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The Clustering of FDI in India: The Importance of Peer Effects

Peter Nunnenkamp and Megha Mukim

Abstract:
We assess the location choices of 6,020 foreign and non-resident Indian investors at the level of Indian districts. Employing conditional logit models, we find that clustering of FDI is driven strongly by herding among investors from both, the same and other countries of origin. However, the behaviour of non-resident Indians and German investors is strikingly different from the general pattern.

Keywords: location choice; FDI; country of origin; Indian districts; conditional logit

JEL classification: F23; R12

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1. Motivation

Foreign direct investment (FDI) boomed in India after previous restrictions were progressively relaxed throughout the 1990s. FDI was widely expected "to work wonders" in India, quoting the former Minister of Finance, P. Chidambaram (*Indian Express*, November 11, 2005). However, FDI appears to be clustered within the country and so the benefits might accrue to a limited number of states and districts (Purfield 2006). To the extent that new foreign investors locate where their peers located before them, it would become increasingly difficult for regional policymakers to attract FDI to relatively remote locations and overcome the legacy of having been sidelined at earlier stages of India's opening up.

Previous empirical evidence on peer effects on location choices of foreign investors is surprisingly scarce. Moreover, most existing studies refer to large regional units such as US states or Chinese provinces, and often neglect more complex spatial effects such as surrounding market potential and distance-weighted clustering.[1] We contribute to closing these gaps by drawing on case-specific data on the location choices of foreign investors and non-resident Indians (NRIs) at the level of 542 Indian districts.[2] The location choices of 6,020 new investors in 2001-2003 represent our binary dependent variable, while the previous choices of peers are reflected in accumulated counts since 1991.

2. Analytical background and hypotheses

Investors decide on a particular location based on expected profitability. Thus, their choices depend on how the characteristics of a given location and its spatial environment affect profits, relative to

[1] Recent examples include Bobonis and Shatz (2007) on US states, Cheng and Kwan (2000) on Chinese provinces, Crozet et al. (2004) on French departments, and Ledyaeva (2009) on Russian regions.
[2] The data on FDI approvals was kindly made available by the Department of Industrial Promotion and Policy of the Ministry of Commerce and Industry. Note that NRIs are regarded as a distinct source of FDI in the database.

the characteristics of other locations. Local characteristics relate to the business environment, economic geography and institutional conditions. Specifically, existing clusters may attract subsequent FDI by allowing for knowledge spillovers as well as offering larger regional markets and a wider range of intermediate inputs. Such factors will induce investor *i* to choose location *j* if profit $\pi_{ij} > \pi_{ik}$, for all possible locations k; $\pi_{ij} = U_{ij} + \varepsilon_{ij}$, with U_{ij} representing the deterministic part and ε_{ij} the error term. The probability of choosing location *j* is:

$$P_{ij} = \frac{\exp(U_{ij})}{\sum_{k=1}^{n} \exp(U_{ik})} \tag{1}$$

In our conditional logit model (CML), the dependent variable takes the value of one if investor *i* chooses location *j*, and zero otherwise. U_{ij} in equation (1) is assumed to be a linear combination of the explanatory variables:

$$U_{ij} = \beta_1 X_{ij}^1 + \beta_2 X_{ij}^2 + ... + \beta_m X_{ij}^m \tag{2}$$

Of these, two explanatory variables account for peer effects, i.e., previous location choices:

$$FS_j = Count_j + \sum_{j \in s} \frac{Count_m}{d_{j-m}} \text{ and } FA_j = Count_j + \sum_{j \in s} \frac{Count_m}{d_{j-m}} \tag{3}$$

FS_j refers to all previous investors from the same country of origin as investor *i*, while FA_j refers to all previous foreign investors from elsewhere. Both count variables consider investors who chose location *j* (here, a particular district in India) or neighbouring locations (weighted by their distance from *j*) prior to investor *i*. By separating *FS* and *FA*, we can assess whether "herding" is particularly strong among investors from the same country of origin.[3]

[3] The separation between *FS* and *FA* limits our choice of model. The choices of investors need to be matched on a one-to-one basis with those belonging to the same country of origin. This matching is not possible in models such as Poisson wherein the dependent variable is a count. The major limitation of the CLM is that the ratio of probabilities for alternatives *j* and *k* does not depend on any alternatives other than *j* and *k* (i.e. the Independence of Irrelevant Alternatives).

Apart from herding, we consider various characteristics of a particular location that can affect the profit of the investor. Larger local markets, proxied by population, are expected to attract FDI. Accessibility of surrounding markets within a radius of 500 km (*MA*) relates to the population of neighbouring locations, discounted with rising distance from location *j*. FDI may also be attracted to locations with greater economic diversity offering specialized inputs. We use the Herfindahl index calculated as the sum of squared employment shares of all industries in location *j*, with higher values reflecting less diversity. Cost-oriented FDI is theorized to locate where (non-agricultural) hourly wages are relatively low. On the other hand, FDI may draw on better-qualified labour, which we capture by higher-secondary education at the district level. The quality of local (physical) infrastructure is reflected by several indicators, including the availability of electricity, telephones, transportation (buses), and financial services (banks). Finally, we account for institutional conditions such as the flexibility of labour market regulations at the level of Indian states and social unrest at the district level (riots).[4]

3. Results

The empirical results from our CLM are summarized in Table 1, and are presented in the form of odds ratios. A ratio greater (smaller) than one implies a positive (negative) effect of the regressor on the probability of investor *i* choosing location *j*. The estimation in column (1) is based on the overall sample of all location choices by foreign and NRI investors during the years 2001-2003.[5] The explanatory variables are all significant, mostly at the one percent level. An increase in local market size (population) by one percent improves the odds of attracting an investor by about 16 percent. Accessibility of surrounding markets (*MA*) impairs the odds, however, negating the view that rural

[4] The data for the explanatory variables relate to 2001. See Appendix 1 for the definition of all variables and sources used. Appendix 2 provides summary statistics

[5] We report only the full specification of the CLM, including all determinants mentioned above. We performed several robustness tests with a restricted set of determinants. In particular we reduced the number of indicators on physical infrastructure in order to mitigate possible multicollinearity. The results (available on request) proved to be robust to these changes.

districts that are closer to large metro areas tend to receive more FDI. Rather, metro areas seem to divert FDI away from rural districts with limited market potential, thereby widening the urban-rural divide in India. Higher values of the Herfindahl index reduce the odds of attracting an investor, in line with the expected positive impact of greater industrial diversity.

All indicators of physical infrastructure have a positive impact. The same applies to the educational attainment of the local workforce, whereas higher local wages are associated with an odds ratio considerably below one. The latter finding clearly suggests that cost-oriented FDI plays a major role in India. Institutional conditions also matter as expected, with flexible labour market regulations improving, and local social unrest (riots) impairing the chances to attract FDI.

Turning to peer effects, both *FA* and *FS* enter with an odds ratio significantly above one. It may be surprising that the effect of a one percent increase in the count of previous investors from the same country of origin raises the odds of attracting a new investor by just six percent, compared to 71 percent with regard to investors from other sources. Nevertheless, the impact of increasing the absolute count by one is typically stronger for *FS* than for *FA*. This applies especially when the number of peers from the same country of origin is very small compared to peers from all other countries. The odds ratios reported in column (1) would imply a stronger impact of one additional *FS* count for countries or origin that account for less than eight percent of the total FDI counts.[6]

In the next step, we assess whether the general pattern shown in column (1) of Table 1 holds for sub-groups of investors from major countries of origin. In columns (2) – (5), we report the odds ratios for investors from the United States (28.1 percent of all FDI cases in 2001-2003), the United

[6] The general pattern revealed in column (1) does not preclude that the same result holds for larger countries of origin in country-specific estimations; see also below.

Kingdom (8.5 percent), Germany (7.1 percent), and Japan (5.3 percent).[7] Column (6) provides the odds ratios for FDI by NRIs (4.3 percent), who may behave differently because of closer contacts and better knowledge of local conditions.

Similarities across sub-groups of investors exist with regard to the impact of population and wages. Yet, the local market orientation of German investors appears to be particularly strong. By contrast, US and UK investors are particularly cost-oriented, as reflected in odds ratios substantially below one for the wage variable. NRIs resemble German investors in that the impact of local markets is particularly strong, while the impact of labour cost is relatively weak. The accessibility of surrounding markets does not attract FDI from any source, corroborating the general pattern mentioned above.[8]

The impact of physical infrastructure on FDI from particular sources is more ambiguous than the general pattern in column (1). Specific indicators are often insignificant at conventional levels, and sub-groups of investors appear to focus on different aspects of infrastructure. The evidence is strongest for financial services (banks). Likewise, institutional conditions matter for almost all sub-groups of investors, though with striking differences. Flexible labour market regulations at the state level encourage only US investors in a significant way.[9] By contrast, NRIs are discouraged most strongly by social unrest at the district level, possibly because they have a better knowledge of local enforcement of law and order.

[7] In contrast to all other estimations, the results for Japan are quite sensitive to changes in the specification (e.g. when dropping specific indicators of infrastructure). Hence, we do not consider the estimation in column (5) for the subsequent discussion.
[8] In sharp contrast to the general pattern, the odds ratios of the Herfindahl index are significantly larger than one for FDI by US investors and NRIs, indicating that they are attracted to districts with higher concentrations of industrial activity (rather than diversity). However, these odds ratios are not robust to changes in the specification of the estimation equation.
[9] US investors are also peculiar insofar as they prefer districts with a better educated labour force.

Most strikingly, peer effects vary considerably across sub-groups of investors. The odds ratios of *FS* and *FA* are almost the same for US investors. This implies that herding is particularly strong among US investors when considering the impact of one additional count of *FS* and, respectively, *FA*. UK investors appear to behave in line with the general pattern, even though *FS* fails to pass conventional significance levels. The surprising finding that German investors avoid locations where national peers invested earlier may be related to the particularly strong local market orientation noted above.[10] Accordingly, already established peers may be regarded as competitors having occupied profitable markets, rather than frontrunners showing the way and reducing FDI-related risk for followers.

Finally, column (6) in Table 1 suggests that peer effects do not drive FDI by NRIs. This finding would be plausible: NRIs might be more familiar with local conditions than foreign investors so that they could afford to make more autonomous decisions about location. However, the odds ratios of *FS* typically turn out to be significantly above one in (unreported) specifications with specific indicators of infrastructure excluded. Hence, it does appear that NRIs ignore previous location choices by foreigners (similar to German investors), while relying to some extent on previous location choices by their fellow NRIs (in sharp contrast to German investors).

4. Summary

This paper makes an important contribution to the understanding of peer effects and locational determinants driving foreign investment decisions. Using new FDI data in India we find that investors are often attracted to districts that their national or other peers previously favoured. This would imply that with regard to FDI, geography might increasingly become destiny in the course of time. Public policy might be hard pressed to change the location decisions of investors at the margin.

[10] Similarly, Crozet et al. (2004) find that German FDI in France does not agglomerate but is rather dispersed.

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Table 1: Conditional logit model results - Odds ratios

	All	USA	UK	Germany	Japan	NRIs
Variables	(1)	(2)	(3)	(4)	(5)	(6)
Population	1.1581***	1.4144***	1.1368	2.3185***	1.0974	1.6170**
	[0.028]	[0.093]	[0.149]	[0.372]	[0.300]	[0.359]
FA	1.7121***	1.2967***	1.6508***	0.9416	1.3206	0.7552
	[0.038]	[0.093]	[0.252]	[0.104]	[0.300]	[0.225]
FS	1.0563***	1.2580***	1.0665	0.8291***	1.1543	1.1273
	[0.009]	[0.072]	[0.124]	[0.047]	[0.123]	[0.174]
Herfindahl	0.9077*	1.9240***	0.8021	0.8307	0.5710	2.6562*
	[0.049]	[0.390]	[0.245]	[0.133]	[0.232]	[1.516]
MA	0.8320***	0.8153	0.7564	0.7725**	0.6662	0.8804
	[0.040]	[0.105]	[0.150]	[0.100]	[0.290]	[0.630]
Electricity	1.4067***	0.4563***	1.2088	0.9622	7.0052*	1.5101
	[0.099]	[0.112]	[0.506]	[0.264]	[7.862]	[2.970]
Telephones	1.0919**	1.9462***	1.1938	1.4977***	0.6643	2.9057**
	[0.040]	[0.219]	[0.169]	[0.206]	[0.280]	[1.407]
Education	1.1383***	1.8460***	0.9735	0.9151	0.9904	1.2223
	[0.038]	[0.181]	[0.156]	[0.106]	[0.423]	[0.678]
Buses	1.2981***	3.7268***	1.0280	0.9682	0.3796**	2.6153**
	[0.052]	[0.513]	[0.256]	[0.171]	[0.143]	[1.181]
Banks	1.5261***	1.9405***	1.2394	1.5160***	1.1759	2.5405**
	[0.047]	[0.134]	[0.251]	[0.182]	[0.274]	[0.939]
Wages	0.6828***	0.2520***	0.4291**	0.8269*	0.4729	0.7165*
	[0.034]	[0.052]	[0.159]	[0.091]	[0.326]	[0.137]
Labour regulations	1.4006***	1.6521***	1.1592	1.0234	1.0644	1.7481
	[0.090]	[0.279]	[0.386]	[0.268]	[0.677]	[1.043]
Riots	0.8166***	0.2026***	0.9291	0.6620**	2.4370	0.0710***
	[0.037]	[0.047]	[0.154]	[0.106]	[1.350]	[0.059]
Observations	261,743	24,255	3,236	6,027	2,342	1,730
AIC	18143.55	3652.14	787.84	1406.66	722.07	679.28
BIC	18279.73	3757.39	866.90	1493.82	796.93	750.21

* p<0.10, ** p<0.05, *** p<0.01

Appendix 1: Explanatory variables – Description and sources

	Variable	Definition	Source
Economic geography	Herfindahl	Herfindahl index; smaller index values reveal greater economic diversity	55th Round NSSO
	MA	Market access; population in surrounding district, weighted by distance from district *j*	2001 Census/ orthodromic distance
	Population	Total population of district *j*	2001 Census
Business environment/ Infrastructure	Wages	Non-agricultural hourly wage rates	55th Round NSSO
	Electricity	Proportion of villages with access to electricity	55th Round NSSO
	Telephones	Proportion of villages with access to telephone connections	55th Round NSSO
	Education	Proportion of population with higher-secondary education	55th Round NSSO
	Buses	Proportion of villages with bus services	2001 Census
	Banks	Banking branches per 1 lakh population	CMIE
Institutional variables	Labour regulations	Flexibility of labour market regulations at the state level	Besley and Burgess (2004)
	Riots	Number of riots per capita	Marshall and Marshall http://www.systemicpeace.org/inscr/inscr.htm
Previous FDI	FA	Previous FDI (all countries of origin, excluding FS)	Ministry of Commerce and Industry
	FS	Previous FDI (same country of origin)	Ministry of Commerce and Industry

Notes: 1 Lakh = 100,000
NSSO: National Sample Survey Organisation; CMIE: Centre for Monitoring of the Indian Economy

Appendix 2: Descriptive statistics

Variable	Expected sign	#	Mean	Standard deviation	Minimum	Maximum
Investment decisions*		542	38	167	0	1289
Herfindahl	-	533	0.2995	0.2085	0	1
MA	+	530	322,228	624,025	534	7,397,880
Population	+	533	2,514,384	1,925,607	0	12,300,000
Wages	-	454	102.11	59.43	18.67	525.39
Electricity	+	454	0.6879	0.2299	0	0.9977
Telephones	+	454	0.1341	0.1056	0	0.6212
Education	+	454	0.0752	0.0443	0	0.2368
Buses	+	533	0.6535	0.6531	0	1
Banks	+	415	8.14	3.81	1.99	26.09
Labour regulations	+	490	0.3534	0.4780	0	1
Riots	-	427	0.00009	0.00011	0	0.00102
FA	+	542	84	199	0	1394
FS	+	542	2	11	0	314

*Reference years: 2001, 2002, and 2003.

Note: # refers to the number of districts for which there are observations.