CREB Working Paper No. 03-13

The Effects of Agglomeration on the Formation and Scale of Operation of New Firms

Maryiam Haroon

Centre for Research in Economics and Business
Lahore School of Economics

Centre for Research in Economics and Business (CREB)

Lahore School of Economics

Intersection Main Boulevard Phase VI, DHA and Burki Road
Lahore 53200, Pakistan
Tel: 042-36561230; 042-36560936
Email: creb@lahoreschool.edu.pk

CREB Working Paper No. 03-13

The Effects of Agglomeration on the Formation and Scale of Operation of New Firms

Maryiam Haroon
Teaching Fellow
Lahore School of Economics

First printing May 2013.

The views expressed in this document are those of the author and do not necessarily reflect the views of the Centre for Research in Economics and Business or the Lahore School of Economics.

Lahore School of Economics
Intersection of Main Boulevard, Phase VI, DHA and Burki Road
Lahore 53200, Pakistan
Tel.: +92 42 3656 1230
creb@lahoreschool.edu.pk
www.creb.org.pk

Price: Rs100

Preface

The Centre for Research in Economics and Business (CREB) was established in 2007 to conduct policy-oriented research with a rigorous academic perspective on key development issues facing Pakistan. In addition, CREB (i) facilitates and coordinates research by faculty at the Lahore School of Economics, (ii) hosts visiting international scholars undertaking research on Pakistan, and (iii) administers the Lahore School's postgraduate program leading to the MPhil and PhD degrees.

An important goal of CREB is to promote public debate on policy issues through conferences, seminars, and publications. In this connection, CREB organizes the Lahore School's Annual Conference on the Management of the Pakistan Economy, the proceedings of which are published in a special issue of the *Lahore Journal of Economics*.

The CREB Working Paper Series was initiated in 2008 to bring to a wider audience the research being carried out at the Centre. It is hoped that these papers will promote discussion on the subject and contribute to a better understanding of economic and business processes and development issues in Pakistan. Comments and feedback on these papers are welcome.

Abstract

The formation of new firms is an important determinant of economic and regional development. The literature on industrial organization highlights agglomeration as one of the main factors enhancing the formation and scale of operation of new firms. Using data from the Directory of Industries, this study estimates a model that determines the effect of local conditions on new firms' formation and scale of operation in the manufacturing sector in Punjab, Pakistan. Our findings reveal that agglomeration through localization and urbanization has a strong impact on the formation of new firms and their scale of operation.

The Effects of Agglomeration on the Formation and Scale of Operation of New Firms

1. Introduction

The formation of new firms is an important characteristic of a growing economy. Entrepreneurial growth, i.e., the birth of new establishments, is known to foster regional development. The literature has investigated various determinants of new firm formation, among which agglomeration has gained considerable attention and been identified as an important factor in the creation of new firms, particularly in developed countries.

A number of positive externalities can accrue to firms that locate in an agglomerated region. Marshall (1920) has identified three externalities/benefits available to firms that choose to locate in a geographically concentrated area: (i) labor pooling, (ii) knowledge spillovers, and (iii) specialized inputs, all of which give entrepreneurs the incentive to locate in concentrated areas. Jacob (1969) also emphasizes the benefits accruing to firms in an agglomerated area from the presence of a diverse labor force. Firms located close to each other will be able to lower costs through input sharing, labor pooling, and accessing maintenance services through mutual contracts, all of which lead to the more effective use of resources. Moreover, agglomeration allows firms to benefit from vertical integration resulting from production at different stages by different firms. Localization and urbanization are the two principal forces of agglomeration affecting the formation of new firms as well as their scale of operations.

This paper is an empirical analysis of the relationship between agglomeration and the formation of new firms as well as their scale of operations at a district level. The study's aim is to analyze, first, whether the presence of similar manufacturing activity in a district fosters new firm formation; and, second, whether a concentration of different industries leads to the entry of new firms into a particular district. Adopting Rosenthal and Strange's (2010) specification, we estimate the effects of agglomeration on the arrival and scale of operations at a district level in the manufacturing industry for 2008, incorporating

socioeconomic characteristics and industrial controls. We use firm-level data taken from the Directory of Industries (2006 and 2010) and the Multiple Indicator Cluster Survey.

The findings indicate that firms derive benefits by 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 this holds at all levels of localization. Additionally, 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. We find that average income has a significant and positive impact on arrival as well as on the scale of operations.

The paper is organized as follows. Section 2 describes the related literature and Section 3 presents the study's theoretical framework. Section 4 describes the dataset used for empirical estimation. Section 5 presents the model to be estimated, while Section 6 reveals the findings obtained from the estimations. The study's conclusions are presented in Section 7.

2. A Review of the Literature

The concentration of industrial activity has gained a significant amount of attention in recent academic research. 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 in different economies of the world, particularly in the US where the entertainment industry in Los Angeles and the computer hardware industry in Silicon Valley (Sorenson & Audia, 2000) are prominent examples. In Pakistan, most studies have focused on the concentration of firms in Punjab with particular reference to the sports industry in Sialkot and the textile industry in Faisalabad.

There are different determinants of agglomeration. According to Marshall (1920), 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. Labor pooling, however, is highlighted 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.

Firms belonging to the same industry are more likely to use similar inputs; through localization, these inputs can be shared or contracts mutually formalized. Labor pooling allows firms to use specialized labor and avoid labor shortages. Moreover, specialized services can be obtained more efficiently at lower rates, such as banking services and repair and maintenance services (Parr, 2002). Knowledge spillovers are also a component of localization economies through which firms 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.

The second aspect of agglomeration is urbanization, which benefits firms located close to each other regardless of the type of industry to which they belong. These benefits include the presence of diversified suppliers, specialized labor and suppliers, and diversified production (Bosma, van Stel, & Suddle, 2006). Market mechanisms are important and play a major role in urbanized economies (Parr, 2002).

Another important factor in the formation of new establishments in a particular area is market demand. Higher demand in a particular region will have a positive effect on firm birth since there will be larger profits for firms by selling more products. The presence of a large population in a region also 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.

Finally, agglomeration in terms of localization and urbanization has 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. Localization enables new firms to take advantage of the learning processes of old firms. 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. New firms can also visualize current demand and forecast future demand.

There is also a greater likelihood of gaining the benefits of innovation. Urbanization improves the working of markets and firms by providing market mechanisms, transportation facilities, infrastructure, and community facilities, which make certain areas more attractive for new firms to enter. 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.

Apart from the factors discussed above, the literature identifies a number of other determinants of new establishments, including regional characteristics. Regional unemployment, for instance, 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 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 analyzed for several countries such as the US and Japan. Existing entrepreneurs create an environment conducive to future entrepreneurship. Glaeser and Kerr (2009) use US data and find that entrepreneurship in a specific city is determined by demographics, natural cost advantages, and agglomeration factors specific to location. Agglomeration incorporates

customer and supplier strength, labor market strength, technology spillovers, and entrepreneurial culture (Marshall's three factors). With industry- and city-level fixed effects, labor and suppliers—Marshall's determinants of agglomeration—have a strong impact on entrepreneurship and are the main drivers of new firm formation.

Delgado, Porter, and Stern (2010) examine the relationship between agglomeration and the growth rate of entrepreneurship at the regional level for two time periods, 1991–94 and 2002–05, for the US. The initial level of startup activity, industry specialization, cluster specialization, and related economic activity is used to explain growth in startup activity with industry and region controls. Their findings reveal that agglomeration is associated with growth in new firm formation and scale of operations by reducing the barriers to entry, but that it also leads to competition for resources.

Rosenthal and Strange (2010) employ a geographic approach to examining the effect of agglomeration (urbanization and localization) on new firm arrival and scale of operations for small, medium, and large establishments in 2007 for the manufacturing, wholesale trade, fire, and services industries. They find 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) determines the impact of regional characteristics on new firm formation in Japan during 1980–1990, taking into account three location characteristics: market demand, agglomeration economies and factor cost, and market conditions for manufacturing and service industries. The study's findings reveal that characteristics affecting firm birth vary from industry to industry. Agglomeration, market access, road transportation availability, labor density, the presence of highways, and lower labor costs are highly likely to affect firm birth in the manufacturing industry. The findings also reveal that localization and urbanization positively and significantly affect firm birth in the manufacturing industry.

One of the limitations of the existing literature is that it focuses on developed countries; another is that few studies distinguish between new independent firms and new subsidiaries of existing firms.

Moreover, many studies fail to incorporate the cost of agglomeration and competition. The relation 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.

As mentioned earlier, government policies also attract new firms to a particular area through government spending on local infrastructure and direct assistance to firms. In developing countries, however, there may be less support to firms from the government. There may be several reasons for this and, correspondingly, a smaller probability of firms entering agglomerated areas, where inadequate infrastructure may raise congestion and reduce the benefits of agglomeration.

3. Theoretical Framework

As mentioned in Section 2, Marshall (1920) identifies the following benefits to firms from clustering: knowledge spillovers, the sharing of specialized inputs and new production techniques, and labor pooling. Jacobs (1969) holds that the presence of diverse employment in a particular region increases the chances of innovation taking place in an area, thereby resulting in the creation of new products. Several studies have investigated the importance of these benefits and the determinants of agglomeration. These benefits of agglomeration include the production of specialized inputs, diversity in production, specialized suppliers and labor, increase in innovation, and low transport costs. Soubeyran and Thisse (1998) emphasize knowledge spillovers in particular, the benefits of which can accrue to firms in the same industry and also to firms across different industries.

Our theoretical framework is based on 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

$$C_d(q_d, w_d, K_d) = w_d l(K_d) q_d + rk(q_d) \tag{1}$$

where q_d is output, w_d is the wage level, and K_d is the initial stock of knowledge in district d. The labor coefficient (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

$$\Pi_d(q_d, w_d, K_d) = pq_d - C_d(q_d, w_d, K_d) \tag{2}$$

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

$$\frac{\partial \hat{\Pi}_d}{\partial K_d} = w_d \hat{q}_d l'(S_d) > 0 \tag{3}$$

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

Positive production by firms can be shown as

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

Combining value functions (2) and (4) yields

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

which can also be summarized as

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

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

$$n_d \hat{q}_d | (K_d) = L_d \tag{7}$$

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

$$n_d = L_d / \hat{q}_d | (K_d) \tag{8}$$

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

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

where ν is strictly increasing.

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

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

Equation (10) 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 within a particular industry and overall employment in a district affects 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 Directory of Industries (DOI) for 2006 and 2010. Data for the

DOI has been collected for three time periods—2002, 2006, and 2010—and includes information on firms' year of establishment, employment levels, and districts. The DOI is a firm-level dataset and encompasses more than 16,000 firms in a particular year. We have used the DOI 2010 to measure the arrival of firms and their scale of operations and the DOI 2006 to measure local conditions (localization and urbanization). Socioeconomic characteristics at the district level are incorporated using the Multiple Indicator Cluster Survey dataset for 2003/04.

Table 1 reports the number of new establishments (arrival) and their scale of operations. There were 312 new firms in 2008 in the manufacturing industry, 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 establishments, their scale of operations, and average localization in 2008 according to industries within the manufacturing sector. 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.

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

Total new establishments (arrival)	312.0000
Total workers at new establishments (scale of operation)	10,501.0000
District/industry pairs with > 0 arrivals	105.0000
District/industry pairs with 0 arrivals	983.0000
Average employment in **own** industry within district (localization)	
All size establishments	24,819.5582
Small establishments (< 10 workers)	1,286.0000
Medium establishments (10–49 workers)	5,042.4710
Large establishments (50 or more workers)	18,491.0900
Average employment in **all** industries within district (urbanization)	
All size establishments	139,634.2000
Small establishments (< 10 workers)	10,283.6200
Medium establishments (10–49 workers)	34,292.6200
Large establishments (50 or more workers)	95,057.9400

Source: Directory of Industries, 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	Scale of operation	Average localization
Meat, fruit, vegetables, oils/fats	15.0000	425.0000	358.8824
Dairy products	1.0000	200.0000	158.5588
Grain mill products and animal feed	52.0000	919.0000	383.6471
Other food products incl. sugar and tea	75.0000	2,724.0000	2,033.4710
Beverages	8.0000	452.0000	259.8824
Tobacco products	0.0000	0.0000	44.3235
Textile spinning, weaving, and finishing	19.0000	519.0000	9,613.8240
Other textiles	11.0000	358.0000	2,002.6470
Apparel	12.0000	1,038.0000	2,462.412
Tanning and leather dressing	1.0000	15.0000	301.6765
Footwear	2.0000	26.0000	267.5000
Wood products	2.0000	27.0000	111.4118
Paper and paper products	1.0000	45.0000	178.3529
Refined petroleum products	3.0000	80.0000	103.2941
Basic chemicals	4.0000	104.0000	201.8235
Other chemical products	10.0000	506.0000	358.0588
Rubber products	1.0000	14.0000	43.6764
Plastic products	21.0000	341.0000	295.2647
Glass and glass products	1.0000	200.0000	115.0882
Nonmetallic mineral products	5.0000	447.0000	518.000
Metal products	21.0000	605.0000	700.9118
Special-purpose machinery	2.0000	35.0000	286.7941
Domestic appliances	12.0000	161.0000	585.4412
Electric motors, generators, transformers	0.0000	0.0000	222.8529
Electricity distribution and control apparatus	5.0000	264.0000	509.7353
Electric lamps and lighting equipment	0.0000	0.0000	113.8529
Medical precision instruments	11.0000	353.0000	1,014.559
Bodies for motor vehicles and trailers	0.0000	0.0000	1.9705
Parts and accessories for motor vehicles	13.0000	538.0000	423.2647

Source: Directory of Industries, 2006 and 2010.

4.1. Mapping Some Districts and Industries

This section illustrates the effects of agglomeration on the formation of new firms and their scale of operations in the manufacturing industry. Industrial clusters are assumed to occur widely across Punjab although the extent of this agglomeration varies between districts as well as within industries.

Figures 1 to 4 below show the geographic distribution of manufacturers in selected districts of Punjab, as represented by the dark markers. New firms are represented by light-colored markers, and the maps show that new firms enter areas where there is already a certain degree of industrial concentration, such as in the case of the sports and food industry (Figures 3 and 4) as well as in the Lahore and Gujranwala districts (Figures 1 and 2).

Figure 1: Location of manufacturing firms in Gujranwala, Punjab

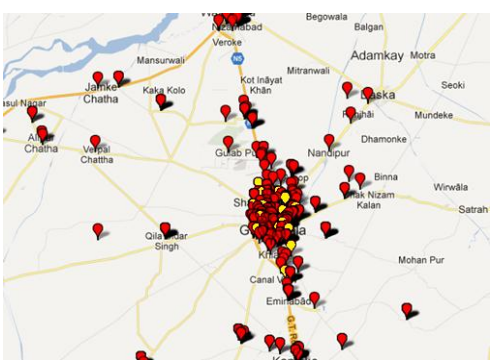


Figure 2: Location of manufacturing firms in Lahore, Punjab

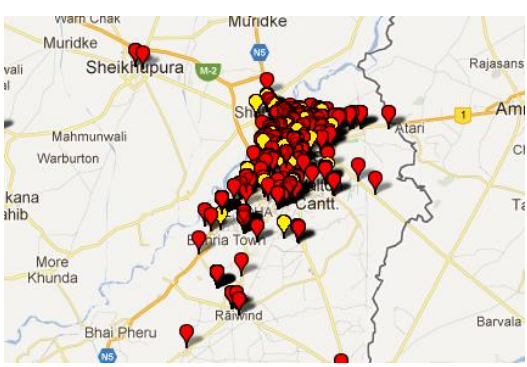


Figure 3: Location of manufacturing firms in Punjab's food industry

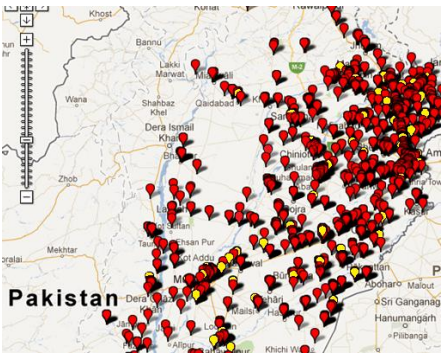
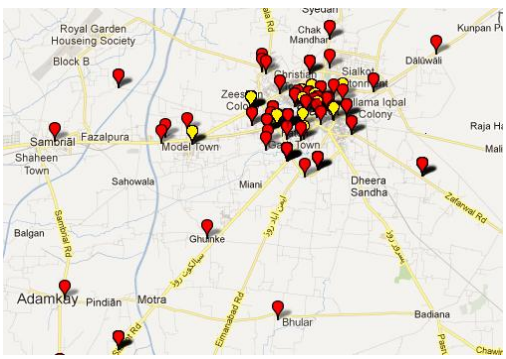


Figure 4: Location of manufacturing firms in Punjab's sports industry



5. Empirical Specification

This study investigates whether industrial agglomeration in a particular district affects the formation and scale of operation of new firms in Punjab's manufacturing industries. In other words, we examine how the local environment—measured by the agglomeration factors of urbanization and localization—and the socioeconomic indicators of a district affect the birth of new establishments. We use the empirical specification employed by Rosenthal and Strange (2010) and empirically estimate the following equations using a Tobit model:

$$Arrival_{id} = A_{id} = \beta_0 + \beta_1 localization_{id} + \beta_2 urbanization_d$$

$$+\beta_3 X_d + \beta_{4i} + \beta_{5sp} + \varepsilon_{a,id} \qquad (11)$$

$$Scale \quad of \quad operation_{id} = E_{id} = \alpha_0 + \alpha_1 localization_{id}$$

$$+\alpha_2 urbanization_d + \alpha_3 X_d + \alpha_{4i} + \alpha_{5sp} + \varepsilon_{e,id} \tag{12}$$

where ε_b and ε_e are error terms, β_{4i} and α_{4i} are industry 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 operation of arrival (E_{id}).

The first dependant variable, $Arrival$, is computed using the year of establishment. Firms for which the reported year of establishment is 2008 are regarded as new entrants. Aggregating these firms for a specific industry and district yields $Arrival$ (A_{id}) for industry i and district d. We use the employment level of new firms to gauge their scale of operation.

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. 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.

Localization and urbanization are measured at three levels of establishment: small, medium, and large. Small establishments are limited to firms with fewer than 10 workers, medium establishments are restricted to 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 establishments, 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 population with primary education, the percentage of population with secondary education, and the percentage of population with tertiary education.

We also incorporate industry and subprovincial region fixed effects to account for industry and regional characteristics that might have an impact on new firm formation in a specific industry and district. Industry fixed effects are associated with higher firm arrival in an industry due to low barriers to entry, innovation, technological shifts, and the introduction of new inputs, etc. This relationship is tested in several ways such as by measuring local conditions over two time periods, incorporating district fixed effects, and estimating the relationship using a subsample.

6. Results and Discussion

Tables 3 and 4 report the marginal effects for the arrival and scale of operations model with same local conditions (independent variables). The coefficient of local activity measures the effect of adding 1,000 workers to the local environment with a given establishment size. The estimations are carried out by analyzing localization and urbanization at an aggregated and disaggregated level (disaggregation is done by establishment size).

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. The first section measures local conditions in 2006 and the second measures local conditions in 2004. Three types of estimations are carried out: the first incorporates localization and urbanization at an aggregated level; the second estimation disaggregates localization into three levels whereas urbanization is incorporated at an aggregated level; and the third estimation incorporates localization and urbanization at a disaggregated level.

We find that localization has a positive relationship with arrival and scale of operations, which could be for several reasons. Localization allows new firms to derive its benefits by locating near similar firms. These benefits, as we have already mentioned, include knowledge spillovers, input sharing, and labor pooling. The presence of localization at all levels leads to the formation of new firms while localization at the medium and large scale has a positive relationship with the scale of operation.

The addition of 1,000 workers to a particular industry comprising small firms increases new firms by 0.0103 units. The same addition in the case of medium and large firms increases new firms by 0.00357 and 0.000457 units, respectively. The relationship between localization and

arrival is, therefore, greater for small firms than for medium and large firms. The proximity of small and medium firms belonging to the same industry is likely to allow new firms to derive the benefits of labor pooling and input sharing.

The results also indicate that the localization of large firms has a positive relationship with arrival. Large firms generate greater knowledge spillovers since research and development and innovation are more likely to take place, from which new firms can then benefit by adapting the new technology and production techniques being used.

There are several benefits available to firms that choose to locate in an urbanized area—that is, one with a concentration of firms from different industries—including the presence of a diverse labor mix. A geographical area with a diverse labor force due to the presence of diverse industries allows firms to share ideas and create new products, and increases the chances of innovation. We find that new firms tend to enter areas with employment from different industries comprising medium firms. Increasing diverse activity in medium firms by 1,000 workers, therefore, increases new firms by 0.00144 units.

The relationship between arrival and urbanization at the medium scale can be attributed to the fact that new firms are able to initiate contracts at a lower cost. New entrepreneurs are able to develop contacts with existing employers from medium firms, which larger firms might find more difficult to do. The presence of medium firms creates greater opportunity to avail mutually beneficial services such as repair and maintenance.

The presence of large firms has a negative relationship with new firm entry because large firms tend to enjoy the benefits of lower costs (through economies of scale) and might thereby be able to erect barriers to entry for new firms. 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. Large firms also have the advantage of internal sourcing.

The socioeconomic controls our model incorporates reveal that the average income of the population in a district has a significant and positive relationship with firm arrival and scale of operation. This is consistent with the expectation that higher income will encourage

greater investment and 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 consistent with the international evidence (Helsley & Strange, 2002; Otsuka, 2008; Bosma et al., 2006; Figueiredo, Guimarães, & Woodward, 2009; Rosenthal & Strange, 2010). The impact of agglomeration on new establishments and the scale of their operation is evident in this empirical analysis of the manufacturing sector. One limitation of the study is, however, that its analysis is restricted to the district level and cannot be performed at a less aggregated level. This is because data on area characteristics was not available for a narrower geographical division.

This research could be performed in the future if data at the town or city level was made available. Another avenue for future research would be to evaluate the impact of agglomeration or local conditions on other sectors such as the services industry. Finally, a distinction could be made between new firms that are set up as independent plants and those that are subsidiary plants.

6.1. Robustness of the Effect of Agglomeration on Arrival and Scale of Operation

Table 5 presents the result of a model employing district fixed effects, in which we have removed socioeconomic and subprovincial region controls. This estimation analyzes the relationship between localization and the arrival and scale of operation of new firms. The results indicate that localization has a positive and significant relationship with arrival and scale of operation. Localization at all levels has a positive relationship with arrival, and the localization of medium and large firms has a significant relationship with the scale of operation. These results are consistent with our earlier findings.

The estimations to verify robustness are carried by incorporating the local environment variable for 2004. The results continue to hold when local environment is measured in 2004, as shown in columns 4, 5, and 6 of Tables 3 and 4. These results indicate that the relationship between agglomeration and arrival is consistent even if the values for local conditions are lagged.

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	0.000007***			0.00000698**		
Localization at small scale		0.015500***	0.010300**		0.015500***	0.010300**
Localization at medium scale		0.003130	0.003570*		0.003170	0.003630*
Localization at large scale		0.000198	0.000457*		169.0000	0.000431
Urbanization						
Aggregated urbanization	0.000311	0.000298		0.000317	0.000304	
Urbanization at small scale			-0.000343			-0.000383
Urbanization at medium scale			0.001440*			0.001480*
Urbanization at large scale			-0.000412**			-0.000415**
Socioeconomic characteristics of a district						
Average age of population	-0.0036	-0.0034	-0.0034*	-0.0036	-0.0034	-0.0035*
Percentage of male population	-0.0052	-0.0055	-0.0014	-0.0052	-0.0055	-0.0014
Average income	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
Unemployment rate	0.0015	0.0013	0.0014	0.0015	0.0013	0.0015
Percentage of population with primary education	-0.0029	-0.0019	-0.0014	-0.0023	-0.0019	-0.0015
Percentage of population with secondary education	0.0011	0.0001	0.0004	0.0010	0.0000	0.0004
Percentage of population with higher education	-0.0013	-0.0007	-0.0015	-0.0013	-0.0008	-0.0015
_CONST	0.2892	0.3027	0.1055	0.2906	0.3020	0.1024
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: Author's calculations.

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

	Scale of operation					
	2006			2004		
	(1)	(2)	(3)	(4)	(5)	(6)
Localization						
Aggregated localization	0.000202 ***			0.000201***		
Localization at small scale		0.294000*	0.215000		0.294000*	0.215000
Localization at medium scale		0.148000*	0.014900**		0.150000*	0.150000**
Localization at large scale		0.016600*	0.023900**		0.015500	0.022800**
Urbanization						
Aggregated urbanization	0.0000172	0.0000167		0.0000173	0.000017	
Urbanization at small scale			-0.031700			-0.033500
Urbanization at medium scale			0.066700**			0.068600**
Urbanization at large scale			-0.014000**			-0.0000142**
Socioeconomic characteristics of a district						
Average age of population	-0.0905	-0.0939	-0.0992	-0.0922	-0.0958	-0.1038
Percentage of male population	-0.2514**	-0.2852**	-0.1163	-0.2520**	-0.2852**	-0.1125
Average income	0.0011***	0.0011**	0.0017***	0.0011***	0.0011**	0.0017***
Unemployment rate	0.0140	0.0106	0.0307	0.0143	0.0111	0.0337
Percentage of population with primary education	-0.0204	-0.0206	-0.0313	-0.019	-0.0198	-0.0313
Percentage of population with secondary education	-0.1090	-0.1234	-0.0408	-0.1117	-0.1264	-0.0413
Percentage of population with higher education	0.0140	0.0214	-0.0364	0.0155	0.0226	-0.0366

Continued...

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

	Scale of operation					
	2006			2004		
	(1)	(2)	(3)	(4)	(5)	(6)
_CONST	12.9305**	14.6778**	6.3864	12.9873**	14.6984**	6.2527
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: Author's 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 operation	
	2006	2004	2006	2004
	(1)	(2)	(3)	(4)
Localization				
At small scale	0.000377***	0.000384***	0.007810	0.007990
At medium scale	0.000109*	0.000114*	0.004350*	0.004570*
At large scale	0.0000191**	0.0000183*	0.001020***	0.000984**
_CONST	-0.0017***	-0.0018***	-0.0654***	-0.0673***
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: Author's calculations.

7. Conclusion

The study's empirical analysis has looked at the impact of agglomeration on new firms' formation and scale of operation in Punjab, Pakistan. The existing literature we have reviewed examines this relationship using datasets from the US, Japan, and the Netherlands. We have used data from the DOI 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 operation 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 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. The localization (the presence of employment from the same industry) of medium and large firms enhances firms' scale of operation. The scale of operation is also greater for firms entering areas that are urbanized, i.e., where there is employment among diverse firms. The presence of employment at the medium scale (urbanization) also increases the scale of operation.

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. The results imply that firms are more likely to enter areas where there is already significant concentration. This has implications for government policy aimed at countering regional disparity, and indicates that there might be a need for incentives and grants in order to attract investment to less developed districts.

References

Bosma, N., van Stel, A., & Suddle, K. (2006). *The geography of new firm formation: Evidence from independent start-ups and new subsidiaries in the Netherlands* (Working paper). Bedford, UK: Cranfield School of Management.

Burki, A. A., & Khan, M. A. (2010, December). *Spatial inequality and geographic concentration of manufacturing industries in Pakistan*. Paper presented at the 27th Annual General Meeting and Conference of the Pakistan Society of Development Economists, Islamabad, Pakistan.

Delgado, M., Porter, M. E., & Stern, S. (2010). Clusters and entrepreneurship. *Journal of Economic Geography*, *10*(4), 495–518.

Ellison, G., & Glaeser, E. L. (1999). The geographic concentration of industry: Does natural advantage explain agglomeration? *American Economic Review*, *89*(2), 311–316.

Figueiredo, O., Guimarães, P., & Woodward, D. (2009). Localization economies and establishment size: Was Marshall right after all? *Journal of Economic Geography*, *9*(6), 853–868.

Glaeser, E. L., & Kerr, W. R. (2009). Local industrial conditions and entrepreneurship: How much of the spatial distribution can we explain? *Journal of Economics and Management Strategy*, *18*(3), 623–663.

Helsley, R. W., & Strange, W. C. (2002). Innovation and input sharing. *Journal of Urban Economics*, *51*(1), 25–45.

Jacob, J. (1969). *The economy of cities*. London, UK: Jonathan Cape.

Marshall, A. (1920). *Principles of economics*. London, UK: Macmillan.

Ota, M., & Fujita, M. (1993). Communication technologies and spatial organization of multiunit firms in metropolitan areas. *Regional Science and Urban Economics*, *23*(6), 695–729.

Otsuka, A. (2008). Determinants of new firm formation in Japan: A comparison of the manufacturing and service sectors. *Economics Bulletin*, *18*(5), 1–7.

Parr, B. J. (2002). Missing elements in the analysis of agglomeration economies. *International Regional Science Review*, *25*(2), 151–168.

Reynolds, P., Storey, D. J., & Westhead, P. (1994). Cross-national comparisons of the variation in new firm formation rates. *Regional Studies*, *28*(4), 443–456.

Rosenthal, S. S., & Strange, W. C. (2001). The determinants of agglomeration. *Journal of Urban Economics*, *50*(2), 191–229.

Rosenthal, S. S., & Strange, W. C. (2010). Small establishments/big effects: Agglomeration, industrial organization, and entrepreneurship. In E. Glaeser (Ed.), *Agglomeration economies*. Chicago, IL: University of Chicago Press.

Sorenson, O., & Audia, P. G. (2000). The social structure of entrepreneurial activity: Geographic concentration of footwear production in the United States, 1940–1989. *American Journal of Sociology*, *106*(2), 424–461.

Soubeyran, A., & Thisse, J.-F. (1998). Learning-by-doing and the development of industrial districts. *Journal of Urban Economics*, *45*(1), 156–176.

Lahore School of Economics
Centre for Research in Economics & Business

Working Paper Series

No. 02-13
Agglomeration and Firm Turnover
Marjan Nasir

No. 01-13
Determinants of School Choice: Evidence from Rural Punjab, Pakistan
Hamna Ahmed, Sahar Amjad, Masooma Habib, Syed Ahsan Shah

No. 03-12
The Effects of External Migration on Enrolments, Accumulated Schooling, and Dropouts in Punjab
Rabia Arif, Azam Chaudhry

No. 02-12
The Determinants of Child Health and Nutritional Status in Punjab: An Economic Analysis
Uzma Afzal

No. 01-12
Investigating the Proposed Changes to Pakistan's Corporate Bankruptcy Code
Ali Hasanain, Syed Ahsan Ahmad Shah

No. 02-11
Cross-Country Growth Spillovers: Separating the Impact of Cultural Distance from Geographical Distance
Azam Chaudhry, Rabia Ikram

No. 01-11
The Determinants of Female Labor Force Participation in Pakistan: An Instrumental Variable Approach
Mehak Ejaz

No. 01-10
The Determinants of Interest Rate Spreads in Pakistan's Commercial Banking Sector
Ayesha Afzal, Nawazish Mirza

No. 03-09
Evaluating the Impact of Microcredit on Women's Empowerment in Pakistan
Salman Asim

No. 02-09
Speculative Bubbles in Karachi Stock Exchange
Nawazish Mirza

No. 01-09
Economic Development: A View From the Provinces
Khalid Ikram

No. 02-08
Agricultural Growth in Irrigated Punjab: Some Issues and Policies
Mahmood Hassan Khan

No. 01-08
Size and Value Premium in Karachi Stock Exchange
Nawazish Mirza

Policy Paper Series

No. 01-11
Pakistan and Lessons from East Asia: Growth, Equity, and Governance
Khalid Ikram

No. 01-10
A Strategy for Reversing Pakistan's Dismal Export Performance
Hamna Ahmed, Mahreen Mahmud, Naved Hamid, Talal-Ur-Rahim

These papers can be accessed at: www.creb.org.pk

The Lahore School of Economics (established in 1993) is one of Pakistan's leading centres of learning for teaching and research in economics, finance and business administration. Its objectives are (i) to train young Pakistanis as professional economists, finance managers, accountants, financial analysts, bankers, and business executives, and (ii) to undertake research in economics, management, finance, and banking to deepen the understanding of major facts, issues, and policies.

The Centre for Research in Economics and Business (CREB) is an independent research centre at the Lahore School of Economics. CREB's mission is to conduct and facilitate research, coordinate and manage the Lahore School's postgraduate program, and promote discussion on policy issues facing Pakistan. The research focus at CREB is on the management of the Pakistan economy, income distribution and poverty, and the role of the modern services sector in the area of economics; and financial markets in the area of business management.

The Lahore School's publication program comprises the Lahore Journal of Economics, Lahore Journal of Policy Studies, Lahore Journal of Business, a Text Book Series, Lahore School Case Study Journal, the CREB Working Paper Series, and CREB Policy Paper Series. The program encourages both in-house and external contributors.

Lahore School of Economics
Intersection Main Boulevard Phase VI, DHA and Burki Road
Burki Lahore 53200, Pakistan