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Where Do New Firms Locate? The Effects of Agglomeration on the Formation and Scale of Operations of New Firms in Punjab

Maryiam Haroon and Azam Chaudhry

Abstract
The formation of new firms is an important determinant of economic development and the industrial organization literature highlights agglomeration as one of the main factors affecting the formation and scale of operations of new firms. This paper is one of the first to use developing country data to estimate the impact of localization (the benefits accruing to firms that choose to locate in a specific region within a specific industry) and urbanization (the benefits accruing to firms located close to each other regardless of the type of industry to which they belong) on new firms' formation and scale of operations. Our findings reveal that agglomeration measured through density of employment has a significant impact on the formation of new firms and on their scale of operations in Punjab.

JEL L1 L2
Keywords Agglomeration; firms; localization; urbanization

Authors
Maryiam Haroon, ✉ Department of Economics, Lahore School of Economics. Intersection Main Boulevard DHA Phase VI and Burki Road, Burki, Lahore, 53200, Pakistan, maryiam@lahoreschool.edu.pk
Azam Chaudhry, Department of Economics, Lahore School of Economics. Intersection Main Boulevard DHA Phase VI and Burki Road, Burki, Lahore, 53200, Pakistan

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1 Introduction

The formation of new firms is a key characteristic of a growing economy and the location of these newly established firms can have a profound impact on regional development. Besides the well established socioeconomic benefits and employment opportunities for the inhabitants of areas experiencing new business growth, a number of positive externalities can also accrue to the firms which decide to locate in an agglomerated region. Early work by Marshall (1920) classified the three principal benefits available to firms that choose to locate in a geographically concentrated area into: (i) labor pooling, (ii) knowledge spillovers, and (iii) availability of specialized inputs, all of which give entrepreneurs the incentive to locate in concentrated areas. Jacobs (1969) also emphasized the benefits accruing to firms in an agglomerated area from the presence of a diverse labor force. Firms located close to each other may also be able to lower costs through input sharing and accessing maintenance services through mutual contracts, all of which lead to the more effective use of resources. More recent empirical work (Rosenthal and Strange, 2010 and Otsuka, 2008) has found that localization (the benefits accruing to firms that choose to locate in a specific region within a specific industry) and urbanization (the benefits firms located close to each other regardless of the type of industry to which they belong) are the two main forces of agglomeration affecting the formation of new firms as well as their scale of operations.

This paper presents the results of a unique developing country analysis of the relationship between agglomeration and the formation of new firms as well as their scale of operations at the district level in Punjab, Pakistan. We analyze whether the presence of similar manufacturing activity in a district fosters new firm formation and also whether a concentration of firms from different industries leads to the entry of new firms into a particular district. This is done by analyzing the effects of agglomeration on the arrival and scale of operations at a district level in the manufacturing industry for 2008, incorporating socioeconomic characteristics at the district level and industrial controls using a combination of firm-level data and household survey data.

Our results indicate that firms in Punjab significantly benefit from locating in agglomerated regions, which induces firm entry to gain the benefits of agglomeration. Localization has a significant and positive impact on new firm formation, and new firm formation is higher in areas of medium-scale urbanization. The scale of operations of new entrants increases where large or medium-scale firms belonging to the same industry are present. The scale of operations also tends to increase in areas of medium-scale urbanization. Interestingly we find that the presence of large firms across different industries in an area tends to negatively affect new firm entry. We also find that average income in a particular area has a significant and positive impact on arrival as well as on the scale of operations of new firms.

The paper is organized as follows. Section 2 describes the related literature and Section 3 presents a theoretical framework. Section 4 describes the dataset used for in the empirical estimations. Section 5 presents the model to be estimated, while Section 6 discusses the results. The conclusions are presented in Section 7.

2 Literature Review

The concentration of industrial activity has been a widely studied phenomenon and agglomeration - defined as the presence of different economic units within the same

geographical location, which allows them to extract some benefit from each other's industries—occurs widely across economies (Krugman, 1995). Among the most well known examples is the computer hardware industry in Silicon Valley (Sorenson & Audia, 2000) and some of the major clusters in Pakistan include the surgical goods and sports goods industries in Sialkot (Nadvi, 1999, Chaudhry, 2010, and Nadvi, 2003).

Marshall (1920) explained that agglomeration occurs as a result of three key factors: First, firms agglomerate near suppliers or customers to save on shipping costs. Second, labor-pooling benefits can accrue to firms when labor is used effectively and different firms share skills. Third, the rate of innovation can be increased through knowledge spillovers. Rosenthal and Strange (2001) show that all these factors play a role in inducing industries to agglomerate, varying from industry to industry and depending on the commodity being produced. In their paper the authors highlighted labor pooling as a particularly important variable in determining the geographic concentration of industries, and the study's findings reveal that agglomeration is positively affected by labor pooling and input sharing.

We examine agglomeration by analyzing two main factors: urbanization and localization. Localization refers to the benefits accruing to firms that choose to locate in a specific region within a specific industry. These benefits can also be described as benefits that are external to the firm, but internal to the industry, e.g., knowledge spillovers, input sharing, and labor pooling.

Localization plays an important role in industrial growth because firms belonging to the same industry are more likely to use similar inputs and through localization, these inputs can be shared or contracts mutually formalized. The accessibility to suppliers provides significant input sharing advantages for a localized industry. Labor pooling allows firms to use specialized labor and avoid labor shortages. Knowledge spillovers are also a component of localization economies which take place across firms due to interaction of workers as they can share information about products in production, production process, innovations, existing and new technology, marketing agendas, and research and development (Parr, 2002). There are several examples of localization economies in the world, including the semiconductor industry in Silicon Valley in the US (Delgado, Porter and Stern, 2010).

Urbanization can also impact industrial growth because of a variety of benefits to firms which include the presence of diversified suppliers, specialized labor and suppliers, and diversified production (Bosma, van Stel, & Suddle, 2006). Urbanization can also provide firms with market mechanisms, transportation facilities, infrastructure, and community facilities, which make certain areas more attractive for new firms to enter (Parr, 2002). The presence of different industries also facilitates production, since one firm may be another firm's supplier and different firms can produce the same product together in different stages.

Recent empirical works has found that localization and urbanization have an impact on a firm's birth decision in a particular region due to the benefits arising from proximity. According to Sorenson and Audia (2000), new entrepreneurial activity is likely to take place in areas of geographic concentration since new firms to take advantage of the learning processes of old firms. Also new firms enter when they can visualize a developed market, existing suppliers, and the availability of factors of production at a lower cost (Bosma et al., 2006). They will use the existing specialized labor and inputs, which results in higher productivity and profits and there is also a greater likelihood of gaining the benefits of innovation.

Apart from the factors discussed above, the literature identifies a number of other determinants of new establishments, including regional characteristics. The presence of a large population in a region positively affects firm birth because it generates higher demand. According to Otsuka (2008), various location factors affect the formation of new establishments in a particular region, including market demand, agglomeration, market conditions, and factor cost. At the same time regional unemployment influences the creation of new establishments because an increase in unemployment is likely to positively affect future entrepreneurs. Workers who have lost their jobs may not want to move away from a particular area due to social ties and end up starting their own business. However, higher unemployment may also lead to a fall in regional income and, hence, to less demand for products, deterring firm entry. Firm entry is also affected by the concentration of personal or household wealth in an area, which affects the capital available to entrepreneurs. Finally, government policies attract new firms to a particular area through government spending on local infrastructure and the provision of direct assistance to firms (Reynolds, Storey, & Westhead, 1994).

The agglomeration–organization relationship has been empirically analyzed for a few countries: Using US data, Glaeser and Kerr (2009) found that labor and suppliers have a strong impact on entrepreneurship and are the main drivers of new firm formation. Delgado, Porter, and Stern (2010) also used US data to examine the relationship between agglomeration and the growth rate of entrepreneurship and their results showed that agglomeration is associated with growth in new firm formation and scale of operations by reducing the barriers to entry. Rosenthal and Strange (2010) used data from the US manufacturing, wholesale trade, fire, and services industries and found that urbanization significantly affects firm arrival and scale of operations for small establishments in the manufacturing sector, while localization affects firm arrival and scale of operations for medium establishments in the manufacturing sector. Otsuka (2008) on the other hand used Japanese data to determine the impact of regional characteristics on new firm formation and determined that localization and urbanization positively and significantly affect firm birth in the manufacturing industry and also that firm birth was significantly affected by market access, road transportation availability, labor density, the presence of highways, and lower labor costs.

In the context of Pakistan, Chaudhry, Nasir and Haroon (2012) analyzed the factors which affected new firm entry and the scale of new firms in the export clusters of Punjab. The results of their paper show that more export sector firms will enter highly concentrated industries and that firm entry increases significantly as a result of a depreciation in the trade-weighted real exchange rate, while the impact of changes in trade partner tariffs is not significant. Chaudhry (2005, 2010) illustrated the benefits of agglomeration in Pakistani clusters while Chaudhry (2011) looked at the drawbacks of agglomeration and showed that firms in clusters may be unwilling to try new suppliers when their existing ones are connected to them socially. Also Burki and Khan (2010) looked at district level industrial agglomeration and found that industrial concentration is a prominent characteristic of all districts of Punjab but is more apparent in the urbanized areas of the province.

The discussion above shows that one of the limitations of the existing empirical analyses is that it primarily focuses on developed countries. This is an obvious shortcoming since the relationship between arrival and agglomeration is as likely to hold for developing countries where there is weak contract enforcement, markets are not as developed, firms face financial constraints, and locating in agglomerated areas is more likely to foster research and development.

3 Theoretical Framework

The theoretical framework we use to explain how agglomeration can have an impact on the entry of firms is the model of Soubeyran and Thisse (1998). The model assumes price to be equal in all districts (locales) and firms choose to maximize profit. Firms are attracted to areas that have a greater stock of knowledge. There are D districts, with $d \in D = \{1,..i\}$. Each district has a fixed labor force represented by L_d in district d, earning positive wages. The district has an initial level of knowledge represented by $K_d \geq 0$, which workers have accumulated over the years.

Entrepreneurs can start a new firm by acquiring capital K_d at interest rate r and hiring labor in a particular district, and can sell their product at price p. Knowledge has been accumulated by labor, which makes districts attractive since firms acquire benefits from the existing knowledge base. The cost function of a firm in a particular district is given by

$$C_d(q_d, w_d, K_d) = w_d \ell(K_d) q_d + rk(q_d) \qquad (1)$$

where q_d is output, w_d is the wage level, K_d is the initial stock of knowledge in district d and ℓ represents workers' knowledge base, which they have acquired through knowledge spillovers. The capital $k(q_d)$ required by a new firm is constant across districts. The profit function of a firm locating in a particular district d is defined as

$$\Pi_d(q_d, w_d, K_d) = pq_d - C_d(q_d, w_d, K_d) \qquad (2)$$

By locating in a particular district, a firm's profits are affected by its initial stock of knowledge. Differentiating the profit function by K_d shows how profit is affected by knowledge, which is given by

$$\frac{\partial \hat{\Pi}_d}{\partial K_d} = w_d \hat{q}_d \ell'(K_d) > 0 \qquad (3)$$

The first-order condition indicates that profit increases with an increase in the stock of knowledge.

Positive production by firms can be shown as

$$\hat{q}_d = (K')^{-1}\{[p - w_d \ell(K_d)]/r\} \qquad (4)$$

Combining value functions (2) and (4) yields

$$\hat{\Pi}_d = \Pi_d[\hat{q}_d(w_d, K_d, r, p), w_d, K_d] = \hat{\Pi}_d(w_d, K_d, r, p) \qquad (5)$$

which Soubeyan and Thisse (1998) have shown to equal

$$\hat{\Pi}_d = r\lambda(\hat{q}_d) \qquad (6)$$

Equation (6) represents the maximum profit a firm can derive by locating in a district d. There are firms already located in district d and with their presence workers have acquired skills

through knowledge spillovers. Districts with greater knowledge stocks have higher chances of firms entering.

Assuming a positive production function and positive wages, full employment can be written as

$$n_d \hat{q}_d \ell(K_d) = L_d \qquad (7)$$

Manipulating equation (7) allows us to determine the number of firms in district d, which can be represented as

$$n_d = L_d / \hat{q}_d \ell(K_d) \qquad (8)$$

Equation (7) and the equality of profits between districts imply that $r\lambda(\hat{q}_d) = r\lambda(\hat{q}_e)$ where $d,e \in I$, and I represents districts where new firms will be established. This indicates that the output produced by firms is the same across districts in equilibrium. Hence, equilibrium output can be stated as

$$\hat{q}(I) = \sum_{d \in D} L_d \nu(K_d) \qquad (9)$$

where ν is strictly increasing.

Combining (8) and (9) gives the equilibrium distribution of firms:

$$n_d(I) = \frac{L_d \nu(K_d)}{\sum_{e \in I} L_e \nu(K_e)}, \; d \in I \qquad (10)$$

Equation (10) is the key equation and states that the higher the number of workers or the greater the knowledge spillovers in a district, the higher the number of firms entering that particular district will be. The empirical analysis in this study analyzes how the density of employment both within a particular industry and overall employment across all industries in a district affect firm arrival and scale of operations.

4 Data Sources and Descriptive Statistics

Our analysis focuses on the province of Punjab, Pakistan, and uses data from the Government of Punjab's Directory of Industries (DOI) for 2006 and 2010. The DOI is a firm-level dataset which includes more than 16,000 firms in a particular year and includes information on firms' years of establishment, employment levels, and districts. We have used the DOI 2010 to measure the arrival of firms and their scale of operations in 2008 and the DOI 2006 to measure local conditions (localization and urbanization) in 2006 and 2004[1]. Socioeconomic characteristics at the district level are incorporated using the Government of Punjab's Multiple Indicator Cluster Survey (MICS) dataset for 2003/04.

In order to understand the nature of the data, it is useful to look at some basic summary statistics. Table 1 reports the number of new establishments (arrival) and their scale of

[1] The reason for using 2006 and 2004 measures of local environment is to overcome the issue of reverse causality between the dependent variables (firm arrival and scale of operations) and the measures of local environment.

operations. As the table shows there were 312 new firms that entered the manufacturing sector in 2008, employing 10,501 employees. The table shows that localization and urbanization are higher in large-scale firms, followed by medium-scale firms.

Table 2 reports the number of new industrial firms and their scale of operations in 2008 and average localization in 2006. The data shows that the highest numbers of new entrants were in the food, textile, plastic, and metal industries. It also shows that new firms entered areas with a higher average level of localization.

It is also useful to map the geographical proximity of firms in certain areas: Figures 1 to 4 below show the geographic distribution of manufacturers in selected districts of Punjab. Previously established firms are represented by the red markers and new firms are represented by the yellow markers. The maps show that new firms enter areas where there is already a significant degree of industrial concentration, such as in the case of the Lahore and Gujranwala districts (Figures 1 and 2) as well as in the sports and food industries (Figures 3 and 4), which supports the idea that agglomeration has a significant impact on new firm entry.

5 Empirical Specification

In order to analyze how local environment—measured by the agglomeration factors of urbanization and localization—and the socioeconomic indicators of a district affect the arrival and scale of operations we estimate the following Tobit models:

$$Arrival_{id} = A_{id} = \beta_0 + \beta_1 localization_{id} + \beta_2 urbanization_d + \beta_3 X_d + \beta_{4i} + \beta_{5sp} + \varepsilon_{a,id} \quad (11)$$

$$Scale\ \ of\ \ operations_{id} = E_{id} = \alpha_0 + \alpha_1 localization_{id} + \alpha_2 urbanization_d + \alpha_3 X_d + \alpha_{4i} + \alpha_{5sp} + \varepsilon_{e,id} \quad (12)$$

where ε_a and ε_e are error terms, β_{4i} and α_{4i} are industry fixed effects, β_{5sp} and α_{5sp} are sub-provincial fixed effects and X_d represents the socioeconomic characteristics of a particular district. Equation (11) explains firm arrival (A_{id}) in industry i and district d, which is affected by localization, urbanization, and the socioeconomic characteristics of the district with industry fixed effects and sub-provincial fixed effects. Equation (12) is similarly interpreted with the dependent variable taken as the scale of operations of arrival (E_{id}).

The first dependant variable, *Arrival* (A_{id}), is the total number of newly established firms in industry *i* and district *d*, where a new entrant is defined as a firm that has reported its year of establishment as 2008. The second dependent variable, *Scale of Operations* (E_{id}), is the total employment of firms regarded as new entrants (according to the definition above) in 2008 for a specific industry *i* and district *d*.

The measure of localization is constructed by aggregating employment in each industry for every district, which allows us to examine how the presence of the same industry leads to new firm

formation in a specific area. Urbanization is measured by the level of employment in the existing establishments within a particular district. This allows us to assess how the presence of different kinds of industries has led to new firm formation in a specific area.

Localization and urbanization are initially incorporated as aggregate measures and then disaggregated into three levels of establishment: small, medium, and large. Or in other words we first look at the impact of the total number of other firms in an area (both within the same industry and in other industries) on new firm entry and size. This is followed by separately looking at the how the number of small, medium and large firms in an area (again in the same industry and across industries) affects new firm entry and size. This disaggregation is done because the impact of small firms in an area on new firm entry and size can be significantly different than the impact of medium and large firms in an area. One reason for this (discussed by Rosenthal and Strange, 2010) is that smaller firms tend to support the entry of other smaller firms because they rely more on shared infrastructure and agglomeration economies. Another potential reason for this differential impact is that large firms may be able to erect formal and informal barriers to new firm entry. In our analysis we define small establishments as those firms with fewer than 10 workers, medium establishments are defined as those firms employing between 10 and 49 workers, and large establishments are those employing 50 or more workers.

In order to account for the socioeconomic factors (X_d) that affect the birth of new firms, we incorporate district-level controls. These include the average age of the population, the male percentage of the population, average income, unemployment rate, the percentage of the population with primary education, the percentage of the population with secondary education, and the percentage of the population with tertiary education.

We also incorporate industry and sub-provincial region fixed effects to account for specific industry and regional characteristics that might have an impact on new firm formation in a specific industry and district. Examples of industry level heterogeneity include different barriers to entry, levels of innovation and technological shifts.

6 Results and Discussion

The results of our models are presented in Tables 3 and 4 which report the marginal effects for the arrival and scale of operations models using the measures of local conditions. The coefficients of the various indicators of local activity measure the effect of adding 1,000 workers to the local environment with a given establishment size. The estimations analyze the impact of localization and urbanization at an aggregated level (where we look at the overall impact of all neighboring firms regardless of size) and at a disaggregated level (where we separately look at the impact of small, medium and large neighboring firms).

Our first analysis looks at the impact of agglomeration on firm arrival and Table 3 reports the results for the arrival model estimated for the manufacturing industry in Punjab. The model incorporates the local environment for two time periods separately. So the results in columns (1), (2) and (3) measures the impact of the local environment in 2006 on firm arrival in 2008 and columns (4), (5) and (6) measure the impact of the local environment in 2004 on firm arrival in 2008[2]. In columns (1) and (4) the model is estimated using aggregate measures of localization

[2] As stated above, the reason for using 2006 and 2004 measures of local environment is to overcome the issue of reverse causality between the dependent variables (firm arrival and scale of operations) and the measures of local environment.

and urbanization, whereas in columns (2) and (5) we used disaggregated measures of localization and an aggregate measure of urbanization. Finally in columns (3) and (6) we used disaggregated measures of both localization and urbanization.

In the first set of results, column (1) of Table 3 shows that aggregate localization (or the total number of firms from the same industry in an area) has a positive and significant impact on new firm arrival, which could be for several reasons: Localization allows new firms to derive benefits from locating near similar firms and these benefits, as we have already mentioned, include knowledge spillovers, input sharing, and labor pooling. The disaggregated results in column (3) of Table 3 show that the presence of localization at all levels, small, medium and large, leads to the higher entry of new firms or in other words the presence of small, medium and large scale firms from the same industry increases firm entry in an area which reinforces the idea that new firms find benefits in locating near similar firms. It is also useful to compare the sizes of the estimated coefficients in the disaggregated analysis: the results in column (3) of Table 3 show that the relationship between localization and firm entry is greater for small firms than for medium and large firms or the presence of small neighboring firms of the same industry has a greater impact on firm entry than the presence of large neighboring firms of the same industry. One reason for this could be that large firms tend to be more vertically integrated which entails fewer opportunities for smaller firms, which tend to be subcontractors, to enter a market.

The results of the impact of disaggregated urbanization on firm arrival in column (3) of Table 3 show that new firms tend to enter areas in which there are a greater number of medium sized firms from all industries. This may be because new firms find it easier to initiate contracts with existing medium sized employers (as opposed to larger firms who may be engaged in more long term contracts) in an area. The most interesting result (shown in columns (3) and (6) of Table 3) is that the presence of large firms across all industries in an area has a negative impact on new firm entry which may be because larger firms are more attractive employers and so they get the best workers which makes it difficult for new firms to attract the required number of workers regardless of their sector. Another potential reason for this result is that new firms might not choose to enter areas where large firms are operating because they anticipate that survival in the latter's presence may be difficult, given their lower-cost advantage especially if resources in the area are constrained.

Our second model looks at the impact of agglomeration on the size of new firms and Table 4 shows the results of the impact of local environment on the scale of operations of new firms. As in Table 3, the different columns show the different levels of aggregation. First we find that localization has a positive relationship with the scale of operations of new firms at an aggregate level (column (1)) while at a disaggregated level it is positive and significant at the medium and large scale only (column (3)). This means that if there are a greater number of medium and large scale firms of the same industry present in an area, then newer entrants tend to be larger. The results which look at the impact of urbanization on scale of operations (column (3)) are similar to the results discussed above for the impact of urbanization on firm arrival. Or in other words, new firms tend to be larger in areas in which there are a greater number of medium sized firms across industries and tend to be smaller in areas where there are a larger number of large scale firms across industries. So it may be that entrants need to be large enough to either survive or compete when the existing firms are bigger, and therefore there is a selection effect (dissuading small firms from entry) which goes along with the results from the entry regressions discussed above. But entrants tend to be smaller if there are a greater number of large firms in an area which may be because large firms in an area may erect formal and informal barriers to limit the entry of larger entrants.

The results for the socioeconomic controls in our models reveal that the average income of the population in a district has a significant and positive relationship with firm arrival and scale of operations. This is consistent with the expectation that areas with higher income will encourage greater investment and firms in these areas can potentially face fewer capital constraints. The remaining controls at the district level are either insignificant or the results are not consistent across different specifications.

Our findings are broadly in line with the results found for other countries like the US and Japan (Helsley & Strange, 2002; Otsuka, 2008; Bosma et al., 2006; Figueiredo, Guimarães, & Woodward, 2009; Rosenthal & Strange, 2010) where localization and urbanization economies were found to have a significant impact on firm size and entry.

6.1 Robustness of the Effect of Agglomeration on Arrival and Scale of Operations

In order to check the robustness of our results, Table 5 presents the result of a model employing district fixed effects, in which we have removed socioeconomic and sub-provincial controls. This estimation analyzes the relationship between localization and the arrival and scale of operations of new firms. These results confirm our earlier results and find that localization has a positive and significant relationship with arrival and scale of operations[3].

7 Conclusions

This study has looked at the impact of agglomeration on new firms' formation and scale of operations in Punjab, Pakistan. While most of the existing literature has examined this relationship in developed countries like the US and Japan, our results are novel in a developing country context. We used data from the Punjab Directory of Industries for 2010 and 2006 to assess how local conditions in an area (measured by localization and urbanization) in 2006 affect the arrival and scale of operations of new firms (in 2008) in Punjab. In other words, our analysis has focused on whether new firms tend to locate in areas where the existing industrial activity is geographically concentrated.

Our findings have shown that the presence of small, medium, and large firms in one industry attract new firms from the same industry to that area. Additionally, new firms are attracted to districts where there is diverse employment (employment in different industries) in medium-sized firms. Also, new firms tend to be larger when there are more medium and large scale firms from the same industry present and new firms tend to be larger in areas where there are more medium scale firms across industries. Finally we find that the presence of large firms across all industries in an area has a negative impact on new firm entry and size.

These results imply that new firms enter agglomerated districts and that the local conditions of a district have a significant impact on new establishments and their scale. The district-level analysis is consistent with the findings of earlier studies for other countries (see Otsuka, 2008; Rosenthal & Strange, 2010; Delgado et al., 2010; Bosma et al., 2006; Figueiredo et al., 2009).

The present study has important implications for economic development and public policy. We have highlighted the mechanisms through which entrepreneurial activity can be enhanced in a

[3] We also estimated the impact of localization and urbanization by using a Herfindahl index and obtained similar results.

developing country context and our results imply that firms are more likely to enter areas where there is already significant industrial concentration. This has implications for government policy aimed at countering regional disparity in developing countries: First, it implies that governments may be wasting resources giving incentives to individual firms to go to underdeveloped areas where there are lower levels of preexisting industrial activity. Second, it suggests that there might be a need for governments to develop policies that attract a critical mass of firms to an underdeveloped area (through initiatives like industrial zones or free trade zones) before any significant industrial development can take place in these areas.

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Tables

Table 1: Number of new establishments, scale of operations, and average localization and urbanization at aggregated and disaggregated levels in Punjab

Total new establishments (arrival) in 2008	312
Total workers at new establishments (scale of operations) in 2008	10,501
District/industry pairs with > 0 arrivals in 2008	105
District/industry pairs with 0 arrivals in 2008	983
Average employment in own industry within district (localization) in 2006	
All size establishments in 2006	24,819
Small establishments (< 10 workers) in 2006	1,286
Medium establishments (10–49 workers) in 2006	5,042
Large establishments (50 or more workers) in 2006	18,491
Average employment in all industries within district (urbanization) in 2006	
All size establishments in 2006	139,634
Small establishments (< 10 workers) in 2006	10,283
Medium establishments (10–49 workers) in 2006	34,292
Large establishments (50 or more workers) in 2006	95,057

Source: Punjab Directory of Industries, Government of Punjab, 2006 and 2010.

Table 2: Number of new establishments and scale of operations in 2008 and average localization in 2006 for each industry in the manufacturing sector in Punjab

Industry	New firms in 2008	Scale of operations in 2008	Average localization 2006
Meat, fruit, vegetables, oils/fats	15	425	358
Dairy products	1	200	158
Grain mill products and animal feed	52	919	383
Other food products incl. sugar and tea	75	2,724	2,033
Beverages	8	452	259
Tobacco products	0	0	44
Textile spinning, weaving, and finishing	19	519	9,613
Other textiles	11	358	2,002
Apparel	12	1,038	2,462
Tanning and leather dressing	1	15	301
Footwear	2	26	267
Wood products	2	27	111
Paper and paper products	1	45	178
Refined petroleum products	3	80	103
Basic chemicals	4	104	201
Other chemical products	10	506	358
Rubber products	1	14	43
Plastic products	21	341	295
Glass and glass products	1	200	115
Nonmetallic mineral products	5	447	518
Metal products	21	605	700
Special-purpose machinery	2	35	286
Domestic appliances	12	161	585
Electric motors, generators, transformers	0	0	222
Electricity distribution and control apparatus	5	264	509
Electric lamps and lighting equipment	0	0	113
Medical precision instruments	11	353	1,014
Bodies for motor vehicles and trailers	0	0	1
Parts and accessories for motor vehicles	13	538	423

Source: Punjab Directory of Industries, Government of Punjab, 2006 and 2010.

Table 3: Marginal effects of Tobit estimation: Impact of agglomeration on firm arrival for manufacturing industry in Punjab

	Arrival					
	2006			2004		
	(1)	(2)	(3)	(4)	(5)	(6)
Localization						
Aggregated localization	0.00083***			0.00082***		
Localization at small scale		0.01438***	0.01029**		0.01435***	0.01029**
Localization at medium scale		0.00445*	0.00358*		0.00450*	0.00363*
Localization at large scale		0.00036	0.00045*		0.00033	0.00043
Urbanization						
Aggregated urbanization	-0.00013*	-0.00014*		-0.00013*	-0.000141*	
Urbanization at small scale			-0.00034			-0.00038
Urbanization at medium scale			0.00144*			0.00148*
Urbanization at large scale			-0.00041**			-0.00041**
Socioeconomic characteristics of a district						
Average age of population	-0.0054**	-0.00540**	-0.00340*	-0.00552**	-0.00542**	-0.00351*
Percentage of male population	-0.0035	-0.00381	-0.00144	-0.00354	-0.00374	-0.00135
Average income	0.00005***	0.00005***	0.00005***	0.00005***	0.00005***	0.00005***
Unemployment rate	0.00117	0.00135	0.00141	0.00117	0.00136	0.00148
Percentage of population with primary education	-0.00361***	-0.00284**	-0.00149	-0.00362***	-0.00284**	-0.00150
Percentage of population with secondary education	0.00410	0.00204	0.00036	0.00414	0.00206	0.00036
Percentage of population with higher education	-0.00092	-0.00061	-0.00154	-0.00093	-0.00061	-0.00154
Constant	0.24267	0.24613	0.0857	0.24027	0.24304	0.08238
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Sub-provincial regions	Yes	Yes	Yes	Yes	Yes	Yes

Note: *** = statistically significant at 1% level, ** = statistically significant at 5% level, * = statistically significant at 10% level.

Source: Authors' calculations.

Table 4: Marginal effects of Tobit estimation: Impact of agglomeration on scale of operation for manufacturing industry in Punjab

	Scale of operations					
	2006			**2004**		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Localization						
Aggregated localization	0.03193 ***			0.03118***		
Localization at small scale		0.28418	0.21611		0.28383	0.21611
Localization at medium scale		0.17276**	0.14906**		0.17454**	0.15097**
Localization at large scale		0.01924*	0.02398**		0.01809*	0.02285**
Urbanization						
Aggregated urbanization	-0.00141	-0.00164		-0.00141	-0.00163	
Urbanization at small scale			-0.03180			-0.03366
Urbanization at medium scale			0.06690**			0.06882**
Urbanization at large scale			-0.01405**			-0.01420**
Socioeconomic characteristics of a district						
Average age of population	-0.14449*	-0.14633*	-0.09964	-0.14545*	-0.14729*	-0.10417
Percentage of male population	-0.24568**	-0.25051**	-0.11673	-0.24458**	-0.24874**	-0.11289
Average income	0.00148***	0.00146***	0.00170***	0.00148***	0.00147***	0.00172***
Unemployment rate	0.00496	0.01086	0.03089	0.00508	0.01117	0.03378
Percentage of population with primary education	-0.06964	-0.05262	-0.03137	-0.07000	-0.05257	-0.03142
Percentage of population with secondary education	-0.00251	-0.05089	-0.04094	-0.00160	-0.05074	-0.04143
Percentage of population with higher education	0.02118	0.02713	-0.03649	0.02115	0.02731	-0.03673
Constant	13.6650**	13.756**	5.71314	13.614**	13.670**	5.56554
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Sub-provincial regions	Yes	Yes	Yes	Yes	Yes	Yes

Note: *** = statistically significant at 1% level, ** = statistically significant at 5% level, * = statistically significant at 10% level.

Source: Authors' calculations.

Table 5: Marginal effects of Tobit estimation: Impact of agglomeration on firm arrival and scale of operation for manufacturing industry in Punjab with district fixed effects

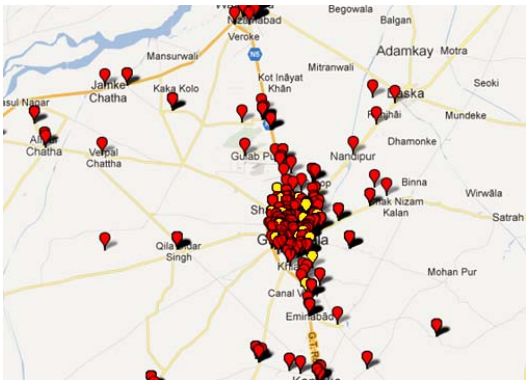
	Arrival		**Scale of operations**	
	2006	**2004**	**2006**	**2004**
	(1)	**(2)**	**(3)**	**(4)**
Localization				
At small scale	0.00037***	0.00038***	0.00780	0.00798
At medium scale	0.00010*	0.00011*	0.00435*	0.00456*
At large scale	0.00001*	0.00001*	0.00101***	0.00098**
Constant	-0.00176***	-0.00180***	-0.06546***	-0.06735***
Industry fixed effects	Yes	Yes	Yes	Yes
District fixed effects	Yes	Yes	Yes	Yes

Note: *** = statistically significant at 1% level, ** = statistically significant at 5% level, * = statistically significant at 10% level.

Source: Authors' calculations.

Figures

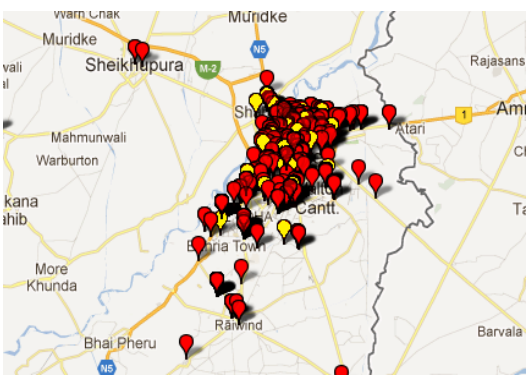
Figure 1: Location of manufacturing firms in Gujranwala, Punjab



Note: Previously established firms are represented by the red markers and new firms are represented by yellow markers. The actual number of previously established firms and new firms is greater than the number of markers since multiple firms that are located close to each geographically can be represented by one marker.

Source: Punjab Directory of Industries, Government of Punjab, 2010.

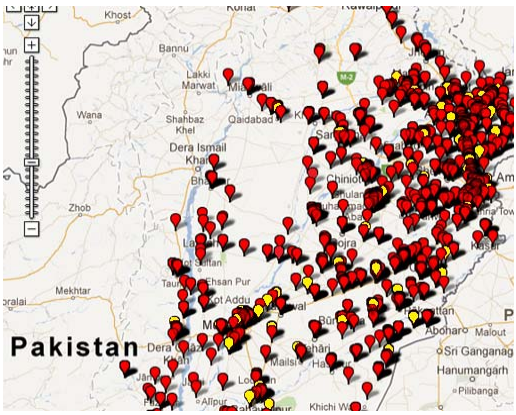
Figure 2: Location of manufacturing firms in Lahore, Punjab



Note: Previously established firms are represented by the red markers and new firms are represented by yellow markers. The actual number of previously established firms and new firms is greater than the number of markers since multiple firms that are located close to each geographically can be represented by one marker.

Source: Punjab Directory of Industries, Government of Punjab, 2010.

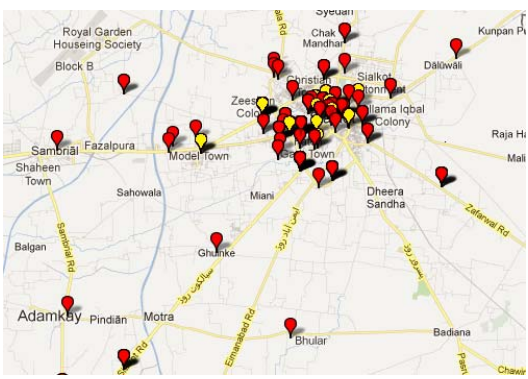
Figure 3: Location of manufacturing firms in Punjab's food industry



Note: Previously established firms are represented by the red markers and new firms are represented by yellow markers. The actual number of previously established firms and new firms is greater than the number of markers since multiple firms that are located close to each geographically can be represented by one marker.

Source: Punjab Directory of Industries, Government of Punjab, 2010.

Figure 4: Location of manufacturing firms in Punjab's sports industry



Note: Previously established firms are represented by the red markers and new firms are represented by yellow markers. The actual number of previously established firms and new firms is greater than the number of markers since multiple firms that are located close to each geographically can be represented by one marker.

Source: Punjab Directory of Industries, Government of Punjab, 2010.