

Mukim, Megha

**Conference Paper**

## Industry and the urge to cluster: A study of the informal sector in India

50th Congress of the European Regional Science Association: "Sustainable Regional Growth and Development in the Creative Knowledge Economy", 19-23 August 2010, Jönköping, Sweden

**Provided in Cooperation with:**

European Regional Science Association (ERSA)

*Suggested Citation:* Mukim, Megha (2010) : Industry and the urge to cluster: A study of the informal sector in India, 50th Congress of the European Regional Science Association: "Sustainable Regional Growth and Development in the Creative Knowledge Economy", 19-23 August 2010, Jönköping, Sweden, European Regional Science Association (ERSA), Louvain-la-Neuve

This Version is available at:

<https://hdl.handle.net/10419/119244>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

## **Industry and the urge to cluster: a study of the informal sector in India**

*(preliminary draft – please do not circulate or quote without permission from the author)*

Megha Mukim  
London School of Economics  
June 2010

### **Abstract:**

This paper studies the determinants of firm location choice at the district-level in India to gauge the relative importance of agglomeration economies vis-à-vis good business environment. A peculiar characteristic of the Indian economy is that the unorganised non-farm sector accounts for 43.2% of Net Domestic Product and employs around 71.6% of the total workforce. I analyse National Sample Survey data on the unorganised sector that covers over 5,000,000 firms, in both sectors – manufacturing and services. The empirical analysis is carried out using count models, and I instrument with land revenue institutions to deal with possible endogeneity bias. As a robustness check I use data on over 140,000 manufacturing firms from the Annual Survey of Industries, and 20,000 manufacturing and services firms from the Prowess database to study the organised sector. I find that buyer-supplier linkages and industrial diversity make a district more attractive to economic activity, whilst the quality and level of infrastructure are also important. I also conclude that public policy may be limited in its ability to encourage relocation of informal firms.

JEL Classification: R12, R3, O17

### ***I Introduction***

The informal sector<sup>1</sup> is an important means of livelihood to millions of people in developing countries. Because of its very nature – it is unregulated by government – data collection and subsequent analysis lags far behind that for the formal sector. In India, the informal sector often falls outside the scope for planned development efforts, and thus remains in the shadows with regard to productivity, social security and statistics.

This paper is a first attempt to understand the forces that drive the clustering of informal sector activities in India. It studies the how new firms within the Indian unorganised sector choose to locate themselves across districts in the country. It does this by carrying out an empirical test employing count models to analyse the decisions of individual firms. In the model, firms compare potential profitability as a function of observable location specific advantages, market access, agglomeration economies and a set of unobserved local attributes of the district. And so, to unpack the location

---

<sup>1</sup> A number of countries, including India, often use the terms ‘unorganised sector’ and ‘informal sector’ interchangeably.

decisions of unorganised sector firms, an econometric analysis of empirical patterns is carried out to identify the ‘revealed preferences’ of firms, based on the characteristics of the location. Firm-level data for the unorganised sector is taken from surveys conducted by the National Sample Survey Organisation (NSSO), which includes information on the number and type of new firms within each location.

In principle, location choice research is important since it tests whether individual firm’s decisions are based on agglomeration economies, or on other factors, such as good business environment – the latter being more amenable to change by policy than the former. In theory, if government is interested in encouraging industrial growth in particular regions, it should have a clear understanding of what factors drive firm location decisions. There are a few papers that have analysed the case of manufacturing firms in India (see Lall et al 2004, Lall and Chakravorty 2005). However, these studies concern themselves primarily with the formal sector. To the author’s knowledge, there has been no previous research that sheds any light on what factors attract smaller, unorganised sector firms to a location. Since the non-farm informal sector in India is a significant source of employment (32%) and economic growth (22.6%), there remains a yawning gap in the empirical understanding of the country’s industrial location choices.

While the results of the analysis provide an understanding of what drives clustering in informal industries in India, they also add to a rapidly growing body of empirical evidence that tests the theoretical implications of Krugman’s economic geography. The paper finds that agglomeration economies and the local business environment jointly influence location decisions, which implies that smaller or remote districts may need to offer better infrastructure than more geographically advantaged locations. While geography is certainly not destiny, incremental policy reforms could be overwhelmed by adverse geography. This is an indication that governments can help narrow regional disparities in industrial growth by fostering a good business environment in locations where powerful forces of economic geography might otherwise hold industry back.

The paper is organised as follows. The next section provides a descriptive overview of the clustering of informal sector activity, in both the manufacturing and services sectors. Section III starts with a theoretical explanation of the factors influencing the location of economic activity. Section IV presents evidence of how these theories have been tested empirically in the literature – this section also provides an overview of how agglomeration economies may be different for services as compared to manufacturing. Section V elaborates on the econometric framework to study how business environment and agglomeration economies affect location decisions through their effect on firm profitability. Section VI presents the results of the model and discusses the main sources of the data. Section VII describes the identification strategy employed. Section VIII concludes and discusses the implications of the findings.

## ***II Descriptive Analysis***

The unorganised sector in India refers to those enterprises whose activities or collection of data is not regulated under legal provision and/or which do not maintain regular accounts. These enterprises are not registered under the Factories Act of 1948. Technically, whilst the terms ‘unorganised’ and ‘informal’ sector enterprises are used interchangeably in this paper, the latter are a subset of the former. The informal sector comprises mainly of unincorporated proprietary or partnership enterprises, while the unorganised sector includes the same along with cooperative societies, trusts, private and public limited companies.

The unorganised sector in India continues to occupy a substantial place in the country’s economy. Its share in the country’s net domestic product (NDP) was 56.7% in 2002-03. The importance of the unorganised sector differs substantially across farm and non-farm activities. For instance, in the same year, its share of agricultural NDP was a whopping 96%, and its share of manufacturing and services NDP was 39.5% and 46.9% respectively.

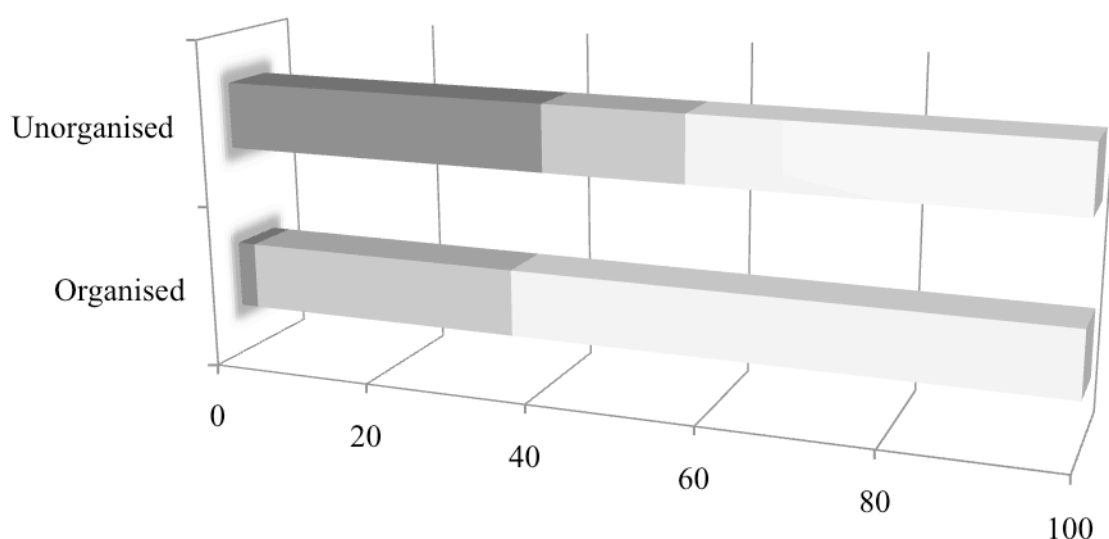
**Table 1: Share of unorganised activity (2002-03)**

Industry	Organised (% of NDP)	Unorganised (% of NDP)	Total
Agriculture, forestry, fishing	4.1	95.9	100
Mining, manufacturing, electricity and construction	60.5	39.5	100
Services	53.1	46.9	100
<b>Total</b>	<b>43.3</b>	<b>56.7</b>	<b>100</b>

Source: National Account Statistics 2005

The unorganised sector’s total NDP contribution can be broken down into its services (43.2%) and manufacturing (16.8%) components. Manufacturing comprises a lower share because of more licensing requirements and availability of infrastructure and capital, whereas service activities can be undertaken without much of these pre-requisites.

**Figure 1: Share of activity as a % of sectoral NDP (2002-03)**



■ Agriculture, forestry, fishing    ■ Mining, manufacturing, electricity and construction    ■ Services

Source: National Account Statistics 2005

The importance of the unorganised sector is even starker with regards to employment. In 2004-05, the unorganised sector was a source of livelihood to approximately 86.3% of the country's workforce. Although a large section of the unorganised sector works within agricultural activities, it is pertinent to note that 71.6% of the total employment in the non-farm sector was also unorganised. In other words, although the unorganised sector contributes just over half of the country's NDP, it employs almost 90% of its workforce.

**Table 2: Distribution of Employment (2004-2005)**

		<b>Number of workers (millions)</b>	<b>Distribution of workers (%)</b>
Agriculture	<i>Organised</i>	6.1	2.4
	<i>Unorganised</i>	252.8	97.6
		<b>258.9</b>	<b>100</b>
Non-Agriculture	<i>Organised</i>	56.5	28.4
	<i>Unorganised</i>	142.1	71.6
		<b>198.5</b>	<b>100</b>
Total	<i>Organised</i>	62.6	13.7
	<i>Unorganised</i>	394.9	86.3
		<b>457.5</b>	<b>100</b>

Source: NSSO Sample Survey 2004-2005

The contribution of the unorganised sector to employment has also remained broadly stable over the last few decades, with that of the formal sector rising very slowly over time. Informal agricultural employment has barely budged around the 99.4 percent mark. In fact the proportion of unorganised sector employment has risen for all these

sectors, especially for services and manufacturing by a few percentage points over the period of study (1983-84 to 1999-2000). Sectors like electricity, gas and water supply, and transport and communication have also experienced rapid informalisation of the their workforce. In other words, the dominance of unorganised employment in the country shows no signs of abating.

**Table 3: Employment by sector (%)**

Industry	1983-84		1987-88		1993-94		1999-2000	
	Org	Unorg	Org	Unorg	Org	Unorg	Org	Unorg
Agriculture, forestry and fishing	0.6	99.4	0.7	99.3	0.6	99.4	0.6	99.4
Mining and quarrying	55.5	44.5	44.2	55.8	40.7	59.3	43.2	56.8
Manufacturing	19.7	80.3	17.3	82.7	16.1	83.9	14.9	85.1
Electricity, gas and water	90.7	9.3	71.3	28.7	69.7	30.3	79.0	21.0
Construction	17.7	82.3	10.1	89.9	10	90	6.5	93.5
Trade, hotels and restaurants	2.1	97.9	1.8	98.2	1.6	98.4	1.2	98.8
Transport, storage and communication	38.8	61.2	34.8	65.2	29.7	70.3	21.5	78.5
Services	40.3	59.7	36.8	63.2	31.7	68.3	34.8	65.2

Source: Sakhtivel and Joddar 2006<sup>2</sup>

Over the last decade, there has been much interest in studying the location and the geographic concentration of economic activity. The location and clustering of economic activity has important implications for economic development, through its effect on wages, employment and growth. The Government of India has been focussing much attention on trying to encourage industrial activity in secondary cities or to areas where such activity has not previously clustered or even favoured. Most of this effort has been focussed on organised sector activity in the manufacturing and the services sector. However, seeing that the unorganised sector is of critical importance to the economy, there is almost no understanding of what attracts these activities to locations.

Before studying the impact of various factors affecting the location of unorganised firms, I will establish that this sector shows much evidence of spatial clustering<sup>3</sup> across different districts in India. A study of what drives spatial concentration of economic activity can only be interesting if such patterns exist in the first place.

There are many visual methods to ascertain whether firms are uniformly distributed across various locations or if they show patterns of spatial concentration. Clustering in its simplest forms can be shown graphically, or through a bird's eye view of where industry is located by means of geographical maps. The following maps provide an actual representation of firm density for the country – the size of the circle is proportional to the number of firms within the district. The first map illustrates that whilst some districts in the country host a lot of unorganised economic activity, others are virtually empty. Also firms tend to cluster in the same geographical districts,

<sup>2</sup> Organised employment figures are obtained from annual reports (1983 and 1988) and Quarterly Employment Review (1994 and 2000).

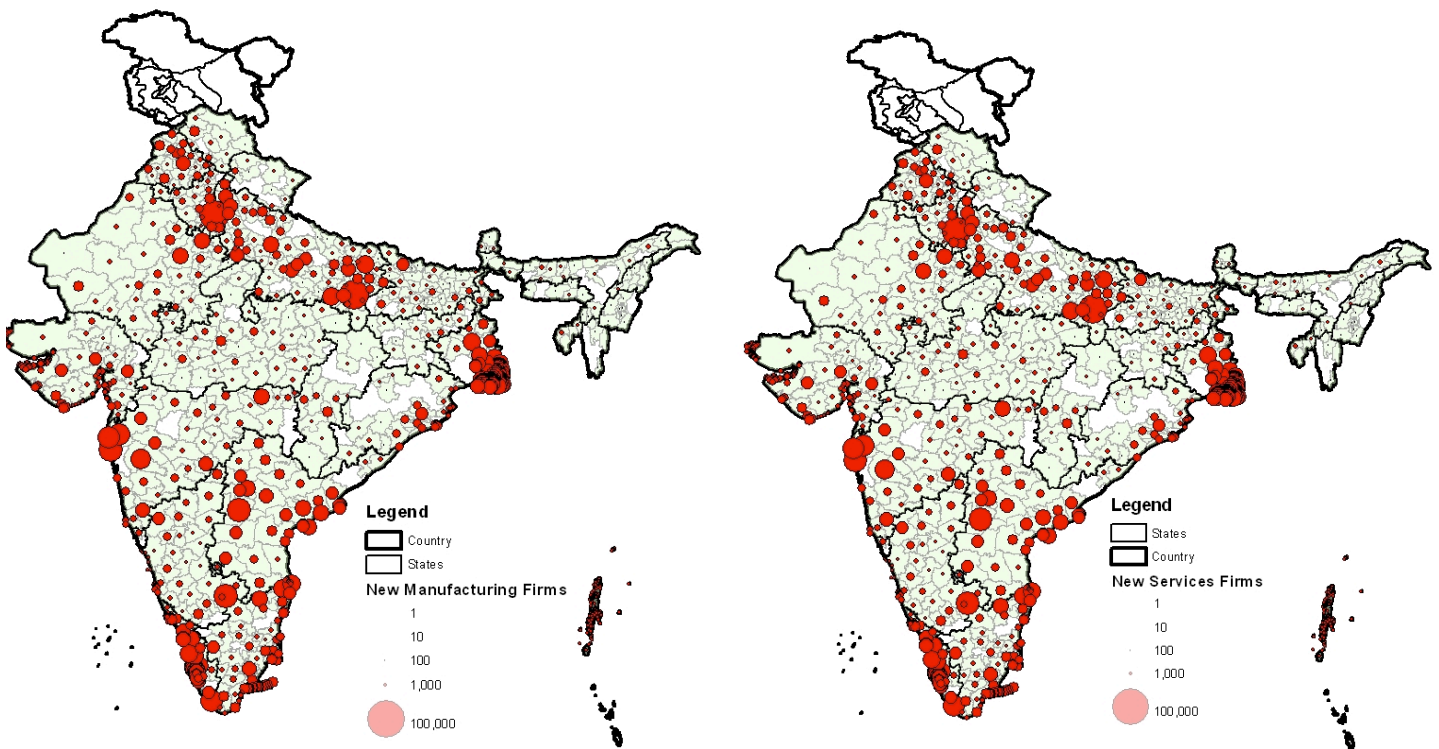
<sup>3</sup> Clustering is a phenomenon in which events or artefacts are not randomly distributed over space, but tend to be organised into proximate groups.

albeit with some differences depending on the type of sub-sector. There are 604 districts in the country, of which informal services firms are present in 556 districts. Of these, around 60 districts account for 50% of all economic activity. Informal manufacturing firms are present in 578 districts, and of these around 39 districts account for 50% of all economic activity. In other words, economic activity is highly concentrated within a few districts in the country. The next set of maps carry out the same exercise, but after controlling for district population – and the results show that, keeping in mind the simplest no-clustering (uniform distribution) benchmark, there is evidence of concentration of economic activity in the country. After controlling for size, clustering moves from particular districts to clusters of districts. In other words, the per capita rate remains high even for the densely populated cities, but that now, it is high even for those close to these cities.

**Figure 2: Distribution of Informal Activity**

**Manufacturing**

**Services**

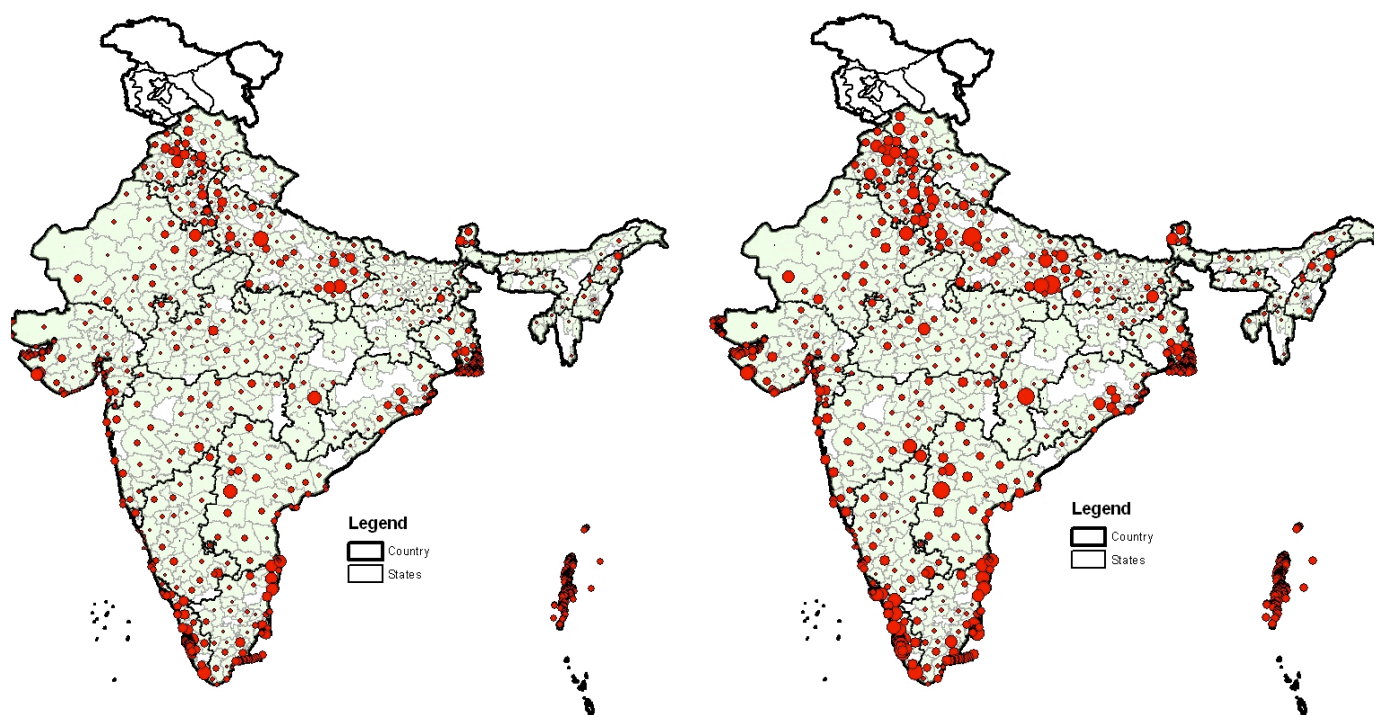


Source: FAO and Prowess

**Figure 3: Distribution of Informal Activity (controlling for size)**

**Manufacturing**

**Services**



Having established that there is evidence of clustering<sup>4</sup> in unorganised industry across different districts in India, this paper will examine the role of agglomeration economies in influencing the decision of firms to cluster, i.e. to locate close to one another. In other words, it will examine the nature and scale of agglomeration economies using district and sector-level data for India.

### ***III Theoretical background***

This section will outline the various factors that drive the spatial distribution of economic activity across and within countries, and will concentrate on the different kinds of agglomeration economies identified within the literature.

Brulhart (1998) categorises location theory into three broad theoretical schools and lists their principal distinguishing features. According to neo-classical theory, location

---

<sup>4</sup> An important measure of spatial concentration used in the literature is the Ellison-Glaeser Index that measures industrial geographic concentration controlling for the size distribution (employment, sales, assets etc) of firms. I am unable to calculate this index for my data, as I do not have data on the characteristics of the unorganised firms within the study.



is determined exogenously, implying that some regions are favoured by economic activity by virtue of their endowments or proximity to rivers, coasts, ports and borders. These models are characterised by perfect competition, homogenous products and non-increasing returns to scale. Models of the new trade theory, on the other hand, emphasise the interaction between economic agents and in particular the increasing returns to scale that is created through dense interactions. Everything but market size is endogenous in these models. The new economic geography models illustrate the possibility of self-organising spatial patterns of production, based on agglomeration effects rather than on differences in climate, transport costs or ecology – in short, location becomes entirely endogenous. For more information on the different strands in location theory, see Table 12 in Appendix 1.

Development economists in the 1950s were also keen to emphasise that large markets are those where more firms and workers locate. There are a variety of concepts related to this argument, such as Perroux's (1955) 'growth poles' (in which an industry or a group of firms within an industry dominate and create growth centres, emphasising geographical location), Myrdal's (1957) 'circular and cumulative causation' (in which the location of a new plant has a multiplier effect on the economy, and could in turn attract more industry, leading to agglomeration and regional inequalities), or Hirschman's (1958) 'forward and backward linkages' (in which firms that produce intermediate products will tend to locate close to their customers, i.e. downstream firms that buy their products – a backwards linkage, and downstream firms will locate close to their suppliers – a forward linkage). New economic geography models helped to formalise these mechanisms to show that regions that are similar in underlying structure could still endogenously differentiate in terms of concentration of economic activity.

Krugman's (1991) approach, in his theories of new economic geography, has much in common with Marshall (1890) and Weber (1929) in relying on externalities to explain agglomeration forces. However, Krugman places more emphasis on labour pooling and specialised suppliers as a source of externality and less emphasis on technology spillovers, since he argued that the latter were difficult to measure and thus, model. In the basic Krugman (1991) model of geographic concentration, industry agglomerates in a particular location as a result of demand linkages between firms, which are created by the interaction of transport costs and fixed costs in production. The model underlies the idea of market access as an important factor as it implies firms will be drawn to densely concentrated regions by the possibility of serving a large market from a single plant at low transport costs. Thus, Krugman's NEG theory unites within a consistent general equilibrium framework older insights from international trade theory and spatial economics.

Venables (1996) addresses the concept introduced by Rosenstein-Rodan (1943), in which the elasticity of labour supply being higher in developing regions explains the domination of primate cities in less-developed countries, since external economies drive the creation of a system of industries in a particular location. Venables argues that firms like to situate themselves close to one another not only because of linkages working through the supply of labour and demand for goods from each other's workers, but also because of the direct input-output linkages amongst themselves. In the vertically linked industries model introduced by Venables (1996), firms use the output of other firms as intermediate inputs, and thus production-shifting results in a change in demand patterns (viewing other firms as customers) and cost patterns

(viewing other firms as suppliers). And thus, as in the Krugman model, agglomeration forces tend to encourage concentration of industrial activity through circular causality – i.e. spatial concentration itself creates an environment that encourages spatial concentration (Baldwin 1999).

Marshall (1919) was the first to identify the benefits from industrial clustering. Clusters of firms that are predominantly in the same sector can take advantage of localisation economies. These include sharing of sector-specific inputs, skilled labour and knowledge. Thus, cost-saving externalities are maximised when a local industry is specialised. The Marshall-Arrow-Romer (Marshall 1890, Arrow, 1962, Romer 1986) models predict that such externalities predominantly occur within the same industry. Therefore, if an industry is subject to localisation externalities, firms are likely to locate in a few regions where other producers of that industry are already clustered.

The next level is that of inter-industry clustering<sup>5</sup>, i.e. when firms in a given industry and those in related industries agglomerate in a particular location. The benefits of clustering would include inter-industry linkages, buyer-supplier networks, and opportunities for efficient sub-contracting. Venables (1996) demonstrated that agglomeration could occur through the combination of firm location decisions and buyer-supplier linkages, since the presence of local suppliers could reduce transaction costs and increase profitability. Inter-industry linkages can also serve as a channel for vital information transfers.

An overall large size of the urban agglomeration and its more diverse industry mix is also thought to provide external benefits beyond those realised within a single sector or due to a tight buyer-supplier network (Henderson 2003). Chinitiz (1961) and Jacobs (1969) proposed that important knowledge transfers primarily occur across industries and the diversity of local industry mix is important for these externality benefits. These benefits are typically called urbanisation economies. These include access to specialised financial and professional services, availability of a large labour pool with multiple specialisations, inter-industry information transfers and the availability of less costly general infrastructure. Larger cities also provide a larger home market for end products, make it easier to attract skilled employees who are attracted by urban amenities not available in smaller towns, and support a large number of complementary service providers such as financial and legal advisers, advertising and real estate services.

Thus, industrial clustering could take place at different levels, which would have different implications for the associated agglomeration economies. A firm could gain from economies of agglomeration that arise from localisation economies, that occur as a result of concentration of firms within the same industry; inter-industry economies, that occur as a result of concentration of firms in related industries in a particular area; and urbanisation economies, that occur across all industries as a result of the scale of a city or region by means of its large markets and urban diversity. It is also pertinent to note that localisation, inter-industry and urbanisation economies are not mutually exclusive – they may occur individually or in combination.

---

<sup>5</sup> As Deichmann et al (2005) points out, empirically the distinction between own-industry versus cross-industry is dependent on the level of sectoral aggregation.

The next section will highlight papers that study the case of services. It will also provide some of the theoretical ideas in the literature of why agglomeration economies in services may be expected to be more or less important than that for manufacturing.

#### ***IV Empirical Literature***

There are two broad approaches to identify the determinants of firm location decisions. One is a survey-based or the 'stated preference' approach – to ask firms directly, through an investment climate survey, for instance, about what location factors are important to them. The second approach is a modelling approach or an econometric analysis of empirical patterns used to identify 'revealed preferences' based on the characteristics of the region.

There are a few papers that empirically test the importance of economic geography for firms in emerging countries. Lall and Meningsstae (2005b) analyse the productivity of manufacturing plants sampled from 40 of India's largest industrial cities and find that there were large gaps across locations which were explained to a large extent by two attributes – economic geography (defined as market access and agglomeration economies) and local business environment (defined as labour regulation and the quality of power supply). Head and Reis (1996) show that foreign firms in China prefer to locate in cities where other foreign firms are located. They estimate a model using data on 931 foreign ventures and find that cities with good infrastructure and established industrial bases gained most in terms of the distribution of new investment and that agglomeration effects greatly magnified the direct impact of policy. A few years later, Cheng and Kwan (2000) confirm that regional markets, good infrastructure and preferential policy had a positive effect on FDI in 29 regions in China from 1985 and 1995, but that wage costs had a negative effect. Amiti and Javorcki (2005) study the determinants of entry of foreign firms into China by using information on 515 Chinese industries at the provincial level between 1998-2001. They find that market and supplier access are the most important factors affecting foreign firms entering into a particular region in the country.

Most location theories, such as the ones described in Table 12 in the Appendix, are based on manufacturing firms, and could be restrictive in explaining the locational determinants for service firms. Services firms could differ in structure and locational strategies, and these differences could be accounted for by not just the nature of the product but also the locational conditions for service production. For instance, in some services, product specialisation, rather than standardisation, may be more important in capturing markets (Enderwick 1989), and proximity to competitors, suppliers and markets may be significant determinants relative to agglomeration economies (Bagchi-Sen 1995). On the other hand, with the introduction of new communication technologies and the ability to slice the service production chain more thinly, proximity may cease to be an important factor in explaining agglomeration economies.

Traditionally, services industries were also theorised to develop close to existing manufacturing locations, recognising the complementarities between goods production and the production of services – this should imply that inter-industry

economies should be an important factor driving the location of services (Bagchi-Sen 1995). Localisation economies might also be expected to be stronger in the case of services owing to the importance of inter-organisational face-to-face contact and high-skilled labour. Thus, supply-side incentives could stem from reducing transaction costs of providing proximity to such complementary activities, and also because service firms rely on the opportunity to specialise and access innovations in services production and delivery. If services firms tend to follow population patterns, then one would also expect that access to markets would be an important determinant of individual firm location decisions. For particular types of service industries where face-to-face contact is crucial, one would expect to see distance as a key limiting factor in explaining location decisions.

The empirical literature for services also lags behind that for manufacturing. Most new economic geography models do not make any distinction between industries and are silent on which industries generally agglomerate. Thia (2007) shows a North-South model of services agglomeration in the North, arguing that services agglomerate close to existing manufacturing agglomerations. On the other hand, Kirn (1987) finds that the concentration of manufacturing industries within the United States could not be regarded as a significant predictor of producer services growth. Additionally, Coffey and McRae (1989), in studying services in the Canadian economy pointed out that producer services did not necessarily follow population and manufacturing location patterns – they could locate in peripheral regions and develop an export base.

It also seems that agglomeration economies are stronger in the case of services, than that for manufacturing, in the empirical literature. Kirn (1987) studies the growth of geographical distribution of the growth of service industries in the US, for large and small metropolitan areas and for small groups of non-metropolitan counties between 1958 and 1977. He finds that services employment decreased as one moved from large to small metropolitan areas, although the smaller areas outpaced the larger ones in terms of expansion of services. It could be argued that the effects of technological advances had yet to have exerted their influence on this analysis. Dekle and Eaton (1999), who study Japanese data on wages and land rents and compare the extent of agglomeration economies in manufacturing and financial services, also find similar results. They find that agglomeration economies in finance are more local, while that for manufacturing more national. They point out that their results provide some of the explanations for the increased land prices in Japan based on the growth of the financial services industry, and suggest that manufacturing, where local agglomeration economies are weaker, move out of cities/places where financial services tend to concentrate. They explain their results by providing examples of ‘creative’ economic life in cities where external economies generated by interactions among educated or experienced individuals are critical, and that they expect that these interactions would be more important in raising profitability in financial services than in manufacturing, since the former are more knowledge-intensive<sup>6</sup>. More recently, Coffey and Shearmur (2002) study agglomeration and dispersion of service employment for high-order sectors in the Montreal metropolitan region (1981-86) and find that, in spite of advances in telecommunications technologies, agglomeration

---

<sup>6</sup> They back this up by pointing out that in Japan 46% of workers in the financial sector have university educations, while the corresponding figure for manufacturing is 21%.

economies continue to exert an important impact on intra-metropolitan location of these service industries.

Bagchi-Sen (1995) finds a slightly different result as she concludes that producer services industries do sprout up away from dense urban agglomerations. She studies the factors determining the location of FDI into the US in the 1980s in sectors such as finance, insurance and real estate. She studies these sectors for two time periods (1979-83 and 1984-88) and examines the temporal variations in the association between FDI in services and a set of location determinants. She notes the growth of service industries in relatively smaller urban agglomerations and in non-metropolitan areas in addition to the large US metropolitan ones.

Ekholm (2007) describes the important role played by skilled labour in the location choice of firms in high-tech sectors. He describes two sources of agglomeration economies – knowledge spillovers from R&D activities and economies based on scale and trade costs, and pointed out that both were based on inputs of skilled labour. Kleinknecht and Poot (1992) also study the relationship between R&D efforts undertaken by firms and their location in urban or rural areas in the Netherlands. They found that the location of the firm did not affect its probability to engage in R&D or its intensity of R&D efforts. However, they do find that service firms that were located in the 4 largest cities did have a higher R&D intensity than those located in the rest of the country, implying that the urban hierarchy theory (that they were testing) could hold for services.

Keeping in mind the results of the theoretical and the empirical literatures, this paper will concentrate on understanding the extent to which agglomeration economies matter to firms' location decisions. The next section will describe estimation framework employed and then move on to discussing the results and possible endogeneity bias.

## **V. Estimation Framework**

### *a. Econometric model*

A popular model of location choice are conditional logits, in which it is assumed that a firm evaluates alternative locations in India at each time period, and would consider relocation if its profitability in another place exceeded that at its current location<sup>7</sup>. The use of a discrete choice framework to model location behaviour stretches back to the 1970s, when Carlton (1979) adapted and applied McFadden's (1974) Random Utility Maximisation Framework to firm location decisions.

Within such a discrete choice framework, a general profit function is used to explain how new firms choose a district to locate in India. Following McFadden (1994) the

---

<sup>7</sup> In reality, relocation can be costly and firms need to take account of sunk investments in production capacity, and other costs of moving. However, these relocation costs are not considered in the model.

model assumes a set  $J = (1, 2, \dots, j, \dots, n)$  of possible locations (districts) and that location  $j$  offers profitability level  $\pi_{ijk}$  to a firm  $i$  in industry  $k$ . The resulting profitability equation yielded by location  $j$  to a firm  $i$  in industry  $k$  is:

$$\pi_{ijk} = \beta Z_{ijk} + \xi_j + \varepsilon_{ijk} \quad (1)$$

where  $\beta$  is the vector of unknown coefficients to be estimated,  $\xi_j$  measures unobserved characteristics of the district which can affect the firm's profitability and  $\varepsilon_{ijk}$  is a random term. Thus, the profit equation is composed of a deterministic and a stochastic component. Under the assumption of independent and identically distributed error terms  $\varepsilon_{ijk}$ , with type I extreme-value distribution, then it can be assumed that the  $i$ th firm will choose district  $j$  if  $\pi_j^i \geq \pi_l^i$  for all  $l$ , where  $l$  indexes all the possible location choices to the  $i$ th firm. The result is that the probability that any firm will choose to locate in a city  $j$ :

$$p_{ijk}(\pi_{ij} \geq \pi_{il} \forall l \neq j) = \frac{e^{\beta Z_{ijk}}}{\sum_{m=1}^J e^{\beta Z_{ijk}}} \quad (2)$$

where  $p_{ijk}$  is the probability that firm  $i$  in industry  $k$  locates in district  $j$ . If we let  $d_{ijk} = 1$  in case firm  $i$  of industry  $k$  picks location  $j$ , and  $d_{ijk} = 0$  otherwise, then we can write the log likelihood of the conditional logit model as

$$\log L_{cl} = \sum_{i=1}^N \sum_{k=1}^K \sum_{j=1}^J d_{ijk} \log p_{ijk} \quad (3)$$

In practice, however, the implementation of the conditional logit model in the face of a large set of spatial alternatives is very cumbersome<sup>8</sup>. The conditional logit model is also characterised by the assumption of Independence of Irrelevant Alternatives (IIA). Consequently, the ratio of the logit probabilities for any two alternatives does not depend on any alternatives other than the two considered. More formally, this implies that the  $\varepsilon_{ijk}$ s are independent across individual firms and choices; all locations would be symmetric substitutes after controlling for observables. This assumption would be violated if districts within particular states were closer substitutes than others outside of the state boundary. To effectively control for the IIA assumption, one would need to introduce a dummy variables for each individual choice. This would amount to a specification of the following type:

$$\pi_{ijk} = \delta_j + \beta Z_{ijk} + \xi_j + \varepsilon_{ijk} \quad (4)$$

---

<sup>8</sup> Guimaraes et al. (2003) provide an overview of the problems and how different researchers have attempted to deal with them in the past.

where  $\delta_j$ s are the alternative specific constants introduced to absorb factors that are specific to each particular choice. In this case all explanatory variables (observable or unobservable) that only change across choices are absorbed by the alternative specific constants. In the presence of large datasets, such as the one I plan on using, this implementation would be impractical because of the large number of parameters to be estimated.

As an econometric alternative, Guimaraes et al (2003) show that the implementation of conditional logit models yields identical results to Poisson regression models when the regressors are not individual specific. They demonstrate how to control for the potential IIA violation by making use of an equivalence relation between the conditional logit and Poisson regression likelihood functions. In a separate paper, Guimaraes et al (2004) provide an empirical demonstration. In this model the alternative constant is a fixed-effect in a Poisson regression model, and coefficients of the model can be given an economic interpretation compatible with the Random Utility Maximisation framework. Since using both models yield identical parameter estimates, I will use Poisson regressions to generate coefficients.

Guimaraes et al (2003) show that Equation (3) is equivalent to that of a Poisson model that takes the number of new firms in a district,  $n_{ijk}$ , as the dependent variable and includes a set of location-specific explanatory variables. The same results will be obtained if we assume that  $n_{ijk}$  follows a Poisson distribution with expected value equal to

$$E(n_{ijk}) = \lambda_{ijk} = \exp(\alpha d_{ijk} + \beta Z_{ijk})$$

where  $[\alpha, \beta]$  is the vector of parameters to be estimated and  $d_{ijk}$  is a vector of  $K$  dummy variables, each one assuming the value 1 if the observation belongs to industry  $k$ . Thus, the above problem can be modelled as a Poisson regression where the  $[\alpha, \beta]$  vector can be estimated regardless of the number of  $\delta_j$  parameters.

To sum up, I test the importance of economic geography and ‘investment climate’ factors by implementing a count model, wherein the count of new firms within a location is modelled as a function of factors common to the location and those common to particular sectors within a location. The original estimation framework is based on a location decision model in which individual firms compare profitability across different locations.

### c. *Specification of variables*

The deterministic component of the function consists of the various attributes of the location that can influence the profitability of a firm in that particular location, and the random component consists of the unobserved characteristics of the location, and measurement errors.

The observables in this model are:

$$Z_{ijk} : \sigma_{jk}, \Lambda_{kj}, U_j, MA_j, Ed_j, X_j, W_j, WE_j$$

Where:

$\sigma_{jk}$  represents localisation economies, represented by the share of firms of type  $k$  found in location  $j$

$\Lambda_{kj}$  represents inter-industry trading relations measured by the strength of buyer-supplier linkages

$U_j$  represents urbanisation economies in location  $j$

$MA_j$  summarises regional market access attributes

Other regional characteristics include:

$Ed_j$  measures the level of human capital in location  $j$

$X_j$  captures the quality and availability of infrastructure (electricity and communications)

$W_j$  a vector of factor input price variables in location  $j$

$WE_j$  captures the level of wealth in location  $j$

$\xi_j$  measures unobserved characteristics of the district which can affect the firm's profitability. Each firm considers these factors at the time it is making its location decision, but these are not captured in the data. The specifics of the endogeneity problem are dealt with in more detail in Section VII.

The economic geography variables in this model are represented by market access ( $MA_j$ ), localisation economies ( $\sigma_{jk}$ ), inter-industry economies ( $\Lambda_{kj}$ ) and urbanisation economies ( $U_j$ ). The variables representing business environment are  $Ed_j$  (educational attainment)  $X_j$  (quality and availability of power and communications' infrastructure) and  $WE_j$  (wealth). The remainder of this section is dedicated to a detailed description of each of the variables used in the model.

Localisation economies ( $\sigma_{jk}$ ) can be measured by own industry employment in the region, own industry establishments in the region, or an index of concentration, which reflects disproportionately high concentration of the industry in the region in comparison to the nation (Lall et al 2003). I measure localisation economies as the proportion of sector  $k$ 's employment in location  $j$  as a share of all of sector  $k$ 's total employment in the country. The higher this value, the higher the expectation of intra-industry concentration benefits in the region.

$$\sigma_{jk} = \frac{E_{k,j}}{E_k}$$

There are several approaches for defining inter-industry linkages: input-output based, labour skill based and technology flow based. Although these approaches represent different aspects of industry linkages and the structure of a regional economy, the most common approach is to use the national level input-output accounts as templates for identifying strengths and weaknesses in regional buyer-supplier linkages (Feser and Bergman 2000). The strong presence or lack of nationally identified buyer-supplier



linkages at the local level can be a good indicator of the probability that a firm is located in that region. To evaluate the strength of buyer-supplier linkages for each industry, following Lall et al (2003) a summation of regional industry employment weighted by the industry's input-output coefficient column vector from the national input-output account is used:

$$\Lambda_{kj} = \sum_{k=1}^n w_k e_{kj}$$

where,  $\Lambda_{kj}$  is the strength of the buyer-supplier linkage,  $w_k$  is industry  $k$ 's national input-output co-efficient column vector and  $e_{kj}$  is total employment for industry  $k$  in district  $j$ . The measure examines local level inter-industry linkages based on national input-output accounts. The national I-O co-efficient column vectors describe intermediate goods requirements for each industry (i.e. inter-industry linkages). Assuming that local industries follow the national average in terms of their purchasing patterns of intermediate goods, national level linkages can be imposed to the local level industry structure for examining whether region  $j$  has a right mix of supplier industries for industry  $k$ . By multiplying the national I-O coefficient column vector for industry  $k$  and the employment size of each sector in region  $j$  (a district is used as a geographical unit for buyer-supplier linkage analysis), simple local employment numbers can be weighted based on what industry  $k$  purchases nationally.

I use the Herfindal measure to examine the degree of economic diversity, as a measure of urbanisation ( $U_j$ ) in each region. The Herfindal index of a region  $j$  ( $U_j$ ) is the sum of squares of employment shares of all industries in region  $j$ :

$$U_j = \sum_k \left( \frac{E_{jk}}{E_j} \right)^2$$

Unlike measures of specialisation, which focus on one industry, the diversity index considers the industry mix of the entire regional economy. The largest value for  $U_j$  is one when the entire regional economy is dominated by a single industry. Thus a higher value signifies lower level of economic diversity.

In principle, improved access to consumer markets (including inter-industry buyers and suppliers) will increase the demand for a firm's products, thereby providing the incentive to increase scale and invest in cost-reducing technologies. The classic gravity model, which is commonly used in the analysis of trade between regions and countries, states that the interaction between two places is proportional to the size of the two places as measured by population, employment or some other index of social or economic activity, and inversely proportional to some measure of separation such as distance. The proposed model will use the formulation proposed initially by Hanson (1959), that states that the accessibility at point 1 to a particular type of activity at area 2 (say, employment) is directly proportional to the size of the activity at area 2 (say, number of jobs) and inversely proportional to some function of the distance separating point 1 from area 2. Accessibility is thus defined as the potential for opportunities for interaction. Thus, following the modified formulation in Lall et al (2004), Market Accessibility is defined as:

$$MA_j = \sum_m \frac{S_m}{d_{j-m}^b}$$

Where,  $MA_j$  is the accessibility indicator estimated for location  $j$ ,  $S_m$  is a size indicator at destination  $m$  (in this case, district population),  $d_{jm}$  is a measure of distance between origin  $j$  and destination  $m$ , and  $b$  describes how increasing distance reduces the expected level of interaction<sup>9</sup>. The accessibility will be constructed using population (as the size indicator), distance (as a measure of separation) and is estimated without exponent values<sup>10</sup>. The market access measure has been constructed by allowing transport to occur along the orthodromic distance connecting any two districts within a 500 kilometre radius.

A distinguishing feature of my approach to evaluating the factors that drive firms to locate in particular cities and city-regions is that I make use of data on education. I assess quantitatively the role played by the human capital across different regions on the decisions of firms across different services industries to situate themselves in a particular state or district. I include a measure of the effect of education, captured by the education variable -  $Ed_j$ . This is defined as the proportion of the population within the district with a high-school education.

I define  $X_j$  as a measure of ‘natural advantage’ through the embedded quality and availability of infrastructure in the district. I use the availability of power (proxied as the proportion of households with access to electricity) within a location as an indicator of the provision of infrastructure. In addition I also use the proportion of households within a district with a telephone connection as an indicator of communications’ infrastructure.

$W_j$  is a vector of factor input-price variables in location  $j$ , and I use nominal district-level wage rates (non-agricultural hourly wages) as an indicator of input costs. The expected effect of this variable is hard to pin down theoretically. On the one hand, one would expect innovative activity to be inversely related to labour costs, since high costs within a location could drive down productivity. On the other hand, since I am unable, at this stage of the analysis, to differentiate wages on the basis of the skill set of workers, it is possible that there would be a positive effect since high wages are in effect accounting for the presence for highly skilled labour in the workforce. I also include the proportion of high-income households within a district as an indicator of the level of wealth ( $WE_j$ ).

---

<sup>9</sup> In the original model proposed by Hanson (1959),  $b$  is an exponent describing the effect of the travel time between the zones.

<sup>10</sup> The exponent value is an indicator of how distance is a restrictive factor.

**Table 4: Some Descriptive Statistics**

Variable	Expected sign	#		Mean	
		<i>services</i>	<i>manufacturing</i>	<i>services</i>	<i>manufacturing</i>
New firms		572	567	4,111	3,531
Localisation	+	469	557	0.003	0.003
Input-Output	+	469	557	3767.742	5550.274
Urbanisation	-	586	578	0.337	0.419
Market Access	+	582	574	871313.700	869363.800
Education	+	480	578	0.002	0.001
Electricity	+	486	578	0.559	0.633
Telephone	+	486	578	0.084	0.368
Wealth	+	486	578	0.055	0.051
Wages	-/+	483	574	93.475	100.949

Notes: # refers to the number of districts for which data is available. There are a total of 604 districts in the country.

### **VI Data**

The dependent variable, used in the reduced form estimation, is the count of new firms within the informal sector in India – in the manufacturing and in the services sector. The data is drawn from the Fifty-Seventh Round (July 2001-June 2002: Unorganised Service Sector) and the Sixty-Second Round (July 2005-June 2006: Unorganised Manufacturing Enterprises) of the National Sample Survey Organisation. The former household survey round contains data on services enterprises in the informal sector, and the latter on manufacturing enterprises in the informal sector. I extract data on new establishments from the question that asks the enterprise its status over the last 3 years (expanding/stagnant/contracting/operated for less than 3 years). I select enterprises that respond in the positive to the latter option, in each of the two surveys. The surveys also contain data on the district within which the enterprise is located. The total number of new services firms counted within the 1999 survey equals 2,409,204 and the count of new manufacturing firms for the 2004 survey is 2,041,137.

The choice of years is dictated by the data. Whilst data on the dependent variable is drawn from the NSSO Rounds described above, I also extract data from the Employment and Unemployment Surveys - Round 55.10 (July 1999 – June 2000) and Round 61.10 (July 2004 – June 2005). This data, which is disaggregated by industry and district, allows me to construct my agglomeration variables. Separately, data on education, electricity and communications infrastructure, and on wages and wealth within the district are also drawn from these surveys. I use population data from the 2001 Census to construct the market access variable.

**Table 5: Predictor Variables**

				Availability	
				1999-2000	2004-2005
	Variable	Indicator	Source(s)		
Economic Geography	Localisation	Intra-industry concentration	NSSO	✓	✓
	Input-Output economies	Buyer-supplier linkages	NSSO	✓	✓
	Urbanisation	Economic Diversity	NSSO	✓	✓
	Market Access	Neighbouring markets	Orthodromic distance calculations	✓	✓
	Education	Proportion of population with a High-School education	NSSO	✓	✓
	Electricity	Proportion of population with access to electricity	NSSO	✓	✓
Business Environment	Telephone	Proportion of households with a telephone connection	NSSO	✓	✓
	Wages	Non-agricultural hourly wages	NSSO	✓	✓
	Wealth	Proportion of high-income households	NSSO	✓	✓

Notes: NSSO - National Sample Survey Organisation

## V. Results and Discussion

I start with an illustration of the key characteristics of the data to explain my subsequent modelling choices. One of the key characteristics of the data is that it is over-dispersed. In Table 6, the mean number of new firms per district is around 4,111 for the services sector, and 3,531 for the manufacturing sector. At the same time the respective standard deviations are around 1.6 to 2.3 times the mean. A Poisson model implies that the expected count, or mean value, is equal to the variance. This is a strong assumption and does not hold for my data. A frequent occurrence with count data is an excess of zeroes – in this case, however, this is not a problem. Only 29 districts (of a total of 586) have zero new services units, and 52 districts (of a total of 578) have zero new manufacturing units.

The Table also allows me to check the suitability of the different types of models with regards to their predictive power. ‘Obs’ refers to actual observations in the data, and Fit\_p, Fit\_nb and Fit\_zip refer to the predictions of the fitted Poisson, negative binomial and zero-inflated Poisson models respectively. Of all the locations in the sample, 4.9% have no new services units, and 9% have no new manufacturing units. In both cases, the Poisson model (Fit\_p) predicts that 0% of all districts would have no new units – clearly the model underestimates the probability of zero counts. The negative binomial (Fit\_nb), which allows for greater variation in the variable than that of a true Poisson, predicts that 0.66% and 3.25% of all districts will have no new services or manufacturing units respectively. One could also assume that the data comes from two separate populations, one where the number of new firms is always zero, and another where the count has a Poisson distribution. The distribution of the outcome is then modelled in terms of two parameters – the probability of always zero

and the mean number of new firms for those locations not in the always zero group. The Zero-inflated Poisson (Fit\_zip) predicts that 2.5% and 8.42% of all districts will have no new services or manufacturing units, much closer to the observed value.

**Table 6: Characteristics of the Data**

Variable	Services			Manufacturing		
	#	Mean	Std. Dev.	#	Mean	Std. Dev.
count	586	4111.27	6749.53	578	3531.38	8207.68
count>0	557	4325.32	6856.00	526	3880.49	8525.32
Obs	586	0.0495	0.2171	578	0.0900	0.2864
Fit_p	480	0.0000	0.0000	570	0.0000	0.0000
Fit_nb	480	0.0066	0.0025	570	0.0325	0.0227
Fit_zip	480	0.0250	0.0632	570	0.0842	0.1438

An alternative approach to the zero-inflated Poisson is to use a two-stage process, with a logit model to distinguish between the zero and positive counts, and then a zero-truncated Poisson or negative binomial model for a positive counts. In the case of this paper this would imply using a logit model to differentiate between districts that have no new firms and those that do, and then a truncated model for the number of districts that have at least one new firm. These models are referred to as “hurdle models” – a binary probability model governs the binary outcome of whether a count variate has a zero or positive realisation; if the realisation is positive, the ‘hurdle’ is crossed and the conditional distribution of the positives is governed by a truncated-at-zero count model data model (McDowell 2003)<sup>11</sup>.

The response variable is ‘count’, i.e. the number of new firms per district. The Poisson regression models the log of the expected count as a function of the predictor variables. More formally,  $\beta = \log(\mu_{x+1}) - \log(\mu_x)$ , where  $\beta$  is the regression coefficient,  $\mu$  is the expected count and the subscripts represent where the regressor, say  $x$ , is evaluated at  $x$  and  $x+1$  (here implying a unit percentage change in the regressor<sup>12</sup>). Since the difference of two logs is equal to the log of their quotient, i.e.  $\log(\mu_{x+1}) - \log(\mu_x) = \log\left(\frac{\mu_{x+1}}{\mu_x}\right)$ , thus one could also interpret the parameter estimate as the log of the ratio of expected counts. In this case, the count refers to the ‘rate’ of new firms per district. The coefficients<sup>13</sup> could also be interpreted as incidence rate ratios (IRR), i.e. the log of the rate at which events occur. Table 7 and Table 8 provide the incidence rate ratios using different types of count models.

The IRR score can be interpreted as follows: if input-output economies were expected to increase by a percentage unit, the rate ratio for the count of new services firms

<sup>11</sup> We were unable to achieve convergence when using the zero-inflated and the zero-truncated negative binomial models, and these results are excluded from the paper.

<sup>12</sup> This is because the regressors are in logarithms of the original independent variables.

<sup>13</sup> The non-exponentiated coefficient results can be made available on request.

would be expected to increase by a factor of 1.22, i.e. by 22 percentage points (see the coefficient of input-output economies for the Poisson model in Table 7). More simply, an incidence rate ratio equal to 1 implies no change, less than 1 implies a decrease and more than 1 implies an increase in the rate ratio. As the model selection criteria I also examine and compare the Bayesian information criterion (BIC) and Akaike's information criterion (AIC). Since the models are used to fit the same data, the model with the smallest values of the information criteria is considered better.

**Table 7: Incidence Rate Ratios (Services)**

Variable	Poisson	Negative Binomial	Zero-inflated Poisson	Zero-inflated Negative Binomial	Zero-truncated Poisson	Zero-truncated Negative Binomial
Localisation	0.962***	0.912**	0.983***	0.935*	0.983***	0.941
Input-output	1.220***	1.496***	1.211***	1.476***	1.211***	1.474***
Urbanisation	0.754***	0.868*	0.781***	0.898*	0.781***	0.898*
Market Access	0.951***	0.942	0.971***	0.984	0.971***	0.989
Education	0.968***	0.933	0.972***	0.947	0.972***	0.926
Telephone	1.107***	1.313***	1.111***	1.319***	1.111***	1.329***
Electricity	1.225***	1.325***	1.208***	1.257***	1.208***	1.275***
Wages	0.969***	0.976	0.957***	0.971	0.957***	0.97
Wealth	1.059***	1.065	1.059***	1.048	1.059***	1.049
#	3119	3119	3119	3119	2722	2722
AIC	2988346	41678	2706936	41365	2704650	39138
BIC	2988600	41938	2707250	41685	2704898	39392

Exponentiated coefficients

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

With regards to agglomeration variables, effect of localisation economies, which is the first agglomeration variable of interest is negative and significant. In other words, the higher the intra-industry concentration, the lower the attractiveness of the location. The effect of inter-industry linkages is positive and significant across different models. The effect of the industrial diversity variable is negative and significant. Recall that since a higher HI implies lower industrial diversity, this is evidence of a positive association between more industrial diversity and more profits, or greater attractiveness of the district. Market access has a slight negative and significant effect, and this could be the case if being located close to more populated districts may in fact attract new firm units away from the smaller location.

With regard to business environment variables, the effect of education is negative and significant – implying that a lower educational attainment is associated with making the district more attractive to new firms. I looked more closely at the unorganised sector by educational level – and found that almost 90% of those with less than a high-school degree found themselves working in the unorganised sector. In other words, districts with a larger proportion of the population with a lower level of education attract more unorganised services activity. This is in line with the coefficient on wages, wherein lower labour costs make a location more attractive. Infrastructure, both electricity and communications, have a positive and significant

effect, and a higher proportion of high-income households in the district again makes a location more attractive to informal services activity.

**Table 8: Incidence Rate Ratios (Manufacturing)**

Variable	Poisson	Negative Binomial	Zero-inflated Poisson	Zero-inflated Negative Binomial	Zero-truncated Poisson	Zero-truncated Negative Binomial
Localisation	0.855***	0.644***	0.860***	0.714***	0.860***	0.715***
Input-output	1.338***	2.824***	1.287***	2.036***	1.287***	2.041***
Urbanisation	0.657***	0.851*	0.755***	0.937	0.755***	0.937
Market Access	0.994***	1.031	0.987***	1.002	0.987***	1.001
Education	1.175***	1.172	1.146***	1.122*	1.146***	1.118
Telephone	1.077***	1.198**	1.053***	1.154**	1.053***	1.150**
Electricity	0.667***	0.774***	0.662***	0.756***	0.662***	0.756***
Wages	0.759***	0.657***	0.795***	0.732***	0.795***	0.736***
Wealth	1.135***	1.230**	1.073***	1.096	1.073***	1.095
#	3762	3762	3762	3762	2078	2078
AIC	5693413	35590	3980274	34871	3975447	30045
BIC	5693476	35658	3980399	35001	3975504	30107

Exponentiated coefficients

\* p<0.05, \*\* p<0.01, \*\*\* p<0.001

The results for informal manufacturing are broadly similar except to say that education now has a positive effect, and that electricity has a negative effect. I am yet to ascertain why this is the case – this could be because manufacturing in India subsidises residential power, and the presence of more households with access to power increases their burden?

## VI. *Endogeneity Issues and Robustness Checks*

Although all the regressors have been lagged, there could remain endogeneity concerns that would bias the coefficients (or, in this case, the reported incidence rate ratios). The underlying assumption within the model is that if a particular location offers some inherent features that improve the profitability of certain economic activities, firms will be attracted to that location. Such inherent features may be related to natural endowments or regulatory specificities, but they could also have to do with essentially un-measurable factors such as local business cultures. How to isolate the effect that runs from agglomeration to performance thus represents a considerable challenge. With regard to the proposed analysis, the presence of these unobservable sources of a location's natural advantage complicates the estimation procedure, particularly in identifying the contribution of production externalities to the location decision of firms.

Ellison and Glaeser (1997) point out that the effects of unobservable sources of 'natural advantage' (i.e. positive values of  $\xi_{jk}$ ) will not be separately identified from those of production externalities between firms that arise simply from firms locating

near one another. Simply including the number of firms or employment in a particular industry, which is a commonly used indicator in empirical studies evaluating localisation economies, will not be able to distinguish whether firms are attracted by a common unobservable, whether they derive benefits from being located in close proximity to one another, or whether it is some combination of the two. As it is impossible to get data on all the factors relevant to a firm's location decision, it is essential to find an instrument for own industry concentration that is not correlated with the unobservable sources of natural advantage  $\xi_{jk}$ .

I follow Lall and Mengistae (2005) who address this problem by using historic land revenue institutions, set up by the British and detailed by Bannerjee and Iyer (2005), as instruments. Land revenue was the most important source of government revenue and the British instituted three systems defining who was responsible for paying the land taxes. These were (a) landlord based systems (zamindari), (b) individual cultivator-based systems (ryotwari) or (c) village-based systems (mahalwari). These institutions are of interest to the analysis for a three reasons. First, the British decision on which land tenure system to adopt depended more on the preferences of individual administrators rather than a systematic evaluation of region-specific characteristics. Thus, the choice of institutional arrangements is largely exogenous to regional attributes. Second, landlords were allowed to extract as much as they wanted from their tenants, thus making their behaviour predatory, leading to high inequality and low general investment in their districts. Further, as most wealthy landlords were not cultivators themselves, this reduced pressure on the state to deliver services important to farmers as well as general public goods. Third, rural institutions have considerable bearing on urban and industrial development (Rao and Woolcock 2001). Rural class structures and social networks do not disappear once people move to cities. Thus, as Lall and Mengistae argue, these land-tenure systems serve as good instruments since they have been found to influence agricultural investment, profitability and general industrialisation in the post-independence period, and since their choice was largely exogenous, they are not correlated with any observable features of the underlying natural geography of the region.

Lall and Mengistae (2005) link Banerjee and Iyer's (2005) land revenue classification with the 1991 district boundaries and code the cities according to if the district had a landlord-based system or a village/cultivator-based system. They find significantly lower levels of industry concentration in landlord districts for all industry types, suggesting that the difference between the two categories is not simply an industry composition effect but truly reflects lower levels of industrial activity in landlord districts. I, also, thus, use instrumental variable techniques in my estimation, and instrument urbanisation with the choice of land revenue system.

I run the instrumental variable estimation within a count data model (Mullahy 1997) using a Stata module for IV/GMM Poisson regression (Nichols 2007). I also run a linear regression with an IV specification, and an alternative generalised linear model (GLM) (Hardin et al 2003) to check for the strength of the instrument and to address endogeneity concerns due to measurement errors.

I report the results of these specifications in the tables below, together with the results of diagnostics. Only the results for the instrumented co-efficient are presented here. The tests confirm the validity of the IV specification and the strength of the



instrument when the urbanisation coefficient is instrumented with land revenue institutions. The instrumented coefficient remains negative and significant, and the F-statistic is well above the rule-of-thumb value of 10. I also perform the Durbin-Wu-Hausman test to examine if endogeneity of urbanisation could have adverse effects on OLS estimates, and find that the results of the IV estimates are preferable.

**Table 9: IV Estimation (Services)**

Variables	IV Poisson	IV Regression	AGLM (Poisson)	AGLM (Negative Binomial)
Urbanisation	0.723*	0.764	0.752	0.952
Other controls	yes	yes	yes	yes
#	3119	2722	3119	3119
AIC		22828.5		
BIC		22887.6		
F-Stat		0.285		

Exponentiated coefficients

\* p<0.05, \*\* p<0.01, \*\*\* p<0.001

**Table 10: IV Estimation (Manufacturing)**

Variables	IV Poisson	IV Regression	AGLM (Poisson)	AGLM (Negative Binomial)
Urbanisation	0.233*	0.185**	0.00780***	0.0672**
Other controls	yes	yes	yes	yes
#	3762	2078	3762	3762
AIC		9101		
BIC		9157.4		
F-Stat		30.038		

Exponentiated coefficients

\* p<0.05, \*\* p<0.01, \*\*\* p<0.001

As a further robustness check, I also carry out the same exercise for the organised manufacturing and services sector in India, to check how the results differ. I use data for both manufacturing and services firms from the Prowess database, and data from the Annual Survey of Industries (ASI) for manufacturing firms. Prowess is a corporate database that contains normalised data built on a sound understanding of disclosures of over 18,000 companies in India. The ASI contains data on over 140,000 manufacturing firms in India. I then re-run the regressions for new firms for the two cross-sections – 1999-2000 and 2004-2005. Although I carry out the regressions using Poisson and zero-inflated and zero-truncated methods as well, I only report the results of the negative binomial specifications<sup>14</sup>. This is to facilitate comparison, but more importantly because the negative binomial models exhibit the

<sup>14</sup> Results from the models are available on request.

best goodness-of-fit statistics. As before, the coefficients are reported as Incidence Rate Ratios for ease of interpretation.

**Table 11: Robustness Checks**

Variable	Services (Prowess)		Manufacturing (Prowess)		Manufacturing (ASI)	
	1999	2004	1999	2004	1999	2004
Localisation	1.863***	1.105	0.942	0.907	0.977	0.983
Input-output	0.997	0.942	1.191*	1.356*	1.295***	1.301***
Urbanisation	0.998	0.807	0.988	0.89	1.05	1.023
Market Access	0.89	1.227	1.262**	0.942	0.974	1.049
Education	1.506	0.878	0.843	1.126	0.964	0.972
Telephone	1.267	0.863	1.731**	1.229	0.951	1.209***
Electricity	1.005	1.52	1.018	1.296	1.201***	0.919
Wages	1.144	1.339	1.06	0.608	0.973	0.884
Wealth	0.856	0.816	0.809	0.849	0.914*	1.085
#	144	65	116	33	1080	531
AIC	663.4	271.3	376.8	101.1	6144.1	2992.7
BIC	696.1	295.2	407.1	117.6	6199	3039.7

Exponentiated coefficients

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

Since I have data on much fewer firms in the organized sector, most of the predictor variables are no longer significant. It seems that input-output economies continue to be positive and significant for the formal manufacturing sector, but not for the formal services sector. For formal services, only localisation economies are now significant, and they now have a positive effect (whilst they had a significant and negative effect for informal services). This could be since formal services consist mostly of finance, insurance, IT firms etc, which may benefit more from knowledge spillovers when in proximity to one another, as compared to informal services firms, such as small shopkeepers, rickshaw drivers etc, which would suffer from higher competition with more proximity.

## VIII Conclusion

This paper seeks answers to the following questions: Where do different industries locate and what factors influence the spatial distribution of informal economic activity within countries? The main aim of the paper is to understand what drives the process of spatial variations in industrial activity, i.e. in identifying the factors that determine location decisions. It is important to understand why economic activity tends to concentrate geographically because if one can explain geographic concentration, then one can go a long way towards explaining important aspects of international trade and economic growth.

The importance of this research is underscored by two inter-related factors – that the clustering of economic activity has important implications for economic development

and that the contribution of the informal sector to economic growth and employment makes it a potent tool in influencing regional economic policy.

The empirical analysis finds that economic geography factors do have an important effect on informal firms' performance, and thus their decision to locate in a particular area. In the case of formal manufacturing in India, Lall and Mengistae (2005b) find that there is a pattern in the data whereby geographically disadvantaged cities seem to compensate partially for their natural disadvantage by having a better business environment than more geographically advantaged locations. The findings in this paper are that economic geography factors, such as inter-industry economies and industrial diversity, do in fact positively impact the attractiveness of a district to new informal activity, whilst localisation seems to be capturing competition, and so it has a negative and significant effect. This is an indication that governments may be limited in their ability to narrow regional disparities in hosting of informal economic activity, which is a source of growth and employment. However, I also find that infrastructure matters – especially with regards to communications, and keeping labour costs low helps. These are factors that public policy could directly influence.

This research also makes an important contribution to the empirical literature on industrial development and economic geography. To my knowledge, there are no papers that have examined the location of informal industry, although a handful study the effects of agglomeration economies and business environment on the spatial concentration of manufacturing in emerging countries. And whilst the theoretical development of new economic geography has received much attention in the literature, there is still much scarcity of empirical tests. Thus, this paper provides evidence of the validity of the forces emphasised by new economic geography and location theory approaches. The paper investigates the significance of agglomeration forces and market access for making a particular location attractive to firms in the unorganised sector, by trying to understand how these factors affect their performance. Thus, this paper does not attempt to perfect the theory of economic geography, but it does attempt to confront the existing tenets with data on unorganised industry in India.

Also, the policy implications of the proposed research and its findings are of significant importance – they aim to inform policy-makers of the relative importance of existing agglomeration economies and business environment in influencing the decisions of informal activity. With the importance of this sector and its potential effect on employment and economic growth, such an understanding could provide a powerful tool for spreading growth to geographically less-advantaged regions. And thus, the spatial concentration of economic activity could result in unbalanced economic development across different regions. The strength of clustering and agglomeration forces would have a direct implication for whether lagging regions can catch up with dynamic ones, or whether regional economic growth would be more 'lumpy'.

## **Bibliography**

- Amiti, M. and Javorcki, B.S. (2005) 'Trade costs and location of foreign firms in China', Working paper No. 55, IMF
- Arrow, K.J. (1962) 'The economic implications of learning by doing', *Review of Economic Studies* 29: 155-173
- Bagchi-Sen, S. (1995) 'FDI in US Producer Services: A Temporal Analysis of Foreign Direct Investment in the Finance, Insurance and Real Estate Sectors', *Regional Studies*, 29:2, 159 – 170
- Baldwin, R. (1999) 'Agglomeration and endogenous capital', *European Economic Review* 43: 253-280
- Bannerjee, A. and Iyer, L. (2005) 'History, institutions and economic performance: the legacy of colonial land tenure systems in India', *American Economic Review* 95 (4): 1190-1213
- Bayer, P. and Timmins, C. (2003) 'Estimating equilibrium models of sorting across locations', Yale University.
- Besley, T. and Burgess. R. (2004) 'Can labour regulation hinder economic performance? Evidence from India', *Quarterly Journal of Economics* 119 (1): 91-134
- Brulhart, M. (1998) 'Economic Geography, industry location and trade: The evidence', *World Economy* 21 (6): 775-801
- Brulhart, M. and Mathys, N.A. (2008) 'Sectoral agglomeration economies in a panel of European regions', *Regional Science and Urban Economics* 28: 348-362
- Chakravorty, S., Koo, J. and Lall, S.V. (2003) 'Metropolitan Industrial Clusters: Patterns and Processes', Policy Research Working Paper 3073, World Bank
- Cheng, L.K. and Kwan, Y.K. (2000) 'What are the determinants of the location of foreign direct investment? The Chinese experience', *Journal of International Economics* 52: 379-400
- Chinitz, B. (1961) 'Contrasts in Agglomeration: New York and Pittsburgh', *American Economic Review* 51: 279-289
- Coffey, W.J. and Shearmur, R.G. (2002) 'Agglomeration and dispersion of high-order service employment in the Montreal metropolitan region 1981-96', *Urban Studies* 39(3): 359-378
- Crozet, M., Mayer, T. and Mucchielle, J.L. (2004) 'How do firms agglomerate? A study of FDI in France', *Regional Science and Urban Economics* 34: 27-54
- Deichmann, U., Kaiser, K., Lall, S.V. and Shalizi, Z. (2005) 'Agglomeration, transport and regional development in Indonesia', Policy Research Working Paper No. 3477, World Bank
- Dekle, R. and Eaton, J. (1999) 'Agglomeration and land rents: evidence from the prefectures', *Journal of Urban Economics* 46: 2001-2014
- Ekholm, K. and Hakkala, K. (2007) 'Location of R&D and high-tech production by vertically integrated multinationals', *The Economic Journal* 117: 512-543
- Ellison, G. and Glaeser, G.L. (1997) 'Geographic Concentration of U.S. Manufacturing Industries: A Dartboard Approach', *Journal of Political Economy* 105 (5): 889–927.
- Enderwick, P. (1989) *Multinational Service Firms*, Routledge, London
- Evenett, S.J. and Keller, W. (2002) 'On theories explaining the success of the gravity equation', *Journal of Political Economy* 110:
- Feser, E.J. and Bergman, E.M. (2000) 'National industry cluster templates: a framework for applied regional cluster analysis', *Regional Studies* 34: 1-20

- Hanson, G.H. (1959) 'How accessibility shapes land use', *Journal of the American Institute of Planners* 25: 73-76
- Hanson, G.H. (2001) 'Scale economies and the geographic concentration of industry', *Journal of Economic Geography* 1: 255-276
- Head, H and Reis, J. (1996) 'Inter-city competition for foreign investment: Static and dynamic effects of China's Incentive', *Journal of Urban Economics* 40: 38-60
- Henderson, J.V. (2003) 'The urbanization process and economic growth: the so-what question', *Journal of Economic Growth* 8: 47-71
- Hirschman, A.O. (1958) *The Strategy of Economic Development*, New Haven: Yale University Press.
- Jacobs, J. (1969) *The Economy of Cities*. Cambridge: MIT Press.
- Kirn, T.J. (1987) 'Growth and change in the service sector of the United States: a spatial perspective', *Ann. Ass. Am. Geography* 77: 353-372
- Kleinknecht, A. and Poot, T.P. (1992) 'Do regions matter for R&D?', *Regional Studies* 26: 221-232
- Koo, J. and Lall, S.V. (2004) 'Economic Geography: Real or Hype?', Policy Research Working Paper No. 3465, World Bank
- Krugman, P. (1991) 'Increasing returns and economic geography', *Journal of Political Economy* 99: 483-499
- Lall, S.V., Koo, J. and Chakravorty, S. (2003) 'Diversity Matters: The Economic Geography of Industrial Location in India', Policy Research Working Paper 3072, World Bank
- Lall, S.V. and Chakravorty, S. (2005) 'Industrial Location and spatial inequality: Theory and Evidence from India', *Review of Development Economics* 9 (1): 47-68
- Lall, S.V., Shalizi, Z. and Deichmann, U. (2004) 'Agglomeration economies and productivity in Indian industry', *Journal of Development Economics* 73 (2): 643-673
- Lall, S.V. and Mengistae, T. (2005) 'Business environment, clustering and industry location: Evidence from Indian cities', Policy Research Working Paper No. 3675, World Bank
- Lall, S.V. and Mengistae, T. (2005b) 'The impact of business environment and economic geography on plant-level productivity: an analysis of Indian industry', Policy Research Working Paper No. 3664, World Bank
- Levinsohn, L. and Petrin, A. (2003) 'Estimating production functions using inputs to control for unobservables', *Review of Economic Studies* 70: 317-341
- Marshall, A. (1890) *Principles of Economics*. London: Macmillan
- Marshall, A. (1919) *Industry and Trade*. London: Macmillan
- Myrdal, G. (1957) *Economic Theory and Under-developed Regions*. London: Duckworth
- Olley, G.S. and Pakes, A. (1996) 'The dynamics of productivity in the telecommunications equipment industry', *Econometrica* 64 (6): 1263-1297
- Perroux, F. (1955) 'Note sur la notion de pôle de croissance', *Economique Appliqué*, 1-2: 307-320
- Rao, V. and Woolcock, M. (2001) 'Social networks and risk management strategies in poor urban communities: What do we know?', World Bank Working Paper, Nov. 15, 2001
- Romer, P.M. (1986) 'Increasing returns and long-run growth', *Journal of Political Economy* 94 (5): 1002-1037
- Rosenstein-Rodan, P. (1943) 'Problems of industrialisation of Eastern and South-Eastern Europe', *Economic Journal* 53: 202-211

- Sakhthivel, S. and Joddar, P. (2006) 'Unorganised sector workforce in India: trends, patterns and social security coverage', Economic and Political Weekly, May 27.
- Steinle, C. and Schiele, H. (2002) 'When do industries cluster? A proposal on how to assess an industry's propensity to concentrate at a single region or nation', Research Policy 31: 849-858
- Thia, J.P. (2007) 'Evolution of locations, specialisation and factor returns: two distinct waves of globalisation', LSE Draft
- Venables, A.J. (1996) 'Equilibrium locations of vertically linked industries', International Economic Review 49: 341-359
- Weber, A. (1929) Theory of the location of industries. Chicago: University of Chicago Press
- Zhao, S.X.B., Zhang, L. and Wang, D.T. (2004) 'Determining factors of the development of a national financial center: the case of China', Geoforum 35: 577-592

## Appendix 1: Location Theory and Data Summary

**Table 12: Location Theory in a nutshell**

	<b>Neo-Classical Theory</b>	<b>New Trade Theory</b>	<b>New Economic Geography</b>
<i>Seminal papers</i>	Ricardo (1817), Heckscher (1919), Ohlin (1933), Weber (1909), Vanek (1986), Deardorff (2005)	Krugman (1979, 1980, 1981), Dixit and Norman (1980), Helpman and Krugman (1985), Weder (1995)	Marshall (1920), Krugman (1991a, 1991b, 1993), Krugman and Venables (1995a, 1995b), Venables (1996), Markusen and Venables (1996), Puga and Venables (1997), Fujita, Krugman and Venables (1998), Ottaviano and Puga (1998), Duranton and Puga (2003), Ottaviano and Thisse (2004), and Fujita and Mori (2005)
<i>Market structure</i>	Perfect competition	Monopolistic competition	Monopolistic competition
<i>Determinants of location</i>	Technological differences Natural resource endowments Factor endowments and factor intensities	Degree of plant-level increasing returns Substitutability of differentiated goods Size of home market	Pecuniary externalities (labour-market pooling, input-output linkages, migration-induced demand linkages) Technological externalities Trade costs
<i>Trade structure</i>	Inter-industry trade	Intra- and inter-industry trade	Intra- and inter-industry trade
<i>Welfare effects of non-</i>	Net welfare gains All countries gain	Net welfare gains Large countries benefit more	Net welfare gains 'U curve': periphery/core can

---

<i>discriminatory trade liberalisation</i>	Owners of scarce factors lose	than small ones	lose at intermediate/advanced
		Possibility that owners of all	stages of integration
		factors gain	

---

Source: Brulhart (1998), and updated