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Spatial Agglomeration and Productivity of Textile and Leather Manufacturing in the Punjab Province of Pakistan

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Abstract

This study investigates whether spatial agglomeration of textile and leather industry facilitates to enhance its own productivity at establishment level in the Punjab province of Pakistan. The empirical analysis is based on the survey data for the years 1995-96, 2000-2001 and 2005-06 collected from the Punjab Bureau of Statistics (PBS). The production function framework has been utilized. The results of production function suggest that spatial agglomeration of textile and leather industry plays a vital role in determining the productivity of establishments. The impact of localization (specialization) is positive and stronger than urbanization (diversification) which implies that locating manufacturing establishments in a particular district leads to enhance the productivity of establishments. Therefore, government policy should be biased to promote localization of textile and leather industry.

Keywords: Managerial entrenchment, cost of capital stock, systematic risk, sales growth, leather , textile.

1. Introduction

Technological development has facilitated the manufacturing industries to enhance their productivity and efficiency. However, regional agglomeration or concentration of industries is still a useful tool to further improve their production performance. The term agglomeration economies is explained as the benefits reaped when economic activities of people and firms can be seen near one another in industrial clusters and urban areas (Glaeser; 2010). The concentration of manufacturing industries enhances the size of economic activities in an area where the clusters of these industries are operational. According to Marshall (1920) clustering of industries reduces the transportation cost associated with knowledge spillovers, input sharing and labor pooling. Such phenomenon also helps to increase the efficiency and productivity of firms.

Moreover, agglomeration economies are one of the main determinants of city sizes. The increased productivity makes it possible for the firms to pay higher wages to workers.

The opportunity of earning higher wages, in turn, attracts more migrants into the city and increases its size. Also to take advantage of these benefits from increasing scale, firms locate close to each other. Again the result is increasing city size. The regional concentration or agglomeration of economic activities and population is a prevalent phenomenon in most of the developed and developing countries. Spatial agglomeration of manufacturing industries prevails more or less in all industries whose location choices are not dependent on natural resources.

The agglomeration economies can be separated into two different categories such as localization (Marshallian externalities) and urbanization (Jacobs externalities) economies. The Marshallian externalities occur due to the positive effects of spatial concentration of a specific industry within a specific area and the Jacobs externalities refer to the benefits occurred due to the concentration of diversified industries in a local system. Both types of economies are the determinants of cities having either a diversified or a specialized industrial base, that is, they affect the composition of industrial activity.

Punjab is the largest province of Pakistan in terms of population and economy's size. It contributes about 60 percent in the total annual production of goods and services in the country (Punjab Bureau of Statistics). Since 1947, the Punjab has been the most economically dynamic and vibrant province of Pakistan and contributing significantly to the economy. However, growth of the province and manufacturing sector including textile and leather industry has decreased significantly in last five years. The insufficient growth in the manufacturing sector is attributed by the hindrances for instance production of low quality manufactured goods, inadequate R&D investment, low domestic and foreign investment, least exposure to the global market, lack of infrastructure and skilled labor force. Recent deceleration particularly in the textile and leather industries is further characterized by the worse situation of law and order, power outages, natural disasters, high cost of inputs and inflation. However, in view of the past performance and potential, there is a sufficient space in this sector to act a key role in the contribution of national income.

This study is aimed to analyze the impact of spatial agglomeration on the productivity of textile and leather products industry in the Punjab province of Pakistan covering the survey data for 1995-95, 2000-01 and 2005-06. Both types of agglomeration economies (localization and urbanization) have been considered in the empirical analysis to see their impact on the productivity of firms. Numerous empirical and theoretical studies have shed light on the importance that both localization and urbanization economies have a significant impact on the industrial productivity (e.g. Nakamura; 1985, Henderson; 1986, Henderson *et al.*; 2001 and Henderson; 2003). The spatial concentration of industrial activities plays a vital role in the growth of cities, however, this area of research in Pakistan has been rather ignored.

This study provides new and useful empirical evidence concerning the impact of spatial agglomeration on the productivity of textile and leather products industries in the Punjab province of Pakistan. The empirical investigation on this area enables to evaluate that which industrial policy is more desirable? Should it be biased in favor of specialization (localization) or in favor of diversity (urbanization) economies to enhance the performance of textile and leather products industries?

The empirical results illustrate that the effect of specialization is stronger than diversification in textile and leather products manufacturing industries. The estimates of localization economies showed the positive and significant impact on the productivity. In

general, it can be argued that the spatially agglomerated manufacturing industries of same kind located in a particular area face high competition which further leads to enhance the productivity of manufacturing sector.

The structure of the rest of the study is as follows: section 2 reviews the theoretical and empirical studies on the spatial agglomeration of industries and productivity. The empirical model, methodology and data issues are discussed in section 3. The empirical results are presented in section 4. The conclusions and policy implications of the study are in section 5.

2. Literature Review

Agglomeration economies or the spatial concentration of economic activities is the foundation of regional and urban development. The body of research literature on agglomeration economies is huge and multifarious, across several sub-disciplines i.e. economics, geography and regional science[1]. It is, therefore, this section provides a brief summary on theoretical and empirical studies of agglomeration economies, relating agglomeration economies with industrial productivity and then focuses on a review of empirical approaches.

2.1 Theoretical Foundation of Agglomeration Economies

The concept of spatial concentration of industrial activities which leads to enhance their performance was first introduced by Marshall (1920). He explains three key sources of external economies arising from regional co-location of similar industries. The first is improved access to specialized inputs. The existence of large local industry assures the more viable and efficient specialization for that industry. As a result, industries make use of low cost and specialized inputs in the production process. The second is labor pooling. The concentration of firms in a local system with akin or complementary need of labor generates a considerable large pool of skilled labor which enhances the job opportunities for specialized skilled workers and raises the chances of a good match between employers' demand for labor and available supply of skilled labor force. The last Marshallian factor is knowledge spillover. Such type of external economies leads to the exchange of information, ideas and innovations among the firms engaged in similar production processes, whether through firm-level interactions, interpersonal communication, or employee job switches, that speeds and improves technological progress.

The classical industrial location theory by Weber (1909, 1929) also explains the significant role of agglomeration as a determinant of industrial location. Although, Marshall and Weber presented the idea of agglomeration economies more than a century old, but later on, this notion has verified by many studies. Theoretical and empirical work on this area has focused mainly on further verifying the original three Marshallian sources of agglomeration economies and expanding its list of potential sources[2]. Many studies in their theoretical and empirical analysis focused the two categories of spatial agglomeration of industries such as urbanization and localization economies.

When firms get benefits of external economies by making clusters or locating together in a local system and engaged in inter-linked or similar production activities, such benefits are called Marshall-Arrow-Romer (MAR) externalities or Localization Economies. Many regional and industrial economists are of the view that the firms engaged in akin or inter-

[1] see Malmberg (1996), Feser (1998a) and Rosenthal and Strange (2004)
[2] see Feser (1998b), Rosenthal and Strange (2001 and 2003)

linked sectors gain from higher productivity and efficiency while locating near to other firms [Moomaw (1981b), Nakamura (1985), Henderson (1986), Henderson *et al.* (1995), Ciccone and Hall (1996), Henderson (1997), Black and Henderson (1999) and Beardsell and Henderson (1999)]. Moreover, Porter (1990, 2000) argues that "industry clusters", geographic concentrations of inter-connected firms, make competitive advantage.

Jacobs (1969) emphasizes on the importance of knowledge spillovers and innovation that the concentration of industries leads to dissemination of information and new ideas across different industries, which is crucial for regional economic development and dynamism. This idea, in the literature often known as Jacobs externalities or urbanization economies and has been tested by many regional economists in favor of Marshall's notion of agglomeration economies [see Goldstein and Gronberg (1984), Helsley and Strange (1990), Glaeser *et al.* (1992), Henderson *et al.* (1995), Henderson (1997) and Feldman and Audretsch (1999)]. Quigley (1998) further explains that the cities attributed with the features of increasing size and diversity are vigorously connected with productivity and innovation, demonstrating the higher returns from urbanization economies.

2.2 Empirical Studies on Agglomeration Economies and Productivity

There is an extensive body of research in the literature that explores the agglomeration economies fabricated by the spatial proximity of similar as well as dissimilar firms. Since external economies cannot be measured directly, therefore, empirical analyses are based on observable characteristics by means of estimating potential agglomeration economies (Richardson 1974a). In general, quantitative research in this area has been considerably laden by persistent methodological barriers and poor quality data. David (1999) argued that empirical research on the subject area has not managed to keep up with theoretical developments. Yet the empirical work on the agglomeration economies continues unabated and the augmentation of results yields appealing regularities which lead to continuing research efforts on subject area (David; 1999).

Most of the empirical studies on agglomeration economies are conducted to observe the productivity of similar as well as dissimilar firms in a local system[3]. Such phenomena is done by modeling a production function that relates output levels to standard production inputs and appropriate proxy variables of external economies together with other the factors of interest.

In the early productivity-based studies, the size of city or region was used as a proxy variable for agglomeration economies, with population found to be positively related to labor or total productivity[4]. Moreover, population density has commonly been substituted for the size of city as a proxy for agglomeration economies, revealing a similar positive association with production or productivity that holds across a range of industrialized nations (e.g. Richardson 1974b; Nicholson 1978; Tabuchi 1986; Ciccone and Hall 1996; Ciccone 2002). On the other hand, in explaining the U.S. industrial deconcentration, Moomaw (1985) introduces a theoretical model of a city size and firm location. The results differ from other studies and suggest that productivity and wage levels do not play a significant role for the location of manufacturing activities in large cities relative to small ones. The study further finds that the spillovers or benefits of productivity in large cities of U.S. have declined in many two-digit manufacturing industries that offer employment to the production workers more than one-third of the region.

[3] see Moomaw (1983a), Malamud (1987), Glaeser *et al.* (1992), Gerking (1994), Aji (1995), Malmberg (1996) and Rosenthal and Strange (2004)

[4] see Aberg 1973; Sveikauskas 1975; Segal 1976; Fogarty and Garofalo 1978; Moomaw 1981b

Beeson (1987) gets the surprising results while analyzing the impact of urban population on the productivity growth in U.S. He explores that states with higher urban population shares to have lower productivity growth, but this effect is offset by productivity gains for states containing one of the largest 20 metropolitan areas. In another study Beeson and Husted (1989) further find that the larger metropolitan population is connected with higher state-level productivity while with lower productivity at the metropolitan-level. Calem and Carlino (1991) in a simultaneous equations model find the evidence of agglomeration economies for U.S. metropolitan areas of up to two million residents by including labor demand and supply in the empirical analysis. The study conducted by Carlino and Voith (1992) on the U.S. states on the relationship between productivity and urbanization reports that with high percentage of population located in the urban setup lead to higher productivity. The study further finds that the congestion disamenities offset the effect for relatively high levels of urbanization.

Mitra (2000) finds the support in favor of the spillover effects due to urbanization economies in Indian manufacturing industries by utilizing panel data for fifteen major states. The total factor productivity growth is positively and significantly associated with the spatial concentration of industries (in eleven out of seventeen two-digit industries). The study suggested that urbanization or industrial spread benefits firms through improved labor quality and the better deployment of resources.

Moretti (2004) analyzes the determinants of firm level productivity within a production function framework by utilizing a unique firm-worker matched data set. The study suggests that productivity of plants in a specific city is higher where ratio of college graduates is higher as compare to other city that experiences slow increase in the ration of college graduates. Such higher productivity gains may be counterbalanced by increased wages. The study further suggests that the firms get more benefits of externalities generated by their co-locating in a city than the industries that are located far-away.

Lall *et al.* (2004) examine whether the agglomeration economies along with other factors contribute to the productivity in Indian manufacturing sector. They suggest that improved infrastructure lead to enhance the productivity at firm-level, however the benefits of urbanization are not helpful to reduce the associated costs. Rice *et al.* (2006) find that the portion of the variation in average regional wages in Britain attributable to productivity differences is positively related to the volume of population accessible within specified ranges of travel time. Summarizing across these studies, larger or more dense population is generally associated with greater productivity, but the extent differs widely by industry, region or country examined, time frame, and estimation technique.

Bosker (2007) empirically investigates the association between economic growth and agglomeration externalities using a sample of 208 European regions over 25 years within a framework of panel regression techniques. The results suggest that highly populated regions have a slow growth than relatively less populated regions. This implies that a net effect of effect of agglomeration economies is negative. Vor and Groot (2010) examine the impact of local economic structure and accessibility on the productivity of industrial clusters. They show that the specialization within a site-industry level slow down the growth. Moreover, industrial sites grow relatively fast that are easily reachable from the highway, as well as industrial sites situated in the Amsterdam Harbour area. Graham (2007) finds that the productivity of small British firms is enhanced by agglomeration as indicated by accessibility to other employers.

Shanzi (2010) analyses the causal relationship between productivity and agglomeration

economies and their determinants for the year 2005 across 617 Chinese cities by extending the work of Ciccone and Hall (1996). The study utilizes simultaneous equation model for the subject purpose and finds that the regional agglomeration of manufacturing industries significantly cause their productivity in the industrialized and adjoining regions, moreover labor productivity is negatively affected by the employment density. The study also discovers that higher productivity due to spatial concentration of industrial activities further leads to encourage various industries to locate near another. Andersson and Lööf (2011) investigate the impact of spatial concentration of industries and productivity utilizing dynamic and static models at the firm level data during 1997-2004 in Sweden. They find that firms are more productive in dense urban cities while learning by doing in such regions raises firms' productivity as well.

The criticism in the literature on agglomeration economies reveals that the simple size as a proxy for agglomeration may confuse urbanization with localization economies. Moreover, it may also consider urbanization diseconomies along with agglomeration externalities (Moomaw 1981a; 1983a; 1983b; Ciccone and Hall 1996). Numerous researchers have investigated nonlinear association between urbanization economies and productivity, exploring diseconomies from urbanization due to the overcrowding of people, employment density, pollution etc. (Kawashima 1975; Fogarty and Garofalo 1978; 1988).

2.3 Urbanization vs. Localization and Productivity

Another approach incorporates multiple indicators to distinguish urbanization from localization economies. While both types of agglomeration economies are most often indicated by level measures (i.e., population size, own-industry employment or value-added), density measures are also common (i.e., population or employment density, location quotients). Shefer (1973) estimates U.S. manufacturing industries to have higher productivity both in the presence of larger metropolitan own-industry employment (localization economies) and greater regional total manufacturing employment (urbanization economies). Carlino (1979) associates localization economies with the ratio of local to national industry employment and includes both population and establishment counts to measure urbanization economies and diseconomies. His results indicate that urbanization economies and diseconomies are generally more significant than localization economies in U.S. metropolitan areas, but the comparisons vary widely across two-digit SIC (Standard Industrial Classification) manufacturing sectors.

Modifying his earlier (1985) study by adding industry employment and population as separate indicators of localization and urbanization economies, respectively, Moomaw (1986) finds that for most industries the declining urban productivity differential is more closely associated with localization than urbanization economies, but also that several industries present the opposite pattern. Examining manufacturing in both the United States and Brazil, Henderson (1986) finds localization but not urbanization economies to be significant determinants of productivity. Four studies by Moomaw (1988; 1998), Lee and Zang (1998), and Pan and Zhang (2002) affirm Henderson's conclusion that localization economies are the more important type of agglomeration economy for the majority of manufacturing industries, but also reveal substantial urbanization economies or diseconomies in several sectors. In contrast, Sveikauskas *et al.* (1988) show that once raw materials locations are taken into account, the U.S. food products industry evidences only urbanization externalities. They reason that other empirical research may mistake the benefits of natural resource proximity for localization economies. Nakamura (1985) estimates productivity separately for different manufacturing industries in Japan.

Incorporating the assumption of constant returns to scale at the firm level, any non-constant returns to scale at the industry level are taken to represent localization economies. Nakamura (1985) discovers urbanization economies (population size) to be more important for light manufacturing industries and localization economies for heavy manufacturing industries. Sveikauskas *et al.* (1985) demonstrate a strong agglomeration benefit for manufacturing plants in Brazil's São Paulo state using the unusual urbanization measure of travel time to the city of São Paulo. Using plant-level data, Feser (2001) finds substantial urbanization externalities in the high technology measuring devices industry and localization economies in the lower-technology farm and garden machinery equipment industry.

In a small-sample study of high-technology firms in Milan, Capello (2002) produces evidence suggesting that urbanization economies are more important for large firms and localization economies for smaller firms. Lall *et al*. (2004) adopt density indicators to study manufacturing industries in India, finding that localization economies return larger benefits for higher-technology industries and that diseconomies either offset or outweigh the advantages of urbanization. Mukkala (2004) reports greater beneficial effects of localization compared to urbanization economies in three Finnish manufacturing sectors, measuring both concepts with density measures, and Tveteras and Battese (2006) demonstrate the existence of both localization economies and diseconomies from own-industry size in Norwegian salmon aquaculture.

Hanink (2006) studies the benefits of agglomeration spillovers on the New England's counties and finds urbanization economies to be more influential than localization economies in raising average earnings except in the financial services, insurance, and real estate sector, with little evidence of agglomeration benefits spilling over across counties. In addition, several studies of U.S. metropolitan or county employment growth conclude that localization is more important to both manufacturing and services industries than urbanization economies, though the correspondence between the agglomeration concepts and the measures used to operationalize them typically is weak.[5]

3. Empirical Model and Data Issues

The studies have employed various approaches while analyzing the impact of agglomeration economies on productivity and regional growth. The production function method is widely used empirical approach for the subject purpose. This study also exploits the same approach to seek the impact of two types of agglomeration economies such as urbanization and localization economies on the productivity of textile and leather products manufacturing in the Punjab province of Pakistan. Following the studies by Nakamura (1985), Henderson (1986), McCoskey and Kao (1999), Capello (2002) and Henderson (2003), the present study utilizes a standard production function in logarithmic form as below:

$$\ln(OP_{jt}) = \theta \ln(INP_{jt}) + \phi \ln(AGGL_{jt}) + \psi \ln(INST_{jt}) + \varphi_t + \rho_{aj} + \delta_{jt} + \varepsilon_{ait} \quad \ldots\ldots(1)$$

where *ln* is natural logarithm, *j* represents establishment in an area *a* in time period *t*,
OP_{jt} is output (value added per worker)
INP_{jt} is a vector of production inputs,

[5] see O hUallachain 1989; O hUallachain and Satterthwaite 1992; Desmet and Fafchamps (2005)

$AGGL_{jt}$ is a vector of agglomeration variables,
$INST_{jt}$ is institutional variable (dummy for ownership: private = 1, otherwise = 0),
φ_t is the time fixed effect,
ρ_{aj} is the location fixed effect,
δ_{jt} is the industry fixed effect and
ε_{ajt} is the usual error term assumed to be identically and independently distributed

The above specification (1) is estimated for textile and leather products manufacturing at the four-digit firm level. The empirical analysis is based on the survey data with five years interval for the years 1995-96, 2000-01 and 2005-06 on Large Scale Manufacturing Industries (LSMI) of Punjab province conducted by the Punjab Bureau of Statistics (PBS). The Federal Bureau of Statistics (FBS), Government of Pakistan conducts survey of LSMI with the coordination of provincial bureaus of statistics after the interval of five years. This survey data is published in Census of Manufacturing Industries (CMI) at national level, which is the only source of data on different aspects of manufacturing industries in Pakistan. However, CMI suffers from severe drawbacks such as, under coverage of firms, changes in definitions of variables over time, gaps and irregularity of survey publications (Zafar and Ahmed; 2009). As this study is focusing on textile and leather manufacturing sector of Punjab province of Pakistan, therefore the unpublished survey data at firm level for the aforementioned period obtained from the PBS, Government of Punjab on request for research purpose. The survey data for the years 1995-06, 2000-01 and 2005-06 covers 713, 711 and 996 reporting firms in the textile and leather manufacturing sector respectively[6]. The data of reporting firms has been transformed into four digit industry according to the Pakistan Standard Industrial Classification (PSIC) codes.

In the estimation of specification (1), the dependent variable (OP_{jt}) is value added per worker. The input vector (INP_{jt}) includes labour (L_{jt}) capital (K_{jt}) and material (M_{jt}). The vector of agglomeration economies ($AGGL_{jt}$) includes urbanization (URB_{at}) and localization (LOC_{jt}) indices to explain their impact on the productivity of textile and leather products manufacturing sectors.

In several previous studies the regional population has been utilized as a proxy to measure urbanization economies which represents the regional economic activities. However, following Jacobs (1969), Nakamura (1985), Henderson *et al.* (2001) and Henderson (2003) the present study used diversity or specialization index in a given area as a proxy for urbanization economies. Diversity index explains interactions among the firms from different manufacturing sectors and determines the concentration of employment in a given city as well. It is quite similar to a Hirschman-Herfindahl index. A standard way to measure the diversity/specialization for a region *a* is[7]:

$$URB_a = \sum_{i=1}^{N}\left[\frac{EL_{ai}}{EL_a} - \frac{EL_i}{EL}\right]^2 \quad \text{.....(2)}$$

where *URB* represents urbanization economies or specialization index for a given district

[6] The reporting firms of overall LSMI for the survey years 1995-06, 2000-01 and 2005-06 are 2364, 2357 and 3528 respectively. The firm level data consists of unbalanced panels; the total number of reporting firms differs across each survey. The PBS does not provide the names of reporting firms to keep the confidentiality of data under Section 11 of General Statistics Act, 1975 and Section 7 of Industrial Statistics Act, 1942.
[7] The diversity index is calculated by considering all four-digit manufacturing sectors of Punjab.

a, *EL* is total manufacturing employment in the Punjab province, EL_i is total manufacturing employment in industry *i*, EL_a is total manufacturing employment in a district *a* and EL_{ai} is total employment of manufacturing sector *i* in a particular area *a*. The minimum value of *URB* is zero (complete non-specialization) while its highest value approaches to two (complete specialization) (Henderson *et al.* 2001).

There are different measures to specify the impact of localization economies on the productivity such as own industry employment in the region, own industry establishments in the region, or an index of concentration. However, the present study used own industry employment to indicate the specialization or localization economies. This measure was used by Henderson *et al.* (2001), Henderson (2003).

Moreover, in addition to above variables, location fixed effects are incorporated in the specification (1) to control for location (district) specific amenities that might has significant impact on productivity and catch the attention of many other firms. Henderson (2003) also included the plant specific fixed effects in the production function. However, the present study has a very short time period (three years) which does not permit to include it due to the loss of degree of freedom. It is assumes that urban factors along with location fixed effects will catch the differences among firms. Here, the industry concentration measures are alike for all firms within given region and manufacturing sector which also rationalize the inclusion of location fixed effects instead of firm fixed effects. The description of the variables can be found in Table 1.

Table 1: Description of Variables

Sr. No.	Variables	Description	
1.	$LnOP_{jt}$	Log of value added divided by the number of employees of an establishment *j* at time *t*	Dependent variable
2.	LnL_{jt}	Log of average number of daily employees of an establishment *j* at time *t*	Input variables
3.	LnK_{jt}	Log of fixed assets (Rs. Million) of an establishment *j* at time *t*, includes the gross value of land, building, plant, machinery, transport and other fixed assets i.e. equipment, furniture etc., as at the end of the year	
4.	LnM_{jt}	Log of value (Rs. Million) of raw materials, fuel and electricity consumed and payments made to others for repair, maintenance of building and machinery of an establishment *j* at time *t*	
5.	$LnURB_{at}$	Diversity index in a particular district *a* at time *t*	Agglomeration variables
6.	$LnLOC_{jt}$	Total number of employees in an industry *j* in a particular district *a* at time *t*	
7.	INS_{jt}	Dummy for Ownership (private = 1, otherwise = 0)	Institutional variable

4. Empirical Results and Discussion

The pooled regression results for the specification (1) are presented in Table 2 for the textile and leather products manufacturing at the four-digit level firms during the period 1995-2005. The two versions are estimated for the specification (1) with industry-time fixed effect and with both industry-time and district fixed effect. The first point to observe is that the R^2 is high enough in all cases to explain good fit of the model. Moreover, the inclusion of district effect in the estimation further significantly improves the value of R^2 and significantly affects the estimated coefficients of institutional characteristics and agglomeration variables. This implies that regions/districts play a vital role to explain the productivity of LSMI in Punjab province.

The dummy variable to control the ownership effect is positive and highly significant. This indicates that the private ownership of an establishment tends to enhance the productivity as oppose to the other structure. The textile and leather products firms under the private ownership perhaps work efficiently due to the better management and planning.

Table 2: Pooled Regression Estimates for Textile and Leather Manufacturing

Dependent Variable Output per Worker $ln(OP_{it})$

	1	2
Inputs (*INP*)		
lnK_{it}	0.1325 (0.0144)	0.1249 (0.0139)
lnL_{it}	-0.0551 (0.0149)	-0.0582 (0.0143)
lnM_{it}	0.5743 (0.0154)	0.5406 (0.0146)
Agglomeration (*AGGL*) Variables		
$lnURB_{at}$	-0.1628 (0.0280)	-0.6145 (0.0465)
$lnLOC_{it}$	0.127 (0.0118)	0.085 (0.0120)
Institutional (*INST*) Variable		
Dummy for Ownership	1.3584 (0.0623)	0.8696 (0.0670)
Time-industry FE	Yes	Yes
Area FE	No	Yes
R-squared	0.4459	0.5342
Adjusted R-squared	0.4438	0.5252
Total No. of observations	1900	1900

Notes: All the estimated coefficients are significant even at 1% level of significance. Standard errors are shown in parentheses.

Turning next to the input factors, the estimated coefficients show the expected signs. The capital is positive and significant. However, capital becomes highly significant when both fixed effects (industry-time and district) are included in the estimation. This implies that increase in the capital leads to increase the labor productivity. Similarly, material is positive and highly significant to explain the labor productivity. Moreover, the estimates

of labor are negative and highly significant. This suggests that an increase in the work force of textile and leather manufacturing establishments is connected with the decline of labor productivity.

The urbanization economies ($LnURB_{at}$) is measure by the industrial diversity index, the positive coefficients indicate a productivity gain and the negative coefficients imply productivity decline to being located in a more industrially diverse area. The estimated coefficients of $LnURB_{at}$ reveal that the urbanization economies in both specification (industry-time and district fixed effects) are negatively and significantly linked with productivity. This implies that diversified structure of the Textile and Leather manufacturing in Punjab province is not favorable for the improvement of productivity. Moreover, a district characterized with the highly diversified manufacturing activities in a particular district diminishes the labor productivity of the manufacturing establishments situated in that district. Negative externalities of urbanization economies are appeared due to high congestion costs that offset benefits of agglomeration economies (Lall *et al.* 2004; Baldwin *et al.* 2008).

Finally, to see the impact of localization economies ($lnLOC_{it}$) on the productivity of textile and leather manufacturing sector, following Henderson *et al.* (2001) and Henderson (2003) the own industry employment is taken as localization economies. The estimates of $LnLOC_{it}$ are positive and significantly linked with productivity in both specifications (industry-time and district fixed effects). These results indicate that spatial agglomeration of same LSMIs in a particular area/district would help to enhance their productivity. These results also support that the Marshallian type externalities are present in the textile and leather manufacturing sector of Punjab province. It is, therefore, can be argued that the level of competition rises among the spatially agglomerated establishments related with the same sectors which further leads to improve the productivity of establishments (Lall *et al.* 2004).

5. Conclusion and Summary

This study analyzed whether spatial agglomeration of textile and leather manufacturing sector facilitates establishments to enhance their productivity in the Punjab province of Pakistan. For this objective, the present study utilized a production function framework which stipulates that productivity is determined by the inputs (labor, capital and material), agglomeration externalities (urbanization and localization economies) and own establishment characteristic variables (dummy for ownership effect). The estimation of pooled regression is based on the survey data collected from the PBS with five years interval for the years 1995-96, 2000-01 and 2005-06.

The diversity or specialization index and own industry employees taken as proxy variables for urbanization and localization economies respectively. Moreover, in addition, location fixed effects and industry-time fixed effects are incorporated in the pooled regression. The district specific effect is imperative in textile and leather manufacturing industries as its inclusion in the model significantly improves the value of R^2.

The impact of urbanization economies on the productivity is significant and inversely related. This implies that diversified industrial structure of textile and leather manufacturing in Punjab province has adverse impact on productivity. On the other hand, the localization economies directly and significantly linked with productivity. In general, it can be argued that spatially agglomerated textile and leather manufacturing establishments located in a particular district lead to enhance its own productivity at

establishment level. Therefore, the government policy should be biased to promote localization. District governments or administration can play a vital role to enhance the spatial agglomeration of textile and leather manufacturing sector. Moreover, the benefits of agglomeration externalities may disappear due to negative externalities, in this regard further policy intervention is needed.

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