Geographic impact of indian economy essay

Where do different industries locate? What factors influence the spatial distribution of economic activity within countries? Finding answers to these questions is important for understanding the development potential of sub national regions. This is particularly important for developing countries as they have relatively lower levels of overall investment and economic activity is concentrated in one or a few growth centers. Thus, regions that do not attract dynamic industries are not only characterized by low productivity, but also by lower relative incomes and standards of living.

These questions on industry location and their implications are not new. Examining the locational aspects of economic activity has long been of interest to geographers, planners, and regional scientists (Weber, 1909; Losch, 1940; Hotelling, 1929; Greenhut and Greenhut, 1975, Isard 1956).

However, analytic difficulties in modeling increasing returns to scale marginalized the analysis of geographic aspects in mainstream economic analysis (Krugman 1991). Recent research on externalities, increasing returns to scale, and imperfect spatial competition (Dixit and Stiglitz 1977; Fujita, et al. 1999; Krugman 1991) has led to renewed interest in analyzing the spatial organization of economic activity.

This is especially true in case of geographic concentration or clustering. Models in the New Economic Geography’ literature (see review in Fujita, Krugman, and Venables, 1999) allow us to move from the question Where will manufacturing concentrate (if it does)?’ to the question What manufacturing will concentrate where?’ These insightful theoretical models provide, for the most part, renewed analytical support for the “ cumulative causation" arguments made in earlier decades on the core-periphery relationship, on agglomeration economies, and on industrial clustering.

In this context, we are interested in finding empirical answers to these (very old) questions, and to go beyond, to ask, " What manufacturing will locate where and why"? Industry location and concentration decisions are driven by two fundamental considerations: a set of " pure" location or " economic geography" criteria, including well recognized elements such as urbanization and localization economies, market access, infrastructure availability, etc. The other is a set of " practical" or " political economy" criteria, where the state is a key player in industrial ownership and production, and uses location considerations that are different from the private sector. The private sector responds to the very strong influence of state regulations, and the result is an industrial geography that is shaped by factors of economic geography and political economy.

To understand the process of industrial location and concentration, it is important to first analyze the location decisions of firms in particular industries. The location decision of the individual firm may be influenced by several factors. These include (a) history – being accidental', (b) availability of infrastructure, proximity to buyers and suppliers, and local amenities – economic geography', and (c) local wages, taxes, subsidies, and incentives – political economy'. In this paper, we undertake two exercises: First, we develop and estimate an economic model to assess the impacts of region specific characteristics on location choices of firms in carefully defined industries. Second, we study the industrial clustering process within metropolitan areas. 4 For the empirical application in the first part, we use micro level establishment data for Indian industry to examine the contribution of regional characteristics on location choices.

Our concept of regional characteristics extends beyond its natural geography. Rather than focusing on inherent characteristics such as climate and physical distance to the coast and market areas, we analyze the economic geography of the region. Economic geography characteristics include quality of the transport network linking the location to market centers, presence of a diverse supply of buyers and suppliers to facilitate inter industry transfers, and local amenities. Drawing on testable hypotheses from the New Economic Geography (NEG) literature, this analysis will provide the micro-foundation for understanding whether a region's economic geography influences location decisions at the firm level. Only by first explaining these decisions, it will be possible to build a general framework for evaluating the overall spatial distribution of economic activity and employment.

In the second part we investigate the industrial location process within metropolitan space. Unlike in the first part, here we do not model intra-metropolitan industrial locationsnot enough is known about intra-metropolitan clustering in developing nations generally to begin hypothesis testing, nor are the kind of data available that would allow it. Instead we take a different two-step investigative approach: First we examine the patterns of industrial clustering (which industries are clustered, in which cities) and identify local clusters of specific industry groups. Second, we attempt to explain the observed patterns of industry location from a number of economic and political economic perspectives.

Using plant or “ factory” level data for 1998-99, from the Indian Annual Survey of Industries (ASI), we examine location choices in eight three-digit manufacturing industries.

These are – 1. Food Processing 2. Textiles and Textile products (including wearing apparel) 3. Leather and leather products 4. Paper products, printing and publishing 5.

Chemical, chemical products, rubber and plastic products 6. Basic Metals and Metal Products 7. Mechanical Machinery and Equipment 8. Electrical and Electronics (including computer) Equipment By grouping firms into carefully defined sectors (rather than examining for all manufacturing together), we can identify the differential impact of regional characteristics or geographic externalities across industries.

For example, in comparison to Food Processing which is closely linked to the traditional rural industrial base, industries such as Machinery, Metals, and Electrical/Electronics are relatively footloose urban industries subject to considerable agglomeration economies. These plant level data are supplemented by district and urban demographic and amenities data from the 1991 Census of India and detailed, geographically referenced information on the availability and quality of transport infrastructure linking urban areas (CMIE, 1998; ML Infomap, 1998).

The ASI data allow us to identify each plant at the district level spatially and at the four digit SIC level sectorally. 5 I.

INDUSTRY LOCATION AT THE NATIONAL SCALE This section of the paper is organized in four parts. First we present the analytic framework and specify the econometric model to examine location decisions at the firm level. 1 Next we discuss the design of spatial parameters (the economic geography variables) and provide an overview of economic performance and spatial distribution in the selected industries. Then we discuss results from the econometric analysis.

We conclude with a summary of main findings and some implications for regional policy. Analytic Framework The analytic framework to examine location of manufacturing industry primarily draws on recent findings from the NEG literature. In the new economic geography' literature Krugman (1991) and Fujita et al. (1999) analytically model increasing returns, which stem from technological and pecuniary externalities.

In models of technological externalities, inter firm information spillovers provide the incentives for agglomeration. Information is treated as a public good, and its diffusion produces benefits for each firm located in the region. Assuming that each firm produces different information, the benefits of interaction increases with the number of firms. As these interactions are informal, the extent of information exchange decreases with increasing distance.

This provides incentives for the entrepreneur to locate the firm in close proximity to other firms, leading to agglomeration.

Models from Fujita and Thisse (1996) and Fujita (1989) show that each firm benefits from information spillovers from other firms locally. If a(x, y) is the benefit to a firm at x obtained from a firm at y, and f(y) denotes the density of firms at each location yI X then, o X dy y f y x a x A) ( ) , ( ) (Thus, A(x) represents the aggregate benefit accrued to a firm at x from the information available in location X. Assuming that production utilizes land (Sf) and labor (Lf) with rents of R(x) and W(x) respectively at x, a firm located at xI X would maximize profits subject to: f f L x W S x R x A x) ( ) ( ) ( ) (– – = P In addition to pure information sharing benefits of locating near firms in the same industry, there are pecuniary benefits from sharing specialized input factors.

A large geographic concentration of similar firms can provide scale economies in the production of shared inputs. Besides, firms that utilize similar technologies and face common issues are more likely to collaborate with one another to share information on a variety of issues from problem solving to the development of new production technologies.

The benefits from locating near own industry concentrations can be augmented by the presence of inter related industries. To a large extent, the work on inter-industry externalities have been motivated by research on industry clusters. Clusters can be defined as a geographically concentrated and interdependent network of firms linked through buyer- 1 The ASI provides information on plants or factories, which are the units of production. These are roughly equivalent to the use of establishment level data.

The industry survey does not allow us to identify enterprises to whom individual establishments may be linked. (1) (2) 6 supplier chains or shared factors.

The success of an industry cluster hinges on how well such local linkages among firms, education and research institutions, and business associations can be developed. The cluster' concept particularly emphasizes interfirm relations that reduce the cost of production by lowering transaction costs among firms (Porter 1990). Interrelated firms located in proximity can reduce their transportation cost for intermediate goods and can share valuable information on their products more easily. Therefore, for profit maximizing firms, the presence of a well-developed network of suppliers in a region is an important factor for their location decision.

Transport costs are also important in determining the location choice of firms. Krugman (1991) shows that manufacturing firms tend to locate in regions with larger market demand to realize scale economies and minimize transportation cost.

If transport costs are very high, then activity is dispersed. In the extreme case, under autarky, every location must have its own industry to meet final demand. On the other hand, if transport costs are negligible, firms may be randomly distributed as proximity to markets or suppliers will not matter. Agglomeration would occur at intermediate transport costs when the spatial mobility of labor is low (Fujita and Thisse 1996).

We therefore expect a bell shaped (inverted U shaped) relationship between the extent of spatial concentration and transport costs. To include transport costs in a firm's location decision, we modify equation (2) as:) ( ) ( ) ( ) ( ) (x TC L x W S x R x A x f f – – – = P to include transport cost (TC) for the firm at location x. With a decline in transport costs, firms have an incentive to concentrate production in a few locations to reduce fixed costs.

Transport costs can be reduced by locating in areas with good access to input and output markets.

Thus, access to markets is a strong driver of agglomeration towards locations where transport costs are low enough that it is relatively cheap to supply markets. In addition to the pure benefits on minimizing transport costs, availability of high quality infrastructure linking firms to urban market centers increases the probability of technology diffusion through interaction and knowledge spillovers among firms, and also increases the potential for input diversity (Lall et al., 2001). Analytical models of monopolistic competition generally show that activities with increasing returns at the plant level are pulled disproportionately towards locations with good market access. The analytic framework in this section highlights the importance of economic geography in influencing location and agglomeration at the firm level.

Insights from NEG and regional science models suggest that own and inter-related industry concentrations, availability of reliable infrastructure to reduce transport costs and enhance market access, regional amenities and economic diversity are important for reducing costs, thereby influencing location and agglomeration of industry. Next we describe the economic geography variables that are used in this analysis. The econometric specification to evaluate the importance of these variables is described next. The empirical strategy is to estimate a cost function to see how cost (thereby profits) are affected by the economic geography of the region where the firm is located.

If specific factors related to the local economic geography have cost reducing impacts, then firms are likely to choose regions with disproportionately higher levels of these factors. (3) 7 Economic Geography Variables Market Accessibility (MA) Access to markets is determined by the distance from and the size and density of market centers in the vicinity of the firm.

The classic gravity model is commonly used in the analysis of trade between regions and countries (Evennet and Keller 2002). It 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.

Following Hansen (1959): a = j b ij j c i d S I where Ii c is the classical' accessibility indicator estimated for location i, Sj is a size indicator at destination j (for example, population, purchasing power or employment), dij is a measure of distance (or more generally, friction) between origin i and destination j, and b describes how increasing distance reduces the expected level of interaction. Empirical research suggests that simple inverse distance weighting describes a more rapid decline of interaction with increasing distance than is often observed in the real world (Weibull, 1976).

The most commonly used modified form is a negative exponential model such as ( ) a – = j a d j ne i b ij e S I 2 2 / where Ii ne is the potential accessibility indicator for location i based on the negative exponential distance decay function, most other parameters are defined as before, and the parameter a is the distance to the point of inflection of the negative exponential function. There are several options for developing accessibility indicators depending on the choice of distance variables used in the computation.

In this analysis, we use network distance as the basis of the inverse weighting parameter as developed in Lall et al (2001). Their accessibility index describes market access using information on the Indian road network system and the location and population of urban centers (ML Infomap 1998).

Own industry concentration: The co-location of firms in the same industry (localization economies) generate externalities that enhance productivity of all firms in that industry (Henderson 1988, Henderson et al. 1999, and Ciccone and Hall, 1995). There are several ways of measuring localization economies. These include 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.

We use own industry employment in the district to measure localization economies. Own industry employment is calculated from employment statistics provided in the 1998-99 sampling frame of the ASI, which provides employment data on the universe of industrial establishments in India.

The sample data used for the cost function estimation are drawn from this sampling frame. 8 Inter Industry Linkages In addition to intra-industry externality effects, we also include a measure to evaluate the importance of inter-industry linkages in explaining firm level profitability, and thereby location decisions.

There are several approaches for defining inter industry linkages : input-output based, labor skill based, and technology flow based. The most common approach is to use the national level input-output account 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 sector, we sum employment in a region weighted by the industry's input-output coefficient column vector from the national input-output account.

Thus, LINK w 1 = a = where LINK is the strength of the buyer supplier linkage, wj is industry j's national inputoutput coefficient column vector and ejr is total employment for industry j in district r. While computing the indicator, we noticed that the industry categories in NIC system and in IO accounts do not have an exact match.

Therefore, we first developed a concordance table between them before multiplying wj and ejr. Data on input output transactions are from the Input Output Transactions Table 1993-94, Ministry of Statistics and Programme Implementation. Economic Diversity In addition to buyer supplier, there are other sources of inter-industry externalities. Prominent among these is the classic Chinitz-Jacobs' diversity. The diversity measure provides a summary measure of urbanization economies, which accrue across industry sectors and provide benefits to all firms in the agglomeration. Chinitz (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.

On the consumption side, the utility level of consumers is enhanced by increasing the range of local goods that are available. At the same time, on the production side, the output variety in the local economy can affect the level of output (Abdel 1988, Fujita 1988, Rivera Batiz 1988). In this study, we use the well-known Herfindahl measure to examine the degree of economic diversity in each district. The Herfindahl index of a region r (Hr) is the sum of squares of employment shares of all industries in region r.

2) (E E H a = Unlike measures of specialization which focus on one industry, the diversity index considers the industry mix of the entire regional economy. The largest value for Hr is one when the entire regional economy is dominated by a single industry. Thus a higher value 9 signifies lower level of economic diversity. Therefore, for more intuitive interpretation of the measure, for the diversity index in our model, Hr is subtracted from unity. Therefore, DVr= 1-Hr.

A higher value of DVr signifies that the regional economy is relatively more diversified.

Econometric Specification In this section, we present the econometric specification to test the effects of economic geography factors in explaining the location of economic activity. Our basic premise is that firms will locate in a particular location if profits exceed some critical level demanded by entrepreneurs. We estimate a cost function with a mix of micro level – factory data and economic geography variables, which may influence the cost structure of a production unit. After developing the estimation methodology, we also provide a short description of the data sources.

A traditional cost function for a firm i is (subscript i is dropped for simplicity): C = f(Y, w) (1) where C is the total cost of production for firm i, Y is its total output, w is an ndimensional vector of input prices.

However, the economic geography – or the characteristics of the region where the firm is located is also an important factor affecting the firm's cost structure. Production cost of a firm is determined not only by its output and the value of its inputs, but also by ease of access to markets via reliable transportation networks, availability of a diverse input mix, and technological externalities from similar firms located in the region. Such location-based advantages have clear implications for a firms' location decision as they create cost-saving externalities. We modify the basic cost function to include the influence of location-based externalities: Cr = f(Y, wr, Ar) (2) where Cr is the total cost of a firm i in region r, wr is an input price vector for the firm in district r, and A is a m-dimensional vector of location externalities (i.

e., economic geography or agglomeration variables such as access to markets, buyer supplier networks, own industry concentration) at location r.

The model has four conventional inputs: capital, labor, energy, and materials. Therefore, the total cost is the sum of the costs for all four inputs.

With respect to agglomeration economies, it is assumed that there are four sources of agglomeration economies at the district level such that A= A1, A2, A3, A4}, where A1 is the market access measure, A2 is the concentration of own industry employment, A3 is the strength of buyer-supplier linkages, and A4 is the relative diversity in the region.

However, a joint estimation of equation (4) and (5) with restriction (6) significantly improves the efficiency of the model. The final model estimated includes two additional dummy variables that identify locational characteristics that may not be captured by agglomeration variables. Locations are categorized as rural, non-metro urban (D1), and metro urban (D2), and rural location is used as a reference category. In addition, we use a dummy variable to test if there are differences between public and private sector firms, and age to examine if profitability varies by firm age. The impact of the economic geography factors on the cost structure (or profitability) of the firm can be evaluated by deriving the elasticity of costs with respect to the economic geography variables.

From equation (4) the cost elasticities are: Y A w A C ly q lq q j jl j l l ln ln ln g g g a + a + a + = (7) In addition to direct impact on the cost structure, these location specific externalities also influence factor demand.

The impact of these variables on input demand can be derived from the cost share equations. Note that the cost share for input i, Si, can 11 be written as wivi/C, where wi is factor price of input i, vi is the quantity demanded of input i, and C is total cost. That is, i i i S w C v = and i i i w S C v ln ln ln ln – + = (8) Therefore, the elasticities of input demands with respect to agglomeration factors Al is l jl l l i A A C A v g + = ln ln (9) Data Sources We use plant level data for 1998-99 from the Annual Survey of Industries (ASI), conducted by the Central Statistical Office of the Government of India. 2 The “ factory” or plant is the unit of observation in the survey and data are based on returns provided by factories.

3 Data on various firm level production parameters such as output, sales, value added, labor cost, employees, capital, materials and energy are used in the analysis (see Table 1. 1 for details). In summary, factory level output is defined as the ex-factory value of products manufactured during the accounting year for sale.

Capital is often measured by perpetual inventory techniques. However, this requires tracking the sample plant over time.

This is a major task for micro-level research due to changes in sampling design and incomplete tracking of factories over time. Instead, in our study (and in the ASI dataset) capital is defined as the gross value of plant and machinery. It includes not only the book value of installed plant and machinery, but also the approximate value of rented-in plant and machinery. Doms (1992) demonstrates that defining capital as a gross stock is a reasonable approximation for capital. Labor is defined as the total number of employee man days worked and paid for by the factory during the accounting year.

The factory or plant level data from the Indian ASI allows us to compute input costs.

With respect to input costs and input prices, capital cost is defined as the sum of rent paid for land, building, plant, and machinery, repair and maintenance cost for fixed capital, and interest on capital. Labor cost is calculated as the total wage paid for employees. Energy cost is the sum of electricity (both generated and purchased), petrol, diesel, oil, and coal consumed. The value of self-generated electricity is calculated from the average price that a firm pays to purchase electricity.

Material cost is the total aggregate purchase value for domestic and foreign intermediate inputs. We define the price of capital as the ratio of total rent to the net fixed capital. The price of labor is calculated by dividing total wage by the number of employees. Energy and material prices are defined as weighted expenditure per unit output.

Output value is weighted by factor cost shares. 2 The ASI covers factories registered under sections 2m(i) and 2m(ii) of the Factories Act 1948, employing 10 or more workers and using power, and those employing 20 or more workers but not using power on any day of the preceding 12 months.

3 Goldar (1997) notes that factories are classified into industries according to their principal products. In some cases this causes reclassification of factories from one class to another in successive surveys, making inter-temporal comparisons difficult. 12 Data quality has been examined by cross referencing with standard growth accounting principles as well as by reviewing comments from other researchers who have used these data. The geographic attributes allow us to identify each firm at the district level.

Spatial Distribution of Indian Industry Before moving on to discussing the results from the empirical analysis, we provide a general overview on the concentration and basic characteristics of firms in the study sectors.

We first divide the economic landscape to comprise of non urban areas, urban areas, and large metropolitan areas. The metropolitan areas include the following cities and their urban agglomerations – Delhi, Mumbai, Kolkata, Chennai, Bangalore, and Ahmedabad. Using the sample data from the ASI for 1998-99, we see that average wages across industries are the highest in metropolitan areas (see Table 1. 1).

In comparison to nationwide average annual of Rs. 60, 000 per employee the country, labor remuneration is Rs. 74, 000 for metropolitan areas, Rs. 54, 000 for other urban areas and Rs. 50, 000 for non urban areas.

Among various industries, annual wages are the highest in Electrical/electronics (Rs. 101, 000 per employee) and lowest in the leather industry (Rs. 41, 000 per employee). Even within sectors (not shown in this table), wages tend to be higher as we move up the urban scale.

Productivity indicators such as output per employee and value added per employee show interesting trends. While per employee output is relatively quite high in several industries, the value added figures show quite a different situation.

For example, per employee output in computing and electronics is Rs. 344, 000 but value added per employee is only Rs. 65, 000. Similarly, the numbers for output and value added per employee are Rs. 376, 000 and Rs. 79, 000 for Chemicals and Rs.

314, 000 and Rs. 204, 000 for printing and publishing. This suggests that these industry sectors are not very efficient in transforming inputs into higher value outputs.

Spatial Distribution: We use the Ellison Glaeser (1997) index of concentration to see if industrial activity within sectors is clustered across locations.

Their concentration index can be defined as:) 1)(1 ( ) 1 ( ) (2 1 H x H x x s r i Mi i M i i i Mi – a – a – – – a = = where r is the extent to which an industry is geographically concentrated, si is the region i's share of the study industry, xi is the regional share of the total employment, and H is the Herfindahl industry plant size distribution index, 2 1 j N j z H = a = . The EG index is explicitly derived from the micro foundations of a firm's location choice. It takes on a value close to zero when the distribution of plant location is completely random (as opposed to a uniform distribution).