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Agglomeration and Firm Turnover

Marjan Nasir

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

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Marjan Nasir
Teaching Fellow
Lahore School of Economics

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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

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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 geographic and industrial concentration of firms affects firm turnover, as highlighted in research on industrial organization. This study conducts a firm-level analysis to determine the impact of agglomeration on firm entry and exit in domestic industries in Punjab, Pakistan. The study also illustrates how some industries exist in clusters while others are highly dispersed. The results suggest that firm entry and exit is higher in highly agglomerated industries.

Agglomeration and Firm Turnover

1. Introduction

Traditionally, researchers in industrial organization have highlighted the role of new firms as stimulators of economic development. Some of the recent literature analyzes the factors that affect the establishment and performance of new firms. Firm entry is associated with employment changes, product and technological innovations, and other structural changes in the related industry. Furthermore, the effect on incumbent firms as they face intensified competition from new arrivals, results in improvements in productivity, which would otherwise cause them to be crowded out. This study looks at the effect of agglomeration on firm entry and exit in the manufacturing sector in Punjab, Pakistan, for the year 2005/06.

Burki and Khan (2010) have put forward evidence of industry agglomeration and factors causing the geographical concentration of firms in Pakistan. Their analysis shows that industries are concentrated in districts where infrastructure is available in the form of road density, markets, and resources such as a skilled labor force. Accordingly, new firms are more likely to locate near similar firms in order to take advantage of the positive spillovers of resource sharing or knowledge or technological spillovers. This study analyzes industrial agglomeration as a factor attracting new businesses.

Of the literature on industrial organization in Pakistan, there is presently no study on firms' entry and exit rates or the factors affecting the entry and exit of new firms; this is due primarily to the unavailability of detailed data required to carry out the analysis. We use data from the Punjab Directory of Industries (available for 2002, 2006, and 2010) to analyze firms' entry and exit rates. The paper also presents a series of maps that show how some firms locate in clusters while others are highly dispersed. The study thus aims to contribute to the existing literature on industrial organization in Pakistan by assessing the impact of spatial and industrial concentration on the entry and exit rates of manufacturing firms in Punjab. Our results conform to the existing literature, which finds that firm entry and exit is higher in more agglomerated industries, ceteris paribus.

Section 2 presents an overview of the literature on firm entry and agglomeration. Section 3 develops a theoretical model while Section 4 discusses the data and maps clustered and dispersed firms. The study's econometric model and results are presented in Sections 5 and 6. Section 7 concludes the paper.

2. Literature Review

The empirical literature assesses factors that might limit or attract the entry of new establishments by conducting analyses at the firm or plant level in the manufacturing, retail, and nonfinancial sectors. According to Hopenhayn (1992), firms in the manufacturing sector tend to be replaced by new entrants over five-year periods, with a similar trend in job turnover. The literature on firm entry differentiates between new entrants, also referred to as "greenfield' firms, and existing or diversifying firms that open plants in different geographic areas and/or expand their range of products.

The importance of studying entry rates is associated with entrants' contribution to regional development. Whether the benefits are direct, in the form of job creation, or indirect, such as improvements in supply conditions, new establishments tend to stimulate economic development in an economy. Roberts and Thompson (2003) suggest that new entrants add to resource flows into their industries, affecting the industry's productivity and contributing to product and technological innovations. These entrants also increase competition in the existing market, thus affecting firms' output and pricing and nonpricing decisions. Fritsch and Mueller (2004) indicate, however, that these benefits can take as long as eight years to occur.

A number of studies have looked at agglomeration as a source of the entry and exit of new firms (see Devereux, Griffith, & Simpson, 2004; Dumais, Ellison, & Glaeser, 2002; Carlton, 1983; Rosenthal & Strange, 2010, De Silva & McComb, 2011), and their findings suggest that agglomeration has a significant impact on the entry of small and low-tech firms, and on the survival rates of existing firms. New establishments or plants are likely to locate near their input suppliers or other similar firms or plants, allowing them to take advantage of positive externalities in the form of labor pooling or technological or knowledge spillovers. These effects vary across industries as well as geographic

areas. The findings on manufacturing plants suggest that their exit contributes to a decline in industry concentration while new plant entry increases the clustering of firms in that location. This suggests that a region's acquired characteristics rather than endowed resources are an important part of firm location.

Porter (2000) puts forward several reasons for why new businesses are more likely to be established within a cluster rather than in a remote area. Lower barriers to entry and exit are one of these reasons—resources such as assets, skills, and inputs are readily available in a cluster, therefore entry rates are higher in clusters. Similarly, a lower requirement for specialized investment also leads to higher exit rates. The combination of lower entry and exit barriers together with intense competition from incumbent firms in a cluster results in high entry and exit rates in more agglomerated industries. Firm survival becomes difficult the more agglomerated an industry is. Competition from incumbent firms becomes intense as resources become more accessible, together with a rise in spillover benefits.

There is also, however, evidence that agglomeration can negatively affect new firm entry, as measured by employment share, especially for large firms, which seem to be more fully integrated than small firms. This suggests that new firms are more likely to locate where there is a smaller geographic concentration of similar firms, but the risk of closure is also more pronounced among these firms.

Ellison and Glaeser (1997) have created an index to measure agglomeration, which uses the Gini coefficient—measuring raw geographical concentration—and the Herfindahl index of industrial concentration for each industry to determine whether the industry is agglomerated. The index requires employment data to calculate these ratios and usually takes a value of between 1 and –1: a highly agglomerated industry will have a high positive value, while a low or negative value implies that the industry is dispersed. An index value in the intermediate range depicts a moderately agglomerated industry. This study uses the Ellison-Glaeser index to measure agglomeration.

3. Theoretical Background: Agglomeration and Firm Entry in Domestic Industries

The model presented in this Section relates agglomeration through knowledge spillovers to firm entry, assuming that all other industrial factors that influence firm entry are held constant.

Marshal (1920) put forward the notion that the geographic concentration or clustering of industries enhanced learning and the exchange of knowledge between firms. These externalities imply that similar firms prefer to locate near each other to take advantage of these spillovers. Soubeyran and Thisse (1998) introduce a formalized model of this notion, which looks at knowledge spillovers (technological externality) in districts with agglomerated industrial clusters to which new firms are attracted. Knowledge spillovers in this model are acquired through "learning-by-doing" where workers share information and ideas within a particular geographic boundary, which eventually increases their productivity when they work for a firm. An assumption that holds at this point is that labor is immobile between geographic locations, such as districts and, therefore, knowledge spillovers are limited to geographic boundaries or to the industrial clusters in a particular location. Moreover, the higher the stock of knowledge or spillover effects in a cluster, the more attractive the industrial cluster becomes to new firms.

Soubeyran and Thisse's (1998) model starts with a set of locales indicated by M, with $x \in M = \{1,...m\}$, each with a fixed labor supply L_t^x in locale x in period t; an initial stock of knowledge $s_0^x \geq 0$; and an identical continuum of entrepreneurs who can start a new firm with capital K_t^x at an interest r_t, and sell homogenous goods in the world at price p_t. There is an infinite number of periods $t = 1, 2\ldots$, and entrepreneurs can set up a firm in a new location in a new period. In order to incorporate Marshallian industrial districts (indicating an agglomerated industrial area), labor accumulates knowledge over time through different social interactions (hence the spillover effect), and firms can take advantage of these spillovers only if they locate in that locale. Lastly, we assume that $\mathrm{I}'(S_{t-1}^x) < 0$.

The cost function that a firm faces in locale x in period t is given by:

$$C_t^x(q_t^x, w_t^x, S_{t-1}^x) = w_t^x \mathrm{l}\,(S_{t-1}^x) q_t^x + r_t K(q_t^x) \tag{1}$$

where q_t^x is output, w_t^x represents wages, and S_{t-1}^x is the sum of past productions. The labor coefficient $\mathrm{l}\,(S_{t-1}^x)$ takes into account the skills accumulated by labor through knowledge spillovers over time; the more knowledge spillovers, the higher the skills accumulated over time. The amount of capital $K(q_t^x)$ required by a new firm is the same across locales.

The profit of a firm established in locale x in period t is denoted by:

$$\Pi_t^x(q_t^x, w_t^x, S_{t-1}^x) = p_t q_t^x - C_t^x(q_t^x, w_t^x, S_{t-1}^x) \tag{2}$$

Firms deciding to enter a new location in period t, maximize profit Π_t^x with a negligible impact on total industry output. The term S_{t-1}^x is the technological externality (knowledge stock) affecting firms in the locale or industry. By differentiating equation (2) with respect to S_{t-1}^x, we can gauge the effect of knowledge on firm profit:

$$\frac{\partial \hat{\Pi}_t^x}{\partial S_{t-1}^x} = -w_t^x \hat{q}_t^x \mathrm{l}\,'(S_{t-1}^x) > 0 \tag{3}$$

Equation (3) above shows that firm profits in a locale increase with the knowledge stock accumulated there.

The following expression indicates positive production by firms:

$$\hat{q}_t^x = (K')^{-1}\{[p_t - w_t^x \mathrm{l}\,(S_{t-1}^x)]/r_t]\} \tag{4}$$

Given w_t^x and S_{t-1}^x, equation (3) is maximized with respect to q_t^x to obtain:

$$\frac{\partial \pi_t^x}{\partial q_t^x} = P_t - w_t^x \mathrm{l}\,(S_{-1}^x) - r_t K'(q_t^x) \le 0,\ q_t^x \frac{\partial \pi_t^x}{\partial q_t^x} = 0,\ q_t^x \ge 0 \tag{5}$$

with the second-order condition partially satisfied. Let $\hat{q}_t^x$ be the unique solution to equation (5). The following expression indicates positive production by firms. Combining equations (5) and (2) yields the value function

$$\hat{\Pi}_t^x = \Pi_t^x[\hat{q}_t^x(w_t^x, S_{t-1}^x, r_t, p_t), w_t^x, S_{t-1}^x] = \hat{\Pi}_t^x(w_t^x, S_{t-1}^x, r_t, p_t) \tag{6}$$

which can be further summarized as:

$$\hat{\Pi}_t^x = r_t \lambda(\hat{q}_t^x) \tag{7}$$

Equation (7) gives the maximum profit that a firm can make when it locates in locale x, and helps determine the equilibrium distribution of firms across locales.

In the model's short-run equilibrium, there are no firms located at $t = 0$ and the initial knowledge stock is $S_0^x \geq 0$. To maximize profits, firms set up in locale x in $t = 1$. Firms are attracted to those locales where the knowledge stock is highest, indicating a more productive labor force. In equilibrium, profits are equal between locales. Given full employment, the number of firms (n_t^x) in locale x is indicated by:

$$n_t^x = L^x / \hat{q}_t^x \mid (S_{t-1}^x) \tag{8}$$

The condition that profits are equal between locales, together with equation (8), implies that $r_t \lambda(\hat{q}_t^x) = r_t \lambda(\hat{q}_t^y)$ with $x, y \in I_t$ (where I_t represents the locales where firms establish). This shows that firms' output in equilibrium is the same across locales. Equilibrium output is denoted by:

$$\hat{q}_t(I_t) = \sum\nolimits_{x \in M} L^x v(S_{t-1}^x) \text{ (where } v \text{ is strictly increasing)} \tag{9}$$

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

$$n_t^x(I_t) = \frac{L^x v(S_{t-1}^x)}{\Sigma_{y \in I_t} L^y v(S_{t-1}^y)}, \; x \in I_t \tag{10}$$

Interpreting equation (10) is important because it shows that the higher the labor (L) or knowledge spillover (S) in locale I_t, the higher the number of new firms (n) that will set up there.

4. Data

This study uses the Directory of Industries compiled by the Punjab government, which provides data for 2002, 2006, and 2010, and includes, on average, approximately 18,000 manufacturing firms. The directory also gives the names and addresses of all the firms in nearly 180 industries (two-digit) in Punjab. Other information includes their year of establishment, employment, and initial investment. (Table A1 in the Appendix gives the total number of firms in each industry for 2002 and 2006.) In almost all the industries, the number of firms has either increased or decreased, indicating volatility in firm turnover. We use the data on employment to calculate the agglomeration index and determine firm size, while using initial investment as a control factor to proxy for sunk costs.

Table 1 provides industry- and firm-level descriptive statistics. There were 180 (two-digit) industries with 18,007 firms operating in Punjab in 2006. On average, firms had operated for about 17 years, employing around 48 workers each. From 2002 to 2006, the mean firm entry rate was 10 percent, and the exit rate was 25 percent. In terms of agglomeration, industries were, on average, more agglomerated, as indicated by a positive Ellison-Glaeser index value. Output growth remained high over the five-year period, with firms investing an initial amount of approximately PKR 40 million on average (with a median value of PKR 2,648,000).

Table 1: Descriptive statistics: All industries, 2006

Number of industries	180
Number of firms	18,007
Mean firm age	17
Mean number of employees	48
Mean industry entry rate	0.10
Mean industry exit rate	0.25
Mean industry E-G index (2002)	0.1554
Mean industry output growth (%)	86
Mean initial investment (PKR)	40,892

Source: Directory of Industries, Government of Punjab.

Table 2 lists the top 20 industries in Punjab in descending order of entry, while Table 3 lists the top 20 industries in descending order of exit. Table 4 shows the concentration of agglomeration, measured by the Ellison-Glaeser index.

Table 2: Top 20 industries with highest entry rates in Punjab, 2006

	Industry	Entry rate
1	Gypsum	0.93
2	Mineral water	0.55
3	Fire-fighting equipment	0.50
4	Motorcycles/rickshaws	0.50
5	Radios/televisions	0.50
6	Welding electrodes	0.50
7	Zips	0.50
8	Knitted textiles	0.45
9	Embroidery	0.43
10	Cones	0.43
11	Yarn doubling	0.41
12	Powder coating	0.33
13	Pesticides and insecticides	0.32
14	Citrus grading	0.29
15	Fruit juices	0.29
16	Readymade garments	0.28
17	Gas appliances	0.28
18	Textile made-ups	0.28
19	Ceramics	0.28
20	Fertilizer	0.27

Note: Entry rate in industry i = number of new firms in industry i in 2006 that did not exist in 2002, divided by total number of firms in industry i in 2006.
Source: Directory of Industries, Government of Punjab.

Table 3: Top 20 industries with highest exit rates in Punjab, 2006

	Industry	Exit rate
1	Bus bodies	0.99
2	Nuts and bolts	0.97
3	Spices	0.95
4	Electroplating	0.89
5	Electric furnaces	0.88
6	Bakery products	0.85
7	Photographic goods	0.83
8	Razors/safety razors/blades	0.83
9	Dyes and blocks	0.80
10	Knitted textiles	0.79
11	Ice cream	0.79
12	Zinc sulphate	0.75
13	Bicycles	0.75
14	Handheld tools	0.67
15	Bulbs and tubes	0.67
16	Refinery	0.67
17	Unani medicines	0.67
18	Weights and scales	0.66
19	Agricultural implements	0.64
20	Pins and clips	0.60

Note: Exit rate in industry i = number of firms in industry i in 2002 that did not exist in 2006, divided by total number of firms in industry i in 2002.
Source: Directory of Industries, Government of Punjab.

Table 4: Top 20 most agglomerated industries in Punjab, 2006

	Industry	E-G index
1	Electroplating	1.5948
2	Citrus grading	1.1967
3	Wool scouring	1.1652
4	Powder coating	1.1072
5	Musical instruments	1.0586
6	Weight and scales	1.0529
7	Sports goods	1.0333
8	Leather garments	0.9820
9	Surgical instruments	0.9380
10	Utensils (all sorts)	0.9254
11	Belts	0.9214
12	Canvas shoes	0.8583
13	Cloth raising	0.8529
14	Cutlery	0.8209
15	Fiber tops	0.8169
16	Polyester yarn	0.8091
17	Crown corks	0.7284
18	Fiberglass	0.7151
19	Sanitary fittings	0.7131
20	Machine tools	0.7128

Note: The Ellison-Glaeser index in 2002 is measured using employment data.
Source: Directory of Industries, Government of Punjab.

4.1. Clustering and Dispersion of Firms in Punjab: An Aerial View

The idea that new firms are likely to locate near or around similar firms, thus leading to the formation of industrial clusters, can be illustrated using maps. Figures 1 to 8 were developed based on firms' addresses from the Directory of Industries for 2010, this is the first such mapping exercise carried out for this area. Many industrial clusters in Punjab have formed in specific areas, making it easier for incumbent as well as new firms to gain access to the necessary resources and technology. On the other hand, there are also industries that are completely dispersed and thus do not comply with the spatial concentration hypothesis put forward in the

literature. Figures 1 to 4 show examples of some industries that exist in clusters because they require more specialized inputs; Figures 5 to 8 show some industries that are highly dispersed in Punjab.

Figure 1: Rubber industry

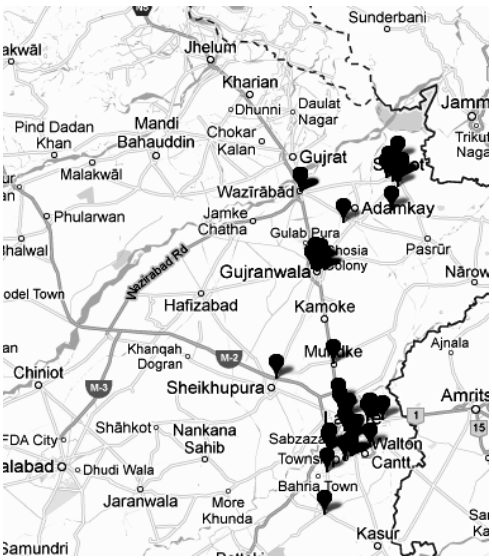


Figure 2: Surgical instruments industry

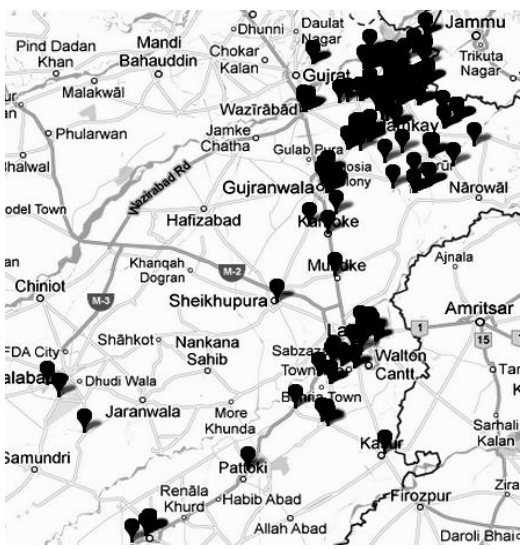


Figure 3: Sports industry

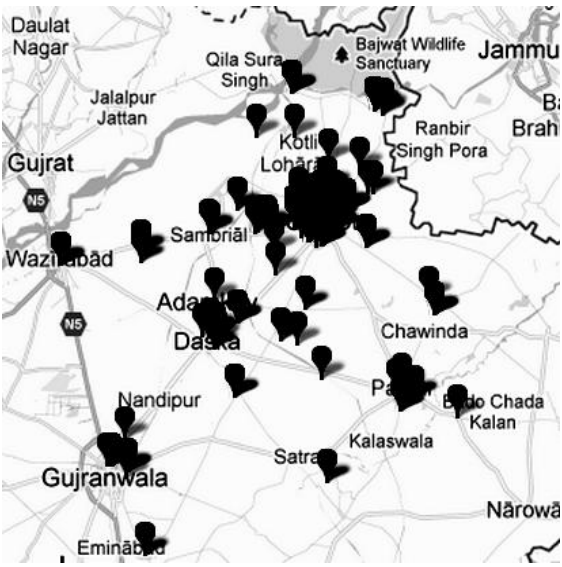


Figure 4: Iron and steel industry

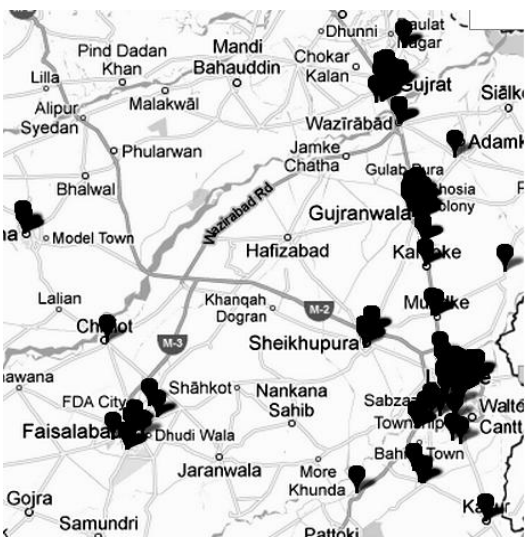


Figure 5: Sugar industry

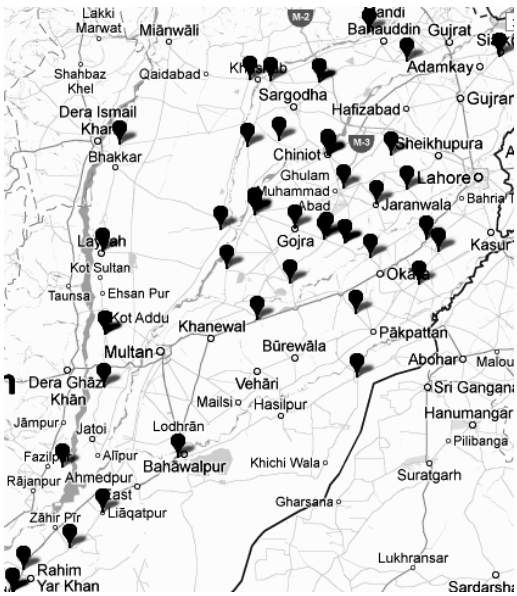


Figure 6: Cement industry

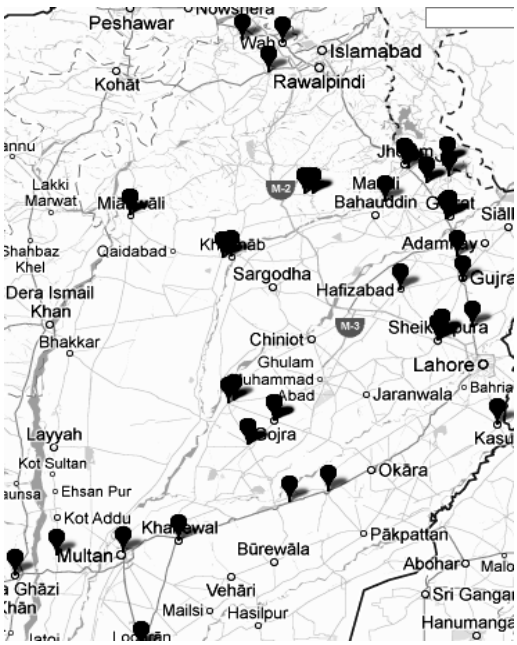


Figure 7: Cotton industry

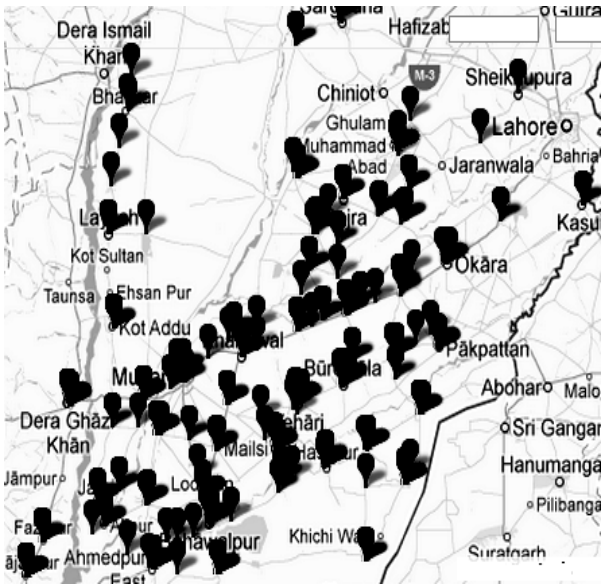
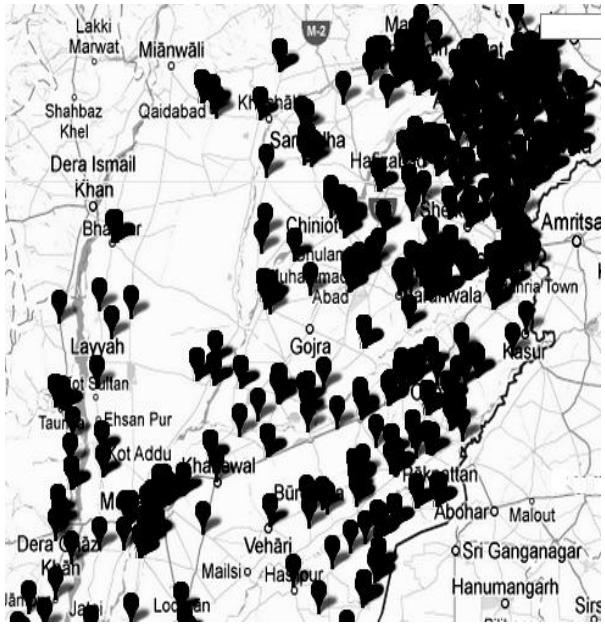


Figure 8: Rice industry



5. Econometric Model

This section presents the econometric model and estimation techniques used. The model is designed to determine the impact of agglomeration on firm entry and exit while controlling for other industry-level factors that affect entry and exit. Table 5 lists and defines all the variables used.

Table 5: Variables' names and definitions

Explanatory variable	Definition
E-G index	The Ellison-Glaeser index of agglomeration is constructed using firm employment and consists of the Gini coefficient and the Herfindahl index
Firm age	Average age of a firm in an industry (since establishment)
Firm size	Average size of a firm in an industry as measured by the number of employees
Output growth	Change in output during the time period
Sunk cost	Average initial investment of firms in an industry

The literature provides a number of estimation models of firm turnover and agglomeration (Devereux et al., 2004; Dumais et al., 2002; and Carlton, 1983), and the following is an adaption of previous models that estimate the entry of new firms and exit of existing firms against the agglomeration index, while controlling for other factors that affect firm entry and exit. This cross-sectional analysis includes all 180 manufacturing industries in Punjab for 2005/06.

$$Entry_i = E_i = \frac{N_i}{I_i} = \beta_0 + \beta_1 E\text{-}Gindex_i + \beta_2 X_i + \varepsilon_i \quad (11)$$

E_i is the entry rate in industry i and is equal to the number of new firms in industry i in 2006 that did not exist in 2002 (N_i), divided by the total number of firms in industry i in 2006 (I_i). *E-Gindex* represents the Ellison-Glaeser index of agglomeration for industry i in 2002. X is a vector of control variables, including firm size, firm age, sunk cost, and output growth.

To measure the entry rate of new firms, we compare the datasets for 2002 and 2006, i.e., firms included in the 2006 dataset but absent from the 2002 dataset were considered new entrants. The subscript i refers to the 180 industries that constitute the manufacturing industry in Punjab.

$$Exit_i = Z_i = \frac{M_i}{F_i} = \beta_0 + \beta_1 E\text{-}Gindex_i + \beta_2 X_i + \varepsilon_i \quad (12)$$

Z_i is the exit rate in industry i, and is equal to the number of firms in industry i in 2002 that did not exist in 2006 (M_i), divided by the total number of firms in industry i in 2002 (F_i). *E-Gindex* is the Ellison-Glaeser index of agglomeration for industry i in 2002. X is a vector of control variables, including firm size, firm age, sunk cost, and output growth.

The exit of firms from the industry is determined by comparing the 2002 and 2006 datasets: firms listed in the 2002 dataset but not in the 2006 dataset are considered to have exited the industry. The exit rate is thus the number of firms that have exited as a proportion of the total number of firms in the industry in 2002.

The vector of control variables for both regression equations includes other industry factors that impact the entry and exit of firms, including the average size of firms in the industry, firm age, firms' sunk cost or initial investment, and the industry's output growth. We use employment data to measure firm size and the year of establishment to determine the firm's age. The output growth variable measures the change in industry output from 2002 to 2006.

We use the Ellison-Glaeser index (*E-Gindex*) to measure agglomeration, which takes a value between 1 and –1. The higher the value of the index, the more concentrated the industry is likely to be. Equation 13 models the index for industry i:

$$E\text{-}Gindex_i = \gamma_i = \frac{G - (1 - \Sigma_j X_j^2) H_i}{(1 - \Sigma_j X_j^2)(1 - H_i)} \quad (13)$$

G is the Gini coefficient, i.e., $\Sigma_j (S_{ij} - X_j)^2$; X_j is the share of the districts' (j) total employment in Punjab; S_{ij} is the share of the districts'

j employment in industry i in Punjab's share of employment in industry i; H_i is the Herfindahl index for industry i, which is equal to $\Sigma_k Z_k^2$; and Z_k is the kth firm's share in the industry's employment.

The Gini coefficient (G) and Herfindahl index (H) are useful measures to study on their own. The Gini coefficient is used as a measure of income inequality across a population, while in the E-G index (γ), it is used to represent raw geographic concentration. From the equation above, we can see that it has a positive impact on agglomeration, i.e., a rise in G will lead to a rise in γ. Intuitively, this means that the greater the number of firms present in a location, the more agglomerated an industry is likely to be. The Herfindahl index is a measure of industry concentration, and is also a rough indicator of the market structure to which the industry belongs. According to the specification above, it is negatively related to the agglomeration index, implying that a high value of H is obtained when there are few firms in the industry, resulting in lower agglomeration. Conversely, a low value of H will be associated with a large number of firms in the industry, with greater agglomeration.

We use ordinary least squares (OLS) (robust regression) to calculate the regression coefficients for both the entry and exit analysis. The model includes dummies representing large industries to control for other industry-level influences on the firm turnover-agglomeration analysis.

6. Results and Discussion

6.1. Firm Entry, Exit, and Agglomeration Estimation Analysis

This section presents the results of our analysis of the impact of agglomeration on firm entry and exit in manufacturing industries in Punjab from 2002 to 2006. Agglomeration implies spillover benefits arising from geographic and industrial concentration. Our results support the findings of studies (see Devereux et al., 2004; Dumais et al., 2002; Carlton, 1983; Rosenthal & Strange, 2010; De Silva & McComb, 2011) that have argued that agglomeration has a significant impact on the entry and exit rates of firms, and that the two rates are likely to be correlated. Firms tend to locate near similar firms or in clusters in order to take advantage of spillovers in the form of access to technology, knowledge sharing, and labor with the required skills. The results also suggest that firm exit is higher in highly agglomerated industries, which indicates that competition is intense and

that weaker firms find it difficult to survive when incumbent firms start taking advantage of the greater spillover benefits.

Table 6 presents the OLS regression results of the entry-agglomeration and exit-agglomeration analysis. The first two columns give the firm entry and agglomeration analysis coefficients; column (2) controls for the effects of large industries (in terms of size) by incorporating industry dummies, while column (1) excludes them. The firm entry variable is the ratio of new firms that have entered between 2002 and 2006 to the total number of firms present in 2006. As shown in column (2), the Ellison-Glaeser index of agglomeration is positive and significant, implying that more firms will enter highly agglomerated industries than dispersed ones, holding other industry factors constant.

The results for the exit-agglomeration analysis are divided into those with and those without the industry dummies (columns 3 and 4, respectively). Firm exit is the ratio of firms that were operating in 2002 but did not exist in 2006 as a proportion of the total firms present in 2002. Column (4) of Table 6 indicates that firm exit is positively influenced by the Ellison-Glaeser index, confirming that firms are more likely to close down in highly agglomerated industries.

This result can be further scrutinized by considering the impact of the two components of the Ellison-Glaeser index, i.e., the Gini coefficient and Herfindahl index. Since both components measure the concentrations of firms, the more firms present either geographically or within an industry, the more competitive the industry is likely to be, thus making it difficult for existing firms to survive. If firms associate highly agglomerated industries with higher spillover benefits, then intuitively there will be a greater number of entrants. It is also possible, however, that weaker firms are being attracted to the cluster and are more liable, therefore, to exit.

Among the control factors, output growth has a direct impact on the entry of new firms, and this result only holds when industry dummies are controlled for. Industries enjoying output growth will be relatively more attractive to new firms in the hope of achieving higher output and, in turn, higher profits.

Another factor with a significant impact on firm entry is firm age, which has a negative impact on firm entry and a positive impact on firm exit.

The higher the number of old firms present in an industry, the lower the number of new firms entering or the higher the number of exiting firms in that industry, holding other factors constant. Older, more well-established firms may have stronger networks together with a certain degree of customer loyalty, which create a barrier for new firms or make it difficult for weaker firms to survive.

The results also show that the variables high cost and firm size have no significant impact on either entry or exit, even though other analyses have found them to impact firm entry and exit significantly.

Table 6: Entry-agglomeration and exit-agglomeration regression results

	Entry		Exit	
Variable	**(1)**	**(2)**	**(3)**	**(4)**
EG-index	0.007	0.016**	-0.015	0.036**
	(0.0089)	(0.006)	(0.026)	(0.018)
Output growth	0.003	0.009***	0.002	-0.005
	(0.0023)	(0.002)	(0.007)	(0.005)
Firm age	-0.003***	-0.001*	0.002	0.003***
	(0.0007)	(0.003)	(0.001)	(0.001)
High cost (dummy = 1 if sunk cost > PKR 50 mn)	0.002	0.036	0.027	0.028
	(0.0219)	(0.022)	(0.063)	(0.066)
Firm size (small) (dummy = 1 if < 49 employees)	-0.011	-0.002	0.083	-0.028
	(0.024)	(0.024)	(0.068)	(0.072)
Firm size (medium) (dummy = 1 if ≥ 49 & < 100 employees)	0.030	0.015	0.064	-0.085
	(0.026)	(0.025)	(0.074)	(0.072)
Firm size (large) (dummy = 1 if ≥ 100 employees)	-	-	-	-
Industry dummies	No	Yes	No	Yes
Cons.	0.129***	0.044*	0.118*	0.081
	(0.026)	(0.024)	(0.070)	(0.070)
	N = 180	N = 180	N = 180	N = 180
	R2 = 0.08	R2 = 0.46	R2 = 0.02	R2 = 0.44

Note: *** = statistically significant at 1 percent level, ** = statistically significant at 5 percent level, * = statistically significant at 10 percent level. Robust standard errors are in parentheses.
Source: Author's calculations.

6.2. Data Limitations and Future Research

The Directory of Industries for Punjab is not published annually, thus restricting our entry and exit analysis to five-year-interval, rather than annual, estimations. Given the sometimes uncertain accuracy of its information on firms' names and addresses, it is possible that entry and exit rates may have been understated or overstated since some firms might spell their names differently, affecting the possibility of their being included as an entering or exiting firm. This problem was, however, minimized by matching the firms by their year of establishment. The lack of information on firm sales, use of technology, and leverage also limited the use of control variables in the estimations. Finally, this study only incorporates industries in Punjab, and could be extended to other provinces, given the availability of data.

7. Conclusion

This paper attempts to contribute to the industrial organization literature on Pakistan by looking at the domestic factors that affect firm turnover in Punjab. New firms are attracted to industries where agglomeration economies are present in the form of human and capital spillover benefits. Entry also occurs in industries where output growth is high, since higher output gives new establishments an opportunity to grow. Additionally, the results suggest that new firms will hesitate to enter industries where older firms already exist since the latter are likely to have a stronger market share. The exit rate is also higher in these industries since weaker firms may find it difficult to survive.

The study provides insight for industrial policies with regard to promoting clusters where firms are highly integrated and where resource and technological flows help firms to improve productivity and growth. Industries are likely to grow together by promoting competition among firms if they are more agglomerated.

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Appendix

Table A1: Number of firms in the manufacturing industry in Punjab, 2002 and 2006

	Industry	2002	2006		Industry	2002	2006
1	Air conditioners/ refrigerators/ deep-freezers	10	15	91	Liquified petroleum gas (LPG)	0	6
2	Agricultural implements	751	419	92	Lubricants	21	10
3	Aluminum products	16	35	93	Machine tools	65	62
4	Arms and ammunition	12	9	94	Marble	222	6
5	Automobile parts	287	278	95	Matches	2	2
6	Bakery products	164	35	96	Melamine (plastic) utensils	76	65
7	Baby bicycles	5	3	97	Mineral water	0	11
8	Batteries	3	5	98	Motorcars	1	1
9	Belts	8	7	99	Motorcycles/ rickshaws	2	23
10	Beverages	20	22	100	Motors/pumps	193	170
11	Bicycles	102	40	101	Musical instruments	9	11
12	Biscuits	29	32	102	Nuts and bolts	216	112
13	Boilers	2	4	103	Oil stoves	2	1
14	Bulbs and tubes	3	3	104	Packages	93	187
15	Canvas shoes	1	1	105	Paints and varnishes	61	61
16	Carpets	67	50	106	Paper and paper board	83	110
17	Caustic soda	3	1	107	Paper cones	3	22
18	Cement	212	43	108	Parachute bags	1	1
19	Ceramics	23	111	109	Pencils/ ballpoint pens	4	6
20	Chalk	1	1	110	Pesticides and insecticides	12	25
21	Chemicals	41	85	111	Petroleum products	0	3
22	Chip/straw board	13	88	112	Photographic goods	6	1
23	Citrus grading	4	41	113	Pins and clips	5	2
24	Cold storage	442	633	114	Plaster of Paris	0	1
25	Cones	23	7	115	Plastic products	343	287

Continued...

Table A1: Number of firms in the manufacturing industry in Punjab, 2002 and 2006 (Continued)

	Industry	2002	2006		Industry	2002	2006
26	Confectionery	69	89	116	Polypropylene bags	33	45
27	Cosmetics	5	7	117	Polyester yarn	4	9
28	Cotton ginning and pressing	1236	1358	118	Polythene bags	12	27
29	Cotton tape	2	1	119	Pottery	143	185
30	Cotton waste	66	56	120	Poultry feed	85	79
31	Crown corks	2	2	121	Powder coating	2	3
32	Cutlery	214	227	122	Power generation	43	46
33	Cycle tyres/tubes	17	21	123	PVC pipes	30	40
34	Dairy products	17	25	124	Radios/televisions	2	2
35	Diapers (baby)	2	1	125	Cloth raising	13	7
36	Dyes and blocks	94	18	126	Razors/blades	6	1
37	Diesel engines	62	70	127	Readymade garments	105	364
38	Domestic hardware	107	70	128	Refineries	3	2
39	Yarn doubling	16	39	129	Rice mills	1066	1717
40	Drugs and pharmaceuticals	114	151	130	Rubber products	67	64
41	Dyes	3	3	131	Sanitary fittings	218	252
42	Elastic	0	6	132	Seed processing	8	11
43	Electric furnaces	51	15	133	Sewing machines /parts	25	23
44	Electric goods	223	219	134	Shoe lasts	1	1
45	Electric meters	5	7	135	Yarn sizing	197	204
46	Electric poles	1	1	136	Soaps and detergents	412	188
47	Electric transformers	16	18	137	Sodium silicate	42	39
48	Electroplating	17	1	138	Solvent oil extraction	18	24
49	Embroidery	50	150	139	Specialized textiles	0	1
50	Essences	1	1	140	Spices	1	2
51	Explosives	1	1	141	Sports goods	500	564
52	Fans/coolers	510	536	142	Spray machines	2	2
53	Fertilizer	7	11	143	Springs	2	1
54	Fiberglass	5	6	144	Starch and products	5	4
55	Fiber tops	2	2	145	Sugar	39	41
56	Fire clay	1	1	146	Sulphuric acid	10	7

Continued...

Table A1: Number of firms in the manufacturing industry in Punjab, 2002 and 2006 (Continued)

	Industry	2002	2006		Industry	2002	2006
57	Fire-fighting equipment	1	2	147	Surgical cotton/ bandages	13	50
58	Flour mills	437	543	148	Surgical instruments	999	1298
59	Foam	8	6	149	Synthetic fiber	0	1
60	Food products	39	47	150	Synthetic resins	4	5
61	Forging	3	17	151	Syringes	3	4
62	Foundry products	762	600	152	Tanneries	524	623
63	Fruit juices	22	28	153	Tents	12	26
64	Fruit preservation	2	1	154	Textile composite	23	28
65	GI/MS pipes	45	66	155	Textile made-ups	32	43
66	Gas appliances	29	45	156	Textile processing	355	483
67	Glass and glass products	29	42	157	Textile spinning	309	421
68	Glue	5	8	158	Textile weaving	188	219
69	Glycerin	1	1	159	Thermopore	6	8
70	Grinding wheels	1	1	160	Thread	11	9
71	Gypsum	14	1	161	Tobacco	3	5
72	Handheld tools	46	15	162	Towel	10	17
73	Hatcheries	23	21	163	Tractors and parts	158	158
74	Heavy engineering (bulldozers/cranes, etc.)	1	1	164	Trucks	1	1
75	Homeopathic medicines	2	2	165	Tyres and tubes	12	11
76	Hosepipes	1	1	166	Unani medicines	45	18
77	Hosiery	444	366	167	Utensils (all sorts)	534	488
78	Ice cream	14	11	168	Ghee and cooking oil	96	92
79	Industrial/burn gases	32	28	169	Velvet cloth	1	1
80	Industrial (textile) machinery	92	92	170	Vermicelli	5	10
81	Ink	6	6	171	Washing machines	94	105
82	Iron and steel rerolling	317	385	172	Weights and scales	41	14
83	Jute mills	13	22	173	Welding electrodes	2	2
84	Knitted textiles	95	91	174	Wire and cable	39	77

Continued...

Table A1: Number of firms in the manufacturing industry in Punjab, 2002 and 2006 (Continued)

	Industry	2002	2006		Industry	2002	2006
85	Leather footwear	96	100	175	Wooden products	6	6
86	Leather garments	201	392	176	Wool scouring	3	4
87	Leather products	51	64	177	Woolen textiles	125	132
88	Light engineering	198	233	178	Zinc sulphate	4	1
89	Locks and padlocks	32	27	179	Zari work	3	3
90	LPG (gas) cylinders	7	9	180	Zips	0	1

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