for exploiting the virtuous aspects of such flows.

In spite of enabling policies, however, success in attracting FDI has varied widely between countries. Such success is also seen to have varied over time. The East and Southeast Asia are distinct cases in point. Together, the two regions received more than three-fourths of total FDI flowing into developing Asian economies in 2005 (UNCTAD, 2006). But 64.3 per cent of this FDI moved to China, Hong Kong and Singapore, underlining the tendency of inward FDI to concentrate in some key locations. It is interesting to note that while China, Hong Kong and Singapore, continue to attract high FDI for more than three decades now,[2] other developing economies from the region such as Indonesia, Malaysia and Thailand, which used to get large chunks of FDI in the 1980s and early 1990s, are unable to draw as much now. On the other hand, India, which received much less FDI than Indonesia, Malaysia and Thailand during the 1990s, has now overtaken these economies.

The literature on FDI tries to explain cross-country variations in FDI inflows in terms of country-specific features encouraging or discouraging such flows. Singh and Jun (1995), Caves (1996), and more recently, Blonigen (2005), provide exhaustive reviews of the features that have been identified by both theoretical and empirical literature. These can

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[1] The authors are grateful to Dr. Rajiv Kumar, Mr. T.C.A. Srinivas Raghavan, Dr. Ramesh Chandra and Dr. Mandira Sarma for valuable comments and suggestions.
[2] China has been a relatively late reformer compared with Hong Kong and Singapore. Its FDI boom has been for less than three decades.

be broadly classified into *economic* factors impacting returns from investment (for example, host country market size, availability and cost of skilled labour, exchange rate stability, availability of natural resources, infrastructure), host country *policies* (for instance, outward-orientation, tax rates, investment incentives) and *institutional* factors influencing investor outlooks (such as, political stability, ease of doing business, cultural differences from home countries, language). While all these factors, individually and collectively, influence inward FDI, it is important to determine which of these are more significant in explaining the ability of some economies to consistently attract more FDI over time.

Globalization has resulted in increasing fragmentation of production networks of multinational enterprises. Several functions, which used to be performed earlier in one location, are now getting dispersed over multiple countries, for maximizing the benefits offered by specific features of different locations. Such fragmentation implies that countries are likely to fall behind in the race for attracting FDI, unless they strengthen their comparative advantages. The East Asian development experience indicates that the initial surge of FDI into the 'Tigers' (that is, Hong Kong, Korea, Taiwan and Singapore), followed by the 'Cubs' (Indonesia, Malaysia, the Philippines and Thailand), and further by China and Vietnam, was mainly to exploit the advantage of cheap labour for export-oriented production (Guha and Ray, 2004). However, rising wages are likely to have diluted this initial advantage over time. But if China, Korea, Hong Kong and Singapore continue to attract high FDI, while Indonesia, Malaysia, the Philippines and Thailand are unable to, then the former must be having some dynamic sources of comparative advantages other than low labour costs for drawing FDI, which the latter don't.

The existing empirical literature on determinants of FDI into developing countries has not devoted adequate attention to country-specific features that constitute sources of dynamic comparative advantages for attracting FDI. In this regard, technological capabilities can be a key factor. It is well known that rapid technological development not only leads to productivity gains, but also production efficiency and higher returns on investment. Developing economies that have successfully scaled higher technological trajectories can

be attractive destinations for FDI that seeks to exploit local technological capabilities in producing high-tech exports for third-country markets. In the East and Southeast Asian context, this implies that countries that continue to draw large FDI have replaced the initial comparative advantage of cheap labour by advanced technological skills, complemented by the ability to utilize such skills, in terms of modern technological infrastructures.

This critical role of national technological capabilities and infrastructure in explaining inward FDI in developing countries, however, is practically unexamined. This paper attempts to fill the gap in existing literature by empirically identifying country-specific features, particularly the level of domestic technological capabilities and quality of IT-based communication facilities, in explaining the pattern of FDI inflows to developing Asian economies.

The paper also attempts to study the main determinants of inward FDI into India. Empirical research on FDI in India has mostly focused on the impact of FDI upon macro-economic fundamentals. The limited literature on host-country determinants of FDI inflows into India points to such FDI being essentially domestic market-oriented (Banga 2003a, Guha and Ray, 2004). India also appears to enjoy the advantage of low wage costs (Guha and Ray, 2004; Gupta and Mehra, 1995). However, there is hardly any empirical analysis of whether some of India's much talked about economic strengths – developed innovative capacity, phenomenal growth in IT, possession of skilled labour and high yields from a vibrant capital market – have influenced inward FDI or not. A close look at the likely impact of these factors on FDI inflows becomes essential with India emerging as a leading recipient of FDI in developing Asia in recent years.

The rest of the paper is organized as follows. Section 2 reports some stylized facts on FDI inflows to major economies of the East, South and Southeast Asia, during the past 15 years. It also reports the pattern of FDI inflows into India. Section 3 explains the theoretical framework leading to the econometric estimation. Section 4 outlines testable hypotheses, data and variables. Section 5 reports and analyzes empirical results for East,

South and Southeast Asia, as well as India. Finally, Section 6 concludes and outlines some policy issues.

II.   FDI Inflows: Some Stylized Facts

We divide this section into two parts for analytical convenience. While the first part discusses FDI inflows into East Southeast, and South Asian economies, the second part looks exclusively at such flows for India.

II.I.   *East, Southeast and South Asia*

The bulk of FDI into Asia flows into East Asia. As Table 1 shows, annual average FDI inflows into East Asia experienced an almost three-fold increase from US$30.1 billion during 1991-95 to US$88.3 billion during 2001-05. The share of the region in total FDI inflows for Asia[3] increased from 55.76 per cent during 1991-95 to 61.03 per cent during 2001-05. However, as a proportion of total global FDI flows, the share of East Asia declined marginally from 13.16 per cent during 1991-95 to 12.15 per cent during 2001-05. The share of FDI inflows into Southeast Asia, as a proportion of total Asian and world FDI flows, were 33.92 per cent and 8 per cent respectively during 1991-95. Both the shares are seen to have dropped to 16.32 per cent and 3.25 per cent respectively during 2001-05. Indeed, for Southeast Asia, average FDI inflows during 2001-05 are lower than those during 1996-2000 (Table 1), which is somewhat surprising considering that the latter was the period which witnessed the Asian financial crisis. In contrast, average FDI inflows into South Asia have almost doubled between 1996-2000 and 2001-05 (Table 1), though the share of such flows in total Asian and world FDI were only 5 per cent and 1 per cent respectively, during 2001-05.

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[3] The shares are in terms of annual average FDI flows for the region as a proportion of the annual average flows for the continent during the reference period. Japan is excluded from East Asia on account of its being a developed country.

**Table 1 : FDI Inflows into East, Southeast and South Asian Developing Economies: 1991-
2005 (in US$ million)**

Region/Time period	1991-95	1996-2000	2001-05
East Asia:			
China	22835.17	42695.77	57232.29
Hong Kong, China	5175.85	24619.08	23402.23
Korea, Democratic People's Republic of	28.70	66.00	89.86
Korea, Republic of	857.12	5600.46	5145.18
Macao, China	-1.34	-0.20	442.79
Mongolia	7.50	28.78	105.50
Taiwan, Province of China	1200.20	2437.60	1906.00
Total (East Asia)	**30103.20**	**75447.49**	**88323.85**
South Asia:			
Afghanistan	0.00	1.09	0.98
Bangladesh	6.44	410.61	437.08
Bhutan	0.13	1.92	0.68
India	796.80	2906.00	5551.20
Maldives	7.19	11.52	13.19
Nepal	0.44	11.62	6.79
Pakistan	462.65	499.46	1008.20
Sri Lanka	123.11	217.99	220.40
Total **(South Asia)**	**1396.76**	**4060.21**	**7238.52**
Southeast Asia:			
Brunei Darussalam	121.93	645.07	1084.67
Cambodia	61.34	217.07	178.22
Indonesia	2341.80	843.20	745.15
Lao, People's Democratic Republic	39.62	69.04	22.60
Malaysia	5063.60	4803.38	2964.37
Myanmar	185.72	531.02	245.13
Philippines	1124.00	1601.60	809.60
Singapore	6372.65	12762.22	13653.23
Thailand	1889.20	4630.60	2377.30
Timor-Leste	14.24	0.00	19.02
Vietnam	1100.07	1772.64	1516.10
Total (Southeast Asia)	**18314.17**	**27875.84**	**23615.39**

Source: UNCTAD; see http://stats.unctad.org/fdi/

East Asia's success in drawing the bulk of Asian FDI has much to do with the surge of
FDI inflows into China. FDI into Hong Kong, though much less than that in China, has

also been among the highest in Asia since 1996 (Table 2). Since 1996, Korea has also been figuring among the top five FDI recipients in Asia. But apart from Singapore, no other Southeast Asian economy figures among the top five FDI destinations in Asia in the current decade. On the contrary, India has become the first economy from South Asia, to reach the league of top five countries during 2001-05. However, in terms of share in total Asian FDI, India is still much below those of China, Hong Kong and Singapore (Table 2).

Table 2: Share of Top Five Recipients of FDI among Developing Asian Economies (1991-2005)

1991-95		*1996-2000*		*2001-05*	
China	45.84	China	39.76	China	48.02
Singapore	12.79	Hong Kong, China	22.93	Hong Kong, China	19.64
Hong Kong, China	10.39	Singapore	11.88	Singapore	11.46
Malaysia	10.16	Korea, Republic of	5.22	India	4.66
Indonesia	4.70	Malaysia	4.47	Korea, Republic of	4.32
Share in Total Asian FDI inflows	**83.88**	**Share in Total Asian FDI inflows**	**84.26**	**Share in Total Asian FDI inflows**	**88.10**

Source: Computed from UNCTAD

The pattern of cross-country FDI flows during 1991-2005 shows a clear deceleration in inward FDI flows into Southeast Asian countries, except Singapore. For all other erstwhile high-growth economies of the region – Indonesia, Malaysia, the Philippines and Thailand – the decline in FDI has been particularly pronounced during 2001-05 (Table 1). It is evident that these countries are unable to attract as much FDI as they did in the past. The same, however, does not hold for Singapore – the only Southeast Asian economy that keeps on drawing large FDI – as well as China, Hong Kong and Korea from East Asia. Indeed, for these economies, and India, the pattern of FDI inflows during 1991-2005 is completely different from those in other Southeast Asian economies.

II.II.   India

FDI inflows into India have improved noticeably since 2001-02 (Table 3). One of the reasons behind the improvement is the broadening of the definition of FDI from 2000-01.

Prior to 2000-01, data on FDI into India used to reflect only equity flows through the automatic approval route, various schemes earmarked for expatriate Indians, the government route (that is, proposals approved by the Foreign Investment Promotion Board) and acquisition of shares[4] by non-residents in Indian companies under the Foreign Exchange Management Act (FEMA) of 1999. Since 2000-01, equity capital of unincorporated bodies (mostly foreign bank branches in India) is also included as part of overall equity flows. Furthermore, reinvested earnings (retained earnings of FDI entities) and other capital (essentially inter-corporate debt transactions between FDI entities) are also considered as part of FDI (RBI, 2007). Thus, the underreporting in FDI statistics has now been taken care of and the data reporting is in line with international norms. However, such changes in data reporting also imply that aggregate data on FDI inflows from 2000-01 onward is strictly not comparable with the previous years (RBI, 2007).

Table 3: FDI Equity Flows 1991-92 to 2005-06

Year	FDI flows (US$ million)			
	Equity	**Reinvested earnings**	**Other capital**	**Total**
1991-92	129	…	….	129
1992-93	315	…	….	315
1993-94	586	…	….	586
1994-95	1314	…	….	1314
1995-96	2144	…	….	2144
1996-97	2821	…	….	2821
1997-98	3557	…	….	3557
1998-99	2462	…	….	2462
1999-2000	2155	…	….	2155
2000-01	2400	1350	279	4029
2001-02	4095	1645	390	6130
2002-03	2764	1833	438	5035
2003-04	2229	1460	633	4322
2004-05	3778	1904	369	6051
2005-06(p)	5820	1676	226	7722
2006-07*	9513	944	135	10592

*Source: RBI's Handbook of Statistics and Bulletin (March 2007); (p): Provisional; *: Up to April-December 2006.*

As reported earlier, India has emerged as one of the leading FDI destinations in Asia in recent years. This is evident from the increase in FDI inflows since 2004-05, and

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[4] These are being reported as part of FDI by the RBI since January 1996. See RBI (2007).

particularly in 2006-07 (April-December), when total FDI inflows into India crossed the US$10 billion mark for the first time (Table 3), despite a full quarter of the year still pending.

Table 4: Top 15 FDI-Receiving Industries in India

Sectors	Share in total FDI stock (%)
1. Electrical equipment (including computer software and electronics)	17.03
2. Services	16.96
3. Telecommunication	9.32
4. Transportation	8.44
5. Fuels (power & oil refinery)	6.67
6. Chemicals (other than fertilizers)	5.21
7. Drugs & pharmaceuticals	2.83
8. Food processing	2.77
9. Cement & gypsum	2.35
10. Metallurgical industries	1.97
11. Consultancy services	1.46
12. Textiles (including dyed & printed)	1.25
13. Miscellaneous mechanical & engineering	1.22
14. Hotel & tourism	1.20
15. Trading	1.05

Source: India FDI Fact Sheet (December 2006); http://dipp.nic.in/fdi_statistics/india_fdi_index.htm

The industry-wise distribution of FDI inflows in India is shown in Table 4. More than half of incoming FDI has moved into electrical equipment (including software and electronics), services (including financial services), telecommunication and transportation (including automobiles). Indeed, concentration of FDI in electronics, computer software, financial and non-financial services, telecommunication, and automobiles, underlines a distinct tendency on part of FDI to move into more technology and skill-intensive activities. There is also perhaps a tendency on the part of such flows to move more into services rather than manufacturing. Among the latter, transportation (automobiles) appears to be the most preferred industry, followed by chemicals, food processing and drugs & pharmaceuticals.

III.   Theoretical Framework & Model Formulation

Within their 'pure' general equilibrium frameworks, neither the theory of international

trade, nor the theory of the firm, can justify FDI. This is on account of rigid assumptions accompanying the frameworks (such as, factor immobility, absence of transport costs, perfect competition, and so on), which constrain them from explaining FDI as a capital movement distinct from other forms of capital flows like portfolio investment or foreign borrowings (Lall and Streeten, 1977). However, theoretical postulates attempted after introducing suitable modifications in the frameworks of the theory of the firm (Hymer 1976; Hirsch 1976) and trade theory (Jones, 1970; Chipman, 1971, Vernon, 1974) come much closer to justifying FDI. While Hymer (1976) explains the emergence of multinationals and their entry in foreign markets as business expansion decisions arising from possession of firm-specific intangible assets (for instance, advanced technology, superior marketing skills) as sources of comparative advantages, Vernon's celebrated product cycle hypothesis (1974) identifies differences in technological endowments as the main source of national comparative advantages and tries to provide a substantive link between international trade and FDI. Some other theoretical expositions in the industrial organization literature also try to explain why firms set up production facilities in foreign markets rather than servicing them through arm's-length arrangements (Williamson, 1985; Ethier, 1986). These indicate the possibility of market failures arising from information asymmetry while dealing with foreign vendors and the resultant high transaction costs as the main reasons for undertaking FDI.

The most conclusive theoretical justification of FDI is provided by Dunning's Ownership (O)-Location (L)-Internalization (I) framework (1977, 1981, 1988). This elegant framework incorporates the necessary and sufficient conditions for FDI and suggests that at any given point of time presence of *ownership* advantages, *location* advantages, and *internalization* advantages, are essential for undertaking FDI. Following O-L-I, three basic conditions need to be satisfied for FDI. First, firms should possess distinct ownership advantages enabling them to compete efficiently with local counterparts. Second, host countries must possess locational advantages, which encourage foreign firms to serve local markets directly, rather than through exports. And finally, firms must have enough incentives for serving foreign markets through 'internal' networks, rather than through market-based arm's-length arrangements. Thus the O-L-I framework groups

determinants of FDI into <u>supply</u>-side (ownership and internalization) and <u>demand</u>-side (location-specific) features.

The thrust of this paper is on identification of location-specific determinants that have enabled some developing economies from Asia to remain attractive destinations for FDI over time. In terms of the O-L-I framework, we can conceptualize our research question as classification of some key demand-side determinants of FDI inflows. Within demand-side determinants again, we are particularly keen on examining the role of technological capabilities of host countries as a source of dynamic comparative advantage. However, as mentioned earlier, inward FDI is influenced by a host of economic, policy and institutional factors, as identified by both theoretical and empirical literature. It is important to control for these variables while studying the role of technology.

Accordingly, we specify the following model for estimation:

FDI inflows in a given economy = f (Size of domestic market, exchange rate stability, cost of capital, quality of communication infrastructure, technological capabilities, outward orientation, political stability)…… (1)

We propose to empirically estimate the above model for 14 developing economies from East, Southeast, and South Asia, during the period 1994-2003.[5] The countries are: China, Hong Kong, Republic of Korea (East Asia), Indonesia, Malaysia, the Philippines, Singapore, Thailand, Vietnam (Southeast Asia) and Bangladesh, India, Nepal, Pakistan, Sri Lanka (South Asia).

Our cross-country sample includes India. However, in addition to an aggregate macro-economic approach illustrated in (1) that attempts to identify determinants of inward FDI flows into a group of developing Asian economies including India, we also propose to study the factors influencing FDI inflows into India through an inter-temporal approach. We propose the following model for India

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[5] Due to lack of data on some of the explanatory variables, we could not carry out the analysis for our original reference period of 1991-2005. We also had to exclude Taiwan from our analysis due to lack of data on some variables.

FDI inflows into India = f (Size of domestic market, exchange rate stability, cost of capital, returns on investment, human resources, quality of communication infrastructure, technological capabilities, outward orientation)…..(2)

While estimating determinants for India, we do not control for political stability, as we do not expect it to have changed significantly during our period of study (1991-92 to 2005-06). However, we expect returns on investment to influence inward FDI. While this is true for other countries as well, we could not include this variable in (1) due to lack of comparable data.

IV.   Testable Hypotheses, Variables & Data

In this section, following the models specified in Section III, we first indicate the expected relationships of different independent variables with the dependent variables. Thereafter, we specify the variables and data sources for both our cross-country and India-specific analyses.

IV.I.   *East, Southeast and South Asia*

 We had specified the following model in Section III for 14 developing economies in East, Southeast and South Asia:

FDI inflows in a given economy = f (Size of domestic market, exchange rate stability, cost of capital, quality of communication infrastructure, human resources, technological capabilities, outward orientation, political stability)……(1)

Our objective is to determine the influence of a set of country-specific features on inward FDI flows into a given sample of countries over a fixed period of time. For the 14 countries in our sample, we have obtained data on annual FDI inflows during the period 1994-2003 from the United Nations Conference on Trade and Development (UNCTAD) database. We now explain the expected relationships between these FDI inflows and different demand-side variables specified in (1).

The empirical literature on determinants of FDI has emphasized upon the size of the host country market as a key factor in influencing inward FDI. Large domestic markets are expected to encourage FDI of the 'market-seeking' variety primarily on account of positive externalities arising from scale economies. Several empirical studies (Schneider & Fray, 1985, Wheeler & Mody, 1992; Loree & Guisinger, 1995; Bevan and Estrin, 2001; Chakraborti, 2001; Kinoshita and Campos, 2002) have found market size to be statistically significant. We expect FDI inflows to be positively related to market size implying that larger markets should attract more FDI. We employ lagged growth rate in per capita GDP (one year lag) for capturing the impact of a large and growing market.[6] The variable is expressed as GDPL. We have used data on GDP at current market prices, as well as population, from the Asian Development Outlook (ADO) database of the Asian Development Bank for GDPL.

Rapid fluctuations in bilateral exchange rates between home and host countries create confusion among foreign investors regarding expected value of future repatriations as well as the value of assets created in foreign locations. Empirical studies indicate that exchange rate volatility discourages FDI flows (Urata and Kawai, 1999). We expect stable exchange rates over a period of time to encourage more FDI flows. We capture the level of fluctuations in exchange rates in terms of the variations in annual average nominal values of national currencies of our sample countries vis-à-vis the US dollar.[7] The variable is expressed as EXGR. Data on exchange rates has been obtained from the ADO database.

Though cost of capital, or domestic interest rate, is expected to influence incoming FDI, the nature of the impact is somewhat ambiguous. Theoretically, capital arbitrage should encourage capital to move to locations having higher interest rates. On the other hand, there is also the possibility of foreign investors mobilizing resources from domestic

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[6] For use of per capita and lagged GDP growth rates, see Singh and Jun (1995), Lipsey (1999), and Guha and Ray (2002).

[7] It is important to clarify that we are not estimating annual appreciation/depreciation in national currencies in US dollar terms, but simply the year-on-year variation in value of the exchange rate.

capital markets at later stages for expansion. High interest rates compared with home countries might be a discouraging factor in this regard. Empirically, there are examples of interest rates being statistically significant (Bende, Nabende et al 2000) as well as insignificant (Banga, 2003). We would like to examine the nature of this relationship as revealed by our present estimation. We capture cost of capital in terms of benchmark lending rates (except for Pakistan)[8] from the ADO database. The variable is expressed as ROI.

Lack of quality infrastructure is a constraint for both domestic as well as foreign investment. Empirical literature has found poor infrastructure to be a significant factor in discouraging FDI in developing countries (Wheeler & Mody, 1992; Urata and Kawai, 1999, Rahman, 2003). Though infrastructure implies a host of essential services including roads, air and sea ports, power, telecommunications among other things, in the present context, we focus primarily on availability of <u>modern IT-enabled communications infrastructure</u>. Given the increasing skill and efficiency-orientation of FDI and its concentration in services, we expect FDI to flow more into locations having strong information and computer technology (ICT)-enabled communication facilities. We measure such facilities through the 'infostate' index developed by the International Telecommunication Union (ITU). The index captures both the ICT-producing capabilities, as well as ICT-consuming capacities of individual countries. A note on the methodology used by ITU for measuring 'infostate' is given in Appendix 1. We refer to the variable as INFO.

We expect well-developed <u>technological capabilities</u>, particularly the ability to innovate and develop new technologies through efficient application of R&D, to be a major source of comparative advantage for host economies, enabling them to attract FDI over time. The existing empirical literature on determinants of FDI has devoted somewhat limited attention to this aspect, presumably on account of the difficulty in quantifying the degree of national technological development. While number of patents issued annually (Acs & Audretsch, 1988) or expenditure on R&D as a proportion of GDP can be used as proxies,

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[8] For Pakistan, we have used discount rates instead of lending rates due to lack of data.

these numbers are also difficult to obtain for most developing countries. Here we employ a composite measure, the 'technological activity index,' developed by UNCTAD for capturing technological capabilities. The measure is a reflection of the innovative capacity and level of technological learning achieved by a country. The variable is expressed as TAI. Details of the methodology used by UNCTAD for computing the index is given in Appendix 1.

The early literature on FDI had stressed upon high tariff walls as a common factor for motivating FDI of the 'tariff-jumping' variety. More recent empirical research, however, indicates that more 'open' economies in terms of lower tariffs, fewer trade barriers, and overall greater economic linkages with the rest of the world, are likely to attract more FDI (Singh and Jun, 1995; Chakraborti, 2001). This FDI, however, is expected to be essentially 'export-oriented' and 'vertical' in nature.[9] We expect more 'open' economies to attract greater FDI. Empirical literature on determinants of FDI has used several measures for capturing 'openness.'[10] We use the ratio of international trade in goods and services to GDP for measuring openness. Such a measure implies the ratio of current receipts and payments for an economy as a proportion of its GDP and is a clear indicator of its economic links of a country with the rest of the world. The variable is expressed as TRGDP. Data on current receipts and payments is obtained from the ADO database.

The literature on determinants of FDI inflows into developing countries show such flows to be negatively affected by political instability and uncertainties (Summary & Summary, 1995; Urata and Kawai, 1999). We expect FDI inflows to be relatively less in countries that have a history of political conflicts, unrest and instability. We use a time dummy to qualitatively capture political stability/instability in our sample countries on the basis of surveys on ethnic conflicts and genocide/politicize problems, as carried out by the

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[9] Firms wishing to invest in a particular country for serving third-country markets through exports aim to take advantage of some particular features of host countries. Such FDI is not only export-oriented, but is also concentrated in a part of the production chain and is therefore 'vertical' in nature.

[10] These include sum of exports and imports as proportion of GDP (Kerr and Monsingh, 2001), level of import tariffs (Gastanga, Nugent and Pashamova, 1998) and share of imports from select trade partners in total country imports (Bevan and Estrin, 2001).

Political Instability Task Force (PITF) in the Center for Global Policy at George Mason University in Fairfax, Virginia. Accordingly, the variable, POLSTAB, is classified as POLSTAB = 1, in years of political instability, in terms of occurrence of ethnic, or revolutionary, or genocide/politicise problems within the given time period; POLSTAB = 0, otherwise

IV.II. India

For India, we had proposed the following model:

FDI inflows into India = f (Size of domestic market, exchange rate stability, cost of capital, returns on investment, human resources, quality of communications infrastructure, technological capabilities, outward orientation).....(2)

Most of the variables and expected relationships are same as what we have outlined earlier. Data on FDI inflows into India for the period 1991-92 to 2005-06 has been taken from the estimates prepared by the Reserve Bank of India (RBI). We use lagged growth rate in GDP at current market prices (GDPL) for capturing domestic market size on the basis of national income estimates prepared by the Central Statistical Organisation (CSO) and variations in indices of Real Effective Exchange Rates (REER) provided by RBI for measuring exchange rate stability. Cost of capital is measured through lending rates used earlier (ROI). We use the share of exports of goods and services to GDP (XGDP) as a measure of outward-orientation to assess whether India is drawing FDI of the export-oriented variety. The data is obtained from the balance of payments statistics prepared by RBI. For technological capability and communications infrastructure, we use data on annual R&D expenditure as published by the Union Ministry of Industry and the INFOSTATE index for India used earlier. The variables are called RDEXP and INFO respectively.

We introduce two new variables for India. The first is return on investment. We expect higher returns to encourage more FDI flows and capture such returns through annual

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price-earnings ratios from stock markets (PER), as provided by RBI. The second variable that we introduce in (2) is <u>human resources</u>. Empirical research points to availability of human resources, or more specifically <u>skilled labour</u>, as a crucial determinant of FDI (Schneider and Fray, 1985; Nunnenkamp, 2002) complementing ownership advantages of multinationals and acting as a 'pull' factor for FDI. We wish to examine whether India's 'human capital,' arguably one of its biggest sources of comparative advantages, is a significant factor in encouraging FDI inflows into India. Skilled labour is usually measured through host country literacy rates (Dunning, 1980), or secondary and tertiary enrolment rates (Schneider & Frey, 1985; Narula and Wakelin, 1995). We use gross tertiary enrollment figures as provided by CSO for measuring the variable[11] and name it TERT.

V.   Empirical Results

We divide this section into two parts. The first part reports results for East, Southeast and South Asia, while the second part does so for India.

V.I.   *East, Southeast and South Asia*

We employed panel regression techniques for estimating (1). The econometric model specified for estimation is:

$$y_{it} = \alpha_i + \beta' x_{it} + \epsilon_{it} \;;\ldots\ldots(3) \qquad i=1,2, \ldots\ldots.N; t=1,2,\ldots\ldots T; \text{where}$$

y_{it}: FDI inflow in i-th host country in period 't'.

x_{it}: Vector of specific characteristics for i-th country in period 't'.

α_i: the individual effect for the i-th country assumed to be constant over time.

ϵ_{it} : the stochastic error term.

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[11] We wish to point out that we could not include returns on investment and human resources in our cross-country model due to lack of comparable data for several countries in the sample.

Depending upon the assumptions for α_i, the model can be analyzed under *fixed effects* and *random effects* respectively. Under *fixed effects*, α_i is a group-specific constant term implying that differences across various cross-section units can be captured through the differences in the constant term. Under such specifications, (3) can be transformed into a *least squares dummy variables (LSDV)* model and consistent and efficient estimators of the coefficients can be obtained by applying ordinary least squares (OLS) technique. Under *random effects*, however, the α_is are treated as random variables rather than fixed constants, and are assumed to be randomly distributed across different cross-section units. They are mutually independent and also independent of the error term ϵ_{it}. Applying OLS under random effects yields consistent but inefficient estimators. It is necessary to apply *feasible generalized least squares* (FGLS) for obtaining efficient estimators.

We obtained pair-wise correlation coefficients between explanatory variables for checking the degree of multicollinearity (Appendix 2). Some variables showed high collinearity, which couldn't be removed even after constructing principal components. We decided to include these variables separately under different model specifications for estimation.

We performed the Breusch and Pagan[12] and Hausman[13] tests for checking whether different model specifications can be carried out under *fixed effects* or *random effects*. We found the results, in terms of the value of the Chi2 statistic, supporting application of random effects. Accordingly, all the model specifications have been estimated under the assumption of random effects. Furthermore, we carried out the estimations under assumptions of heteroskedasticity between panels (p (h)), as well as correlations between such panels (p(c)), separately. We found the latter assumption to yield more robust results. The results are reported in Tables 5, 6 and 7 respectively.

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[12] See Breusch and Pagan (1980).
[13] See Hausman (1978).

Table 5 : Technological capability and FDI inflows

SPECIFICATION	FGLS,P(h)	FGLS,P(c)
Dependent Variable:	FDI	FDI
Independent Variables:		
GDPL		
Coefficient	-3.903	-2.048
t-value	-0.086	-0.508
EXGR		
Coefficient	-9.323	-2.888
t-value	-0.349	-1.129
ROI		
Coefficient	-160.158	-150.850
t-value	-1.064	-12.408*
TAI		
Coefficient	11977.42	12041.6
t-value	4.446*	55.551*
INTERCEPT		
Coefficient	1451.955	1243.308
t-value	0.572	6.223
BREUSCH & PAGAN Chi2(1)	301.99	
HAUSMAN Chi2(4)	1.66	

*Note: *, ** and *** denote 1%, 5% and 10% level of significance respectively.*

We do not find GDPL to be statistically significant in any of our model specifications. Indeed, the variable has negative coefficients in some instances (Tables 6 and 7). The finding indicates that domestic market size is not a significant factor in influencing incoming FDI. This is in contrast to several earlier studies (Schneider & Fray, 1985, Wheeler & Mody, 1992; Bevan and Estrin, 2001; Kinoshita and Campos, 2002 etc). However, the apparently surprising result can be explained by the nature of our sample, which comprises several East and Southeast Asian economies drawing resource-seeking, export-oriented FDI. Indeed, there are past studies that have found domestic market size to be statistically insignificant in explaining export-oriented FDI (Lipsey, 1999; Urata and Kawai, 1999).

We find the coefficient of EXGR to be negative, as hypothesized, and statistically significant (Tables 6 and 7). Large variations in bilateral exchange rates, reflecting higher volatility in domestic currency, appear to discourage inward FDI. Similarly, FDI inflows appear to be discouraged by higher cost of capital in host countries, as indicated by the

negative significance of ROI, that is, domestic lending rates (Tables 5 & 7). The discouraging influence of high lending rates on inward FDI is consistent with our hypothesis. Indeed, for our sample countries, FDI inflows do not seem to respond to arbitrage opportunities. Rather, high domestic interest rates might preclude 'crowding out' fears on part of foreign investors.

Among other variables that we had controlled for, TRGDP is found to be positively significant at 1 per cent (Table 7). This finding is consistent with our earlier observation indicating insignificance of domestic market size in explaining FDI inflows and underlines the 'export-orientation' of incoming FDI for our sample countries. Finally, POLSTAB is found to be negatively significant (Tables 6 & 7) and confirms our hypothesis that politically unstable countries are unlikely to be attractive destinations for FDI. This could be one of the main factors behind lower FDI inflows to South Asia given the region's vulnerability to conflict and ethnic unrest.

Table 6 : ICT Infrastructure and FDI inflows

SPECIFICATION	FGLS,P(h)	FGLS,P(c)
Dependent Variable:	FDI	FDI
Independent Variables:		
GDPL		
Coefficient	-8.388	-1.538
t-value	-0.121	-0.319
EXGR		
Coefficient	-70.078	-11.442
t-value	-1.082	-5.360*
INFO		
Coefficient	59.388	55.564
t-value	3.431*	31.690*
POLSTAB		
Coefficient	-4846.406	-1108.945
t-value	-2.367**	-10.089*
INTERCEPT		
Coefficient	5592.218	821.557
t-value	3.499*	7.729*
BREUSCH & PAGAN Chi2(1)	398.08	
HAUSMAN Chi2(4)	0.97	

*Note: *, ** and *** denote 1%, 5% and 10% level of significance respectively.*

We now report results for INFO and TAI. Both the variables are found to be statistically significant with positive coefficients (Tables 5 & 6). These results confirm our hypotheses that developed technological capabilities and availability of modern IT-enabled communications infrastructure are critical determinants for FDI inflows. Indeed, the results suggest that developing Asian economies that have succeeded in enhancing technological capabilities through better application of R&D and have been able to generate maximum benefits of such capabilities by creating modern ICT facilities are best equipped to attract FDI.

Table 7 : Political stability and FDI inflows

SPECIFICATION		FGLS,P(h)	FGLS,P(c)
Dependent Variable:		FDI	FDI
Independent Variables:			
GDPL			
	Coefficient	80.017	4.355
	t-value	1.195	0.874
TRGDP			
	Coefficient	-380.865	3798.623
	t-value	-0.313	14.271*
EXGR			
	Coefficient	4.395	-10.874
	t-value	0.070	-2.962*
ROI			
	Coefficient	-1108.884	-171.415
	t-value	-4.872*	-8.671*
POLSTAB			
	Coefficient	-4032.703	-1520.567
	t-value	-2.095**	-13.960*
INTERCEPT			
	Coefficient	20640.52	3023.967
	t-value	5.978*	9.408*
BREUSCH & PAGAN Chi2(1)		303.92	
HAUSMAN Chi2(4)		5.85	

*Note: *, ** and *** denote 1%, 5% and 10% level of significance respectively.*

V.II.   India

We use a simple time-series model amenable to applying OLS for estimating (2) as specified earlier. The Augmented Dickey Fuller (ADF) test for stationarity (carried out at level, first and second differencing) shows the dependent variable (FDI), INFO, RDEXP,

ROI, and TERT, to be integrated of order one and XGDP and GDPL to be integrated of order two. Further, RDEXP, TERT and INFO are found to be highly correlated. For overcoming multicollinearity, we create a principal component – RDTEIN – out of RDEXP, TERT and INFO. We also found ROI and PER to be highly correlated and estimated two different model specifications (IA and IB) by including these variables separately. We use robust OLS methods for correcting possible heteroscedastic disturbances. The results are shown in Table 8.

Table 8 : Determinants of FDI inflows for India

SPECIFICATION	Model I (A)	Model I (B)
Dependent variable	FDI	FDI
Independent variables		
GDPL		
Coefficient	1726.65	2028.07
t-value	3.59**	4.95**
XGDP		
Coefficient	-604.13	-826.28
t-value	-1.07	-1.69
PER		
Coefficient	-49.08	
t-value	-0.48	
RDTEIN		
Coefficient	7675.89	9758.275
t-value	4.04**	5.04**
REER		
Coefficient		-333.09
t-value		-2.44*
ROI		
Coefficient		535.96
t-value		0.68
INTERCEPT		
Coefficient	-1221.092	-10407.4
t-value	-0.17	-0.87
F STATISTICS	38.10	29.83
REGRESSION COEFFICIENT(R^2)	0.89	0.92
ROOT MEAN SQUARE ERROR	2637.4	2448.5

*Note: **and *denote 1% and 5% level of significance respectively.*

We find the coefficients of GDPL and XGDP to be positively significant and insignificant respectively. This indicates that while the size of the domestic market positively influences FDI inflows into India, exports do not. The results confirm some earlier studies (Guha and Ray, 2002; Nagaraj, 2003; Banga, 2003) that have indicated that FDI in India is more of the market-seeking variety, rather than the resource-seeking, export-oriented kind. It is also interesting to note that this result is in complete contrast to our earlier observation for East, Southeast and South Asian economies, where outward orientation was found to be a key determinant of FDI inflows.

Both PER and ROI are found to be statistically insignificant in explaining FDI inflows into India. Thus while returns from stock markets might be relevant for short-term portfolio flows, they do not appear to be significant for long-term FDI flows. The result regarding cost of capital, that is, domestic lending rates, is again different from what we observed in the cross-country analysis. It appears that interest rates in India have not led to any 'crowding-out' perceptions on part of long-term foreign investors. Regarding exchange rate stability, however, the findings are similar between the cross-country panel and India, as shown by the negative significance of REER in explaining FDI inflows.

We find the coefficient of RDTEIN to be positive and statistically significant. The result indicates that FDI inflows into India are encouraged by national technological capabilities, the quality of communications infrastructure, as well as human resources. Indeed, the sectoral pattern of FDI inflows into India (Table 4) appears to be consistent with our findings. The main sectors drawing FDI in India (software, electronics, telecommunications, automobiles, pharmaceuticals) are not only technology and skill-intensive, but are also segments that have witnessed efficient and widespread application of ICT facilities.[14]

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[14] Some of these sectors (for instance, software and electronics) have experienced good export growth. This, however, does not contradict our earlier findings regarding GDPL and XGDP. Rather, it is to be noted that all these sectors have experienced robust growth in domestic sales, while export success is limited mainly to a couple only.

VI.   Conclusion

Our main objective was to identify the reasons behind some developing economies from Asia being able to consistently attract more FDI than others in the region. We wanted to examine whether the success of these economies in getting more FDI can be explained by their technological capabilities and modern IT-based communications infrastructure. We also wished to identify the country-specific features influencing FDI inflows into India and the reasons behind India's recent emergence as a key FDI destination in developing Asia.

Most of the FDI in developing Asia is export-oriented. This is the FDI that seeks to exploit some particular assets of host locations for producing exports for third-country markets. Traditionally, East and Southeast Asian economies, offered low-cost labour as the 'pull' factor for attracting FDI in large-scale labour-intensive export facilities. But as our findings indicate with production processes becoming more complex and technology-intensive, domestic technological capabilities, particularly innovative capacities, along with the ability to apply such innovations efficiently through advanced IT-based techniques, have become more important locational advantages than cheap labour.

The level and quality of technological development achieved by different developing Asian economies does explain why some of them have remained attractive destinations for FDI, while others have fallen behind. The more mature Asian 'Tigers' – Hong Kong, Korea, Singapore – and China continue to be the top FDI destinations in developing Asia, while the 'new' Tigers – Indonesia, Malaysia, Thailand and the Philippines – are not so any longer. It is interesting to note that none of the latter has shown as much technological 'deepening' as the former. Indeed, barring Singapore, none of the other Southeast Asian economies have been able to develop R&D-based frontier technological capabilities (UNCTAD, 2003). While the mature Asian Tigers have successfully graduated from the initial know-how based 'learning-by-doing' stage of technological development to the more advanced R&D-based 'learning by design' level, the new Tigers have lagged behind. As a result, while the former have harnessed innovative capabilities

and developed domestic technological strengths as strong sources of comparative advantage for drawing technology-intensive FDI, the latter have remained only capable assemblers of high-tech exports and are losing out in the race for attracting advanced R&D-based FDI.

It is also interesting to note that advanced communications infrastructure, in terms of availability of modern ICT facilities and large IT users, is not sufficient for making a country an attractive FDI destination. Had it been so, then Southeast Asian economies (barring Singapore again), almost all of which have made good progress in creating such facilities would not have experienced decelerations in FDI inflows. The recipe for attracting technology-intensive export-oriented FDI appears to be a combination of R&D-based technological capabilities and the ability to apply ICT facilities in using such capabilities efficiently. Indeed, this also appears to be the reason behind India's recent entry among the top five FDI spots in developing Asia.

The latest data on FDI flows indicates that India is on the threshold of breaking into the big league of FDI countries in Asia. Technological capabilities, particularly R&D-driven innovation capacities, are a major factor in this regard. Indeed, this attribute, along with the prowess registered in using IT-based techniques in business operations, can signal a significant change in the nature of FDI inflows into India, from the market-seeking (including 'tariff-jumping') kind to the export-oriented variety. The surge in FDI inflows in the last couple of years might be indicative of this virtuous shift. In this regard, India's attractiveness as a FDI destination is reinforced by the quality of its human resources that is capable of handling complex, technology-intensive processes efficiently.

What implications do our findings have for FDI-targeting strategies? The Asian experience underlines the critical importance of technological development as a host country feature in drawing FDI. Such development, along with skilled labour, can be strong 'pull' factors for FDI. This is particularly relevant in a globalized world, where production processes are becoming increasingly fragmented among countries in line with country-specific features enabling efficient production. Unless developing countries

acquire competencies in technological innovation and develop technically articulate work forces, liberal policies for drawing FDI are unlikely to yield results. This is, of course, not to deny that other factors, like quality of business climates, do influence investor confidence and FDI inflows. In this regard, the difficulties involved in 'starting' businesses in India, as well as the procedural inflexibilities in factor markets preventing efficient factor deployment, are critical handicaps. However, overall business environments, in terms of enabling rules, transparent procedures and efficient institutions, while being 'necessary' for drawing FDI, cannot be treated as 'sufficient' (Palit, 2006). Had it been so, then China and India ranked much below Malaysia and Thailand in terms of ease of doing business,[15] would not be attracting more FDI than the latter. So while quality of business practices does matter as determinants of FDI, they are not substitutes for technological capabilities and skills.

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[15] China and India are ranked 93 and 134 in ease of doing business, while Malaysia and Thailand are ranked 25 and 18 respectively, for the year 2006. See *Economy Rankings*; http://doingbusiness.org; World Bank Group.

Appendix 1

A Note on Measuring *Infostate* and *Technological Activity Index* (TAI)

Infostate[16]

Conceptually, <u>infostate (or ICT-ization)</u> of a country is defined as the aggregation of its <u>infodensity</u> and <u>info-use</u>. <u>Infodensity</u> represents the ICT factor inputs of the country, which basically indicates the extent by which use of ICT can influence national productive capacity. ICT inputs are classified into ICT-capital, comprising network infrastructure and ICT machinery & equipment and ICT-labour, which captures the total stock of ICT skills in the national labour force. <u>Info-use,</u> on the other hand, takes into account the availability of ICT goods and services in the country. So while, <u>infodensity</u> reflects the role of ICT in production, <u>info-use</u> captures consumption.

Empirical measurement of infodensity and info-state takes into account several indicators. These are:

Infodensity
  a. <u>Network infrastructure:</u> Main telephone lines, cell phones, waiting lines, digital mainlines, cable connections, internet hosts, secure servers and international bandwidth.
  b. Skills: Adult literacy rates and gross enrolment ratios in primary, secondary and tertiary education.

Info-use: TV-equipped households, residential phone lines, personal computers, Internet users, broadband users, international incoming and outgoing telephone traffic.

Infostates are calculated for different countries on the basis of a reference country (for benchmarking) and a reference year. The final index is an aggregation of sub-indices constructed from the raw data for each indicator. The aggregate indices for infodensity and info-use are finally used to compute *infostate* as:

$$Infostate = \sqrt[2]{(infodensity \times info\text{-}use)}$$

Technological Activity Index (TAI)[17]

The TAI is a measure of national technological development propagated by UNCTAD. The index tries to capture the innovative capabilities of different countries. Higher values of the index imply higher innovative capabilities and concomitantly, greater technological development. Based on the value of TAI, innovative capacities of countries are divided into 'high', 'medium-high', 'medium' and 'low' categories.

The index is a weighted average of three parameters. These are: manpower engaged in R&D effort, patents taken out and articles published in scientific journals. Each parameter has equal weight. The final value of the index – TAI – is the simple average of the normalized value of the three variables.

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[16] See ITU (2005) – Chapter 1 (pp.2-4) and Chapter 8 (197-198).
[17] See UNCTAD (2005), p.290.

Appendix 2

PAIR-WISE CORRELATION MATRIX OF THE DEPENDENT AND INDEPENDENT VARIABLES:

	FDI	*GDPL*	*TRDGDP*	*EXGR*	*ROI*	*TAI*	*INFO*	*POLINSTAB*
FDI	1.0000							
GDPL	-0.0302 *0.7332*	1.0000						
TRDGDP	0.1862 *0.0340*	-0.0440 *0.6194*	1.0000					
EXGR	-0.1342 *0.1279*	0.0682 *0.4408*	-0.0749 *0.3973*	1.0000				
ROI	-0.4271 *0.0000*	0.2207 *0.0116*	-0.5210 *0.0000*	0.2417 *0.0056*	1.0000			
TAI	0.3122 *0.0003*	0.0347 *0.6953*	0.6622 *0.0000*	-0.1055 *0.2322*	-0.6331 *0.0000*	1.0000		
INFO	0.2514 *0.0039*	-0.0273 *0.7582*	0.7489 *0.0000*	-0.0921 *0.2973*	-0.6018 *0.0000*	0.8440 *0.0000*	1.0000	
POLINSTAB	-0.1773 *0.0435*	-0.0885 *0.3167*	0.1119 *0.2052*	-0.0045 *0.9595*	-0.0176 *0.8423*	0.2249 *0.0101*	0.0792 *0.3706*	1.0000

Note: Values in italics indicate levels of significance.

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About ICRIER

ICRIER, established in August, 1981, has successfully completed its 25 years, as an autonomous, policy oriented, not-for-profit research institute. We have nurtured our cherished autonomy by establishing an endowment fund, income from which meets all our administration expenses. ICRIER's offices are located in the prime institutional complex of India Habitat Centre, New Delhi. The prime focus of all our work is to support India's interface with the global economy.

ICRIER's founding Chairman was Dr. K B Lall who led the organization from its inception from 1981 to 1992 when he handed over the Chairmanship to Mr. R N Malhotra (1992-1996). He was followed by Dr. I G Patel who remained Chairman from 1997 to 2005 until his demise in July 2005. ICRIER's current Chairperson is Dr. Isher Judge Ahluwalia.

Amongst ICRIER's founding member are: Dr. Manmohan Singh, Dr. C Rangarjan, Dr. M S Swaminathan, Dr. Jagdish Bhagwati, Mr. Montek Singh Ahluwalia and Mr.Bharat Ram.

ICRIER conducts thematic research on its six thrust areas that are:

- Trade, Openness, Restructuring and Competitiveness

- WTO Related Issues

- Regional and Bilateral Issues

- Financial Liberalization and Integration

- Macroeconomic Management in an Open Economy

- Strategic Aspects of India's External Relations

In addition, ICRIER holds public policy workshops to bring together policy makers, academicians, senior industry representatives, MPs and Media persons to try and forge a consensus on issues of major policy interest. In the effort to better understand global developments and experiences of other economies which have bearing on India's policies and performance, ICRIER invites distinguished scholars and policy makers from around the world to deliver public lectures on economic themes of interest to contemporary India.

ICRIER's highly qualified core team of researchers includes several PhD's from reputed Indian and foreign universities. At present the team has 18 economists. The team is led by Dr. Rajiv Kumar, D.Phil in Economics from Oxford University.