Effect of Agglomeration on Socio-Economic Outcomes: A District Level Panel study of Punjab

Annus Azhar* & Shahid Adil**

Abstract

*This paper examines the variation of agglomeration across districts over time in Punjab and analyzes effects of agglomeration on socioeconomic outcomes in terms of social inclusion[1] and efficiency of firms at district level in Punjab. Earlier studies in this regard faced multiple problems since they used cross-sectional data. To bridge the gap, we used newly constructed panel data from CMI. Principal Component Analysis/Factor Analysis technique has been used to analyze social-inclusion variable, in addition to some other control variables as well. Data Envelopment Analysis (DEA) with bootstrap technique (performed in **R**) has been used to calculate district wise firm efficiency. DEA technique ensures reliability of results since it is non-parametric in nature and is therefore free from specification bias. The results show that district agglomeration has positive effect on average district wise efficiency of firms and has a positive statistically significant relation with social-inclusion. Interesting implications arise from results, setting up clusters in urbanized rather than highly urbanized areas under China Pakistan Economic Corridor (CPEC) can be a game changer for the economy of Pakistan especially Punjab since it has significant potential positive effects on the economy of the Punjab.*

Key words: Agglomeration, Social Inclusion, Efficiency, Districts of Punjab

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[1.] Social inclusion is both an outcome and a process of improving the terms on which people take part in society. It is central to ending extreme poverty and fostering shared prosperity. (World Bank)

1. INTRODUCTION

Punjab is the biggest province of Pakistan with total population of more than 100 million which is about 60 percent of the total population of the country. It is administratively divided into nine divisions and 36 districts. It has a long history of being overshadowed by agriculture sector which has resulted in the neglect of industrial sector. In the past Punjab lacked a clear vision/policy for the industrial sector. The recent negative growth rate in the agriculture sector along with positive trend of huge foreign direct investment from China has put the spotlight on the manufacturing sector.

Manufacturing is the backbone of the industrial sector and large scale manufacturing is the most pivotal subsector in manufacturing. It is a main source of tax proceeds for the government and also contributes significantly in the provision of job opportunities to the labor force. According to Pakistan Economic Survey (2015-16) the industrial sector of Pakistan contributes 20 percent in GDP.This sector has experienced dynamic changes over time.

Over the years' clusters have been developed in Punjab due to geographical, social and historical reasons. Punjab has geographically divergent industrial clusters comprising Gujranwala, Sialkot, and Gujarat. In total, there are seven industrial zones/clusters in Punjab: Faisalabad, Lahore, Gujranwala, Sheikhupura, Sialkot, Rawalpindi and Wazirabad (Figure-1). One can clearly see that development in Punjab is only limited to industrial clusters present in North East & North West of Punjab (Figure 1). This has led to uneven economic development in the province. Many studies (Glaeser et al, 1992, Rizov et al., 2012, Ciccone & Hall, 1996 and Burki & Khan, 2013) have been conducted to examine the impact of such agglomeration (clusters) on firm efficiency/productivity. However, none of these studies have examined the welfare aspect of these clusters.

In the manufacturing sector large producers manufacture high quality output because of adoption of modern methods of production and employment of both skilled and unskilled labor force this leads to the income generation and reduction of poverty in areas where these large businesses operate. This supports the hypothesis that industrialization leads to social inclusion. This idea is commonly known as *trickle-down effect*, a phenomenon that has not yet been proven in the case of Pakistan. Only one study by Chaudhry.A (2015) is available in literature which examined the effect of entry of new firms on variables as diverse as employment, education, hospitals and

schooling etc. Under China Pakistan Economic Corridor (CPEC) Pakistan will receive multi-billion-dollar investment which will be used to build infrastructure as well as industrial estates in various districts of Punjab. Setting up industrial estates will lead to clusters or agglomeration. Since clusters/districts are diverse in terms of industry type, average firm size, legal status, and geographical location, a "one-size-fits-all" industrial policy will not be suitable. Therefore, classifying constraints to industrial growth at the district level serves two important purposes: First, it helps policymakers to classify and rank agglomeration constraints at the district rather than industry level. Second, this more detailed assessment can contribute to tailoring policy for districts and sectors in order to spur industrial growth and productivity.

This paper addresses the important question of how agglomeration economies affect socio economic variables. It also studies the impact of agglomeration on average firm efficiency at district level. The results provide evidence to support the hypothesis that agglomeration leads to social inclusion or that growth of industrial sector has *trickle-down* effect by creating jobs and promoting income for the poor (Figure 2) and that if infrastructure is also provided with cluster development then binding social & economic constraints will also be removed.

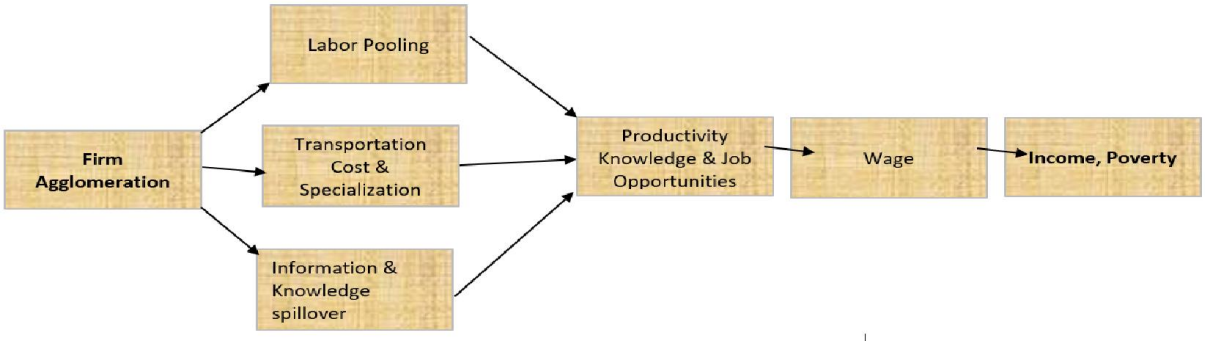
Figure 1

Industrial Zones and Their Major Industries

Districts	Specialization
Rawalpindi	Food, Garment, Textile
Sialkot	Leather & Leather Products, Garment, Machinery & Sports
Gujranwala and Wazirabad	Textile, Machinery & Equipment & Electronics
Faisalabad	Textiles, garments, Machinery & Equipment
Shiekupura	Textile, Food, & Machinery & Equipment
Lahore	Food, Garments, Textiles

Figure 2

Theoretical Framework



Source: Giang, L. T et. all. (2016).

Above figure shows the link between firm agglomeration and income/poverty. Agglomeration leads to positive externalities like labor pooling, reduction in transport cost, information and knowledge spillover etc. This leads to rise in productivity of firms and more job opportunities in the area which in turn leads to rising income & reduction in poverty. In Solow's Model, productivity is key and is the link between performance of firms, economic growth and improving welfare of people. This productivity can only be gained if private sector takes charge of economy and government sets up industrial estates to help the private sector.

Objectives of the study:

Main objective of the study is to examine the effect of agglomeration on socio- economic outcomes at district level in Punjab. The specific objectives of the study are:

i. To examine whether agglomeration leads to social-inclusion.
ii. To find out the determinants of social-inclusion.
iii. To analyze link between agglomeration and average district efficiency.
iv. To find out Socio-Economic benefits of CPEC.
v. To provide policy guidelines for government on how to improve efficiency and social inclusion

The rest of the paper is organized as follows. Section 2 presents literature review. Section 3 & 4 discusses Data & Econometric specification respectively. Results & Discussion is presented in section 5 which is followed by conclusion in section 6. We conclude the paper in Section 7 by providing policy implications.

2. LITERATURE REVIEW

There is wide literature on benefits urban economics and how this effects growth of cities through expansion of industries. Cities grow initially because of geography, history and then by their industrial structures based on extent of specialization or diversity of business. With industrial growth the firms get benefit from other businesses or overall level of economic activity around them e.g., accessibility of infrastructure, access to financial establishments and publishing & marketing. These externalities are known as Jacob externalities which echo the diversity in the area which is case of present study is a district. Localization economies exist when firm gains value from within the industry or firms which are involved in matching activity. Firms benefit from knowledge spillover due to collaboration of agents, availability of particular labor, availability of non-tradable intermediate goods and low transportation cost due to access to market. These externalities are also known as Marshall-Arrow-Romer (MAR) externalities in dynamic form. Many benefits arise due to both of these agglomeration economies. Thus location of firm may depend on closeness to target market to reduce transportation cost or because the nature of product is perishable and thus requires speedy delivery (Marshall, 1890, Myrdal, 1957, and LaFountain 2005). However, some firms may be constrained to locate near the source of raw material (Hirschman, 1958)

Firms locating closer to each other may have significant potential benefits at different level of economic activities.Hazledine et al, (2013) summarized that the benefits of agglomeration can occur at four different levels: I) Internal to individuals/households: individuals gain from wider job opportunities and better amenity. II) Internal to firms: firms gain from larger labor markets, and from economies of scale generated by access to effectively larger accessible output markets. III) Internal to industries: technological (knowledge) spillovers; better choice of intermediate inputs; larger skilled labor pool. IV) Internal to the city: scale of local markets and the more efficient provision of infrastructure, public administration and amenity

Additionally, agglomeration also has direct benefits as well.Giang.L et al (2015) found a linkage between agglomeration and poverty reduction in the case of Vietnam. This effect was greater for houses with male younger and more educated household heads. Firms can improve household welfare and reduce poverty by having a positive effect on employment and wages.

Chaudhry & Haroon (2015) observed that in case of manufacturing sector of Pakistan, firm entry has a significant impact on socio economic outcomes and that these outcomes normally materialize with lag. They recommended that policy makers should recognize that different type of firms have different type of impact which warrants the need for customized approach to industrial development. Thus agglomeration can lead to social uplift of people. These findings were confirmed by Quintana & Royuela (2014) which provides that agglomeration processes can be associated with economic growth, at least in countries at early stages of development.

Apart from effecting community agglomeration contributes positively to firm level variables as well. Albert and Maudos (2002) found that investment in physical capital also positively relates with business efficiency. Beeson and Husted (1989) in a cross-state study for the US observed that a substantial part of the difference of efficiency can be credited to regional dissimilarities of the labor force features, intensity of urbanization and industrial structure. The New Economic Geography literature (Fujita, Krugman, & Venables, 2001) points out that transport cost explain agglomeration.

Agglomeration if unchecked may lead to diseconomies as well. According to Lall et al. (2004) agglomeration may be associated with negative consequences as well. Krugman, (1991) argues that when transport cost of a region decreases then it begins to invite industries towards it hence increasing concentration of industry and eventually increasing the population of the region. Fujita & Thisse (2002) found that when concentration of industry in a specific area crosses a certain level it begins to raise the cost of functioning in that area due to greater labor wages, greater land prices and rent, over population, congestion cost, higher transportation cost and communication costs. According to Kim (2008) while negative spillovers result from increased cluster of industry, it will eventually raise the cost of production and it is known as "Thin Market Effect" by Cohen & Paul (2005). Rising costs due to agglomeration shrinks additional concentration of industry in the nearby areas and disperses economic activities in the region (Fujita and Thisse, 1996 and Kim, 2008). Equilibrium between two positive and negative forces i.e. centripetal and centrifugal respectively leads to stability. For example Mitra (1998), studied the connection between agglomeration economies and technical efficiency of electrical machinery and cotton textile sector through firm level data. The outcomes indicate the same

behavior that agglomeration raises the efficiency of firms but the effect started to diminish for cities which are very bigger in size.

3. DATA AND METHODOLOGY

In previous studies, due to data constraints, industry level firm efficiency was measured using cross sectional data. Lall (2004) in his study on agglomeration in India mentioned similar data constraints. To understand the true impact of independent variable on dependent variable we have to follow the same units over time. Lall (2004) thus mentioned that ideally for work on agglomeration panel data should be used.

For this study we used panel data constructed from CMI 2001, 2005 & 2010.Since the data has same i's for each t .It is expected that unobserved effects might be correlated with the independent variables. If this is indeed the case, pooled OLS will lead to bias results. Hausman test was run to check if Fixed Effects (FE) or Random Effects (RE) needs to be selected. FE eliminates the effect of time-invariant features so we can assess the net effect of the predictors on the outcome variable. According to Hausman test results, FE Model was chosen.

Table 1

Variable and Their Data Sources

Variables	Methodology	Data Sources
Agglomeration	Lee & Lee Agglomeration Index	CMI (2001,2005,2010)
Efficiency	DEA Bootstrap	Calculated in **R**-Software
Social Inclusion	Factor Analysis/ Principal Component Analysis	MICS, Punjab Development Statistics
Road Density	Ratio	Punjab Development Statistics
Education Index	Factor Analysis	Punjab Development Statistics
Investment	Taken as reported in the source	Directory of Industries
Employment Cost	Taken as reported in the source	Directory of Industries
Number of Factories	Taken as reported in the source	Directory of Industries

Panel data and variables used in efficiency model mentioned in Appendix were constructed by Ahmad.T (2016). Agglomeration was calculated in STATA through Lee & Lee Index. Efficiency was calculated in **R** using DEA Bootstrap technique.

Independent Variable of interest:

Agglomeration	Chaudhry & Haroon (2015); Ahmad.T (2016)

Lee & Lee Agglomeration (Diversity Index):

$$g_i^s = \sum_{n=1}^{N} \left[\frac{E_{ij}}{E_i} - \frac{E_j}{E}\right]^2$$

Where *i* signify districts and *j* signify industry; g_i^s represents the extend of localization and urbanization in the i^{th} district. E_{ij} is employment in i^{th} district in j^{th} industry; Ei is the employment in *i*th district, E_j employment in industry *j;* and *E* signifies total manufacturing sector employment. A lesser value of index signifies high diversity which means urbanization economies are stronger while higher value of this index represents that firms are specializing which indicates localization economies are stronger. The index varies from 0 to 2 with zero meaning zero specialization (high diversity) and two representing complete specialization (zero diversity). In order to measure extend and effects of localization economies and urbanization economies on technical efficiency the diversity index has been used (as proposed by Henderson et al. 2001). The index is calculated at district level where district boundaries are frozen at 2000-01 level. The 29 districts that existed in Punjab at that time are used for the index.

Social Inclusion:

Dependent Variable (Social Inclusion) is made of four variables taken from MICS (2003, 2007, and 2011) and is calculated by using Factor Analysis using variables namely: Infant Mortality Rate (IMR); Antenatal care; Improved water sources and Improved Sanitation.

Factor Analysis:

Principal component analysis (PCA) & Factor Analysis is used to transforms a number of (probably) correlated variables into a (lesser) number of uncorrelated variables called *Principal Components*. The first principal component accounts for maximum variability in the data as

possible, and each succeeding component accounts for as much of the remaining variability as possible. The goal of principal components analysis is to explain the maximum amount of variance with the fewest number of principal components. Factor Analysis is also used which is similar to PCA technique. The principal component with smallest eigenvalue is contributing the least variance and so is least informative and is thus discarded.

Let's take Four Variables X_1, X_2, X_3, X_4

Their Linear Combination:

$$Z_1 = \sum_{i=1}^{i=4} a_i X_i$$

$$Z_2 = \sum_{i=1}^{i=4} b_i X_i \quad etc$$

Constant a_1, a_2, a_3, a_4 are determined such that variance of Z_1 is maximized subject to the normalizing condition:

$$\sum_{i=1} a_i^2 = 1$$

Constant b_1, b_2, b_3, b_4 are determined such that variance of Z_2 is maximized subject to the normalizing condition:

$$\sum_{i=1} b_i^2 = 1$$

Second Principal Component (Z_2) is independent of the first principal component (Z_1). In our case for social inclusion variable this is done for four such linear combinations namely Z_1, Z_2, Z_3, Z_4 such that $Var\ (Z_1) > Var(Z_2) > Var\ (Z_3) > Var\ (Z_4)$

These Z Variables are a column vectors are new set of explanatory variables which are called as principal component.

Control Variables:

In order to control for infrastructure we have taken road density as a suitable proxy. Employment Cost & Investment has been taken to see if firm efficiency is sensitive to cost & Investment changes respectively. Results are robust as seen by minor changes in coefficients even if we add/drop few variables

Description of Summary Statistics (See Table 2 in Appendix)

- District with most agglomeration: Layah, Rajanpur, Mianwali, RY Khan.
- District with most Diversity: Lahore, Khanewal, Multan, Kasur, Attock & Shiekupura
- Districts with highest average efficiency of firms: Sargodha, Jhangh, Kasur, R.Y. Khan, Sheikhupura & Faisalabad
- Districts with lowest average efficiency: Rawalpindi, Lahore, Sahiwal & Gujranwala (Larger districts e.g. Lahore etc. may have low average efficiency due to huge variation in the operations of firms)

This study faced time and data constraints. Efficiency model could not be estimated with full robustness due to degrees of freedom problem. This issue was expected since we have used district level data.Aforementionned problem could have been avoided had the regression was run at firm level but that would not have added anything substantial to the already dense literature on agglomeration. Perhaps future studies could counter this degrees of freedom limitation

4. ECONOMETRIC SPECIFICATION

Careful consideration was taken to ensure correct specification of econometric model. Ordinary Least Square was rejected after Lagrange Multiplier test and Random effects model was rejected based on the results of Haussmann Specification test.We have estimated following equation for present study:

$$\boldsymbol{Y_{it} = B_1 X_{it} + B_2 X_{2it} + B_3 X_{3it} + \alpha_1 + \alpha_2 + \ldots \alpha_n \epsilon_{it}}$$

The use of above equation (Fixed Effects) will solve the problem of endogeneity by ensuring that the assumption of $Cov\ (X, U) = 0$ is not violated.

Skewness/Kurtosis:

It is necessary to check whether data is normally distributed or not. Therefore, we use Cameron & Trivedi's (1990) decomposition of IM-test in STATA.

$$H_o: No\ presence\ of\ \ Skeness/Kurtosis$$

$$H_1: Presence\ of\ Skeness/Kurtosis$$

Table 3

Skewness and Kurtosis of the data

	Chi	Df	P
Skewness	17.63	34	.9908
Kurtosis	1.65	1	.1994

Source: Authors' own Calculations

Overall there is no skewness or kurtosis in the data. Individually the variables for social inclusion, agglomeration, road density & crime factors follow normal distribution.

Specification/Endogeneity Test:

Ramsey *reset* test (1969) checks for misspecification in a model and also omitted variable bias.

The *reset* test procedure is as follows:

1. Regress $Y\ on\ X_1, \dots X_k\ and\ obtain\ \hat{Y}$
2. $Calculate\ (\hat{Y})^2 and\ (\hat{Y})^3$
3. $Regress\ Y\ on\ X_1, \dots X_k\ \&\ (\hat{Y})^2 and\ (\hat{Y})^3$
4. $Test\ the\ null\ that\ (\hat{Y})^2 = (\hat{Y})^3 = 0$

$$H_o: \text{No omitted Variables/Correct Specification}$$

$$H_1: \text{Omitted Variables/Incorrect Specification}$$

Prob > F = 0.4118 is greater than 0.05 fail to reject Ho. This implies the model is correctly specified and that it has no omitted variable bias.

Heteroscedasticity Test:

Group wise heteroscedasticity was checked for using Modified Wald test in the Fixed Effect regression model using STATA. The same answers were also obtained Breusch–Pagan (1979) and Cook–Weisberg (1983) test for heteroscedasticity

$$H_o: \text{Errors are homeskedatic}$$

$$H_1 : \text{Errors arehetroskedastic}$$

Prob>chi2 = 0.0000 Therefore null hypothesis was rejected which implies that heteroscedasticity exits. To counter this problem, we have used heteroskedastic robust standard errors.

Multi Collinearity:

Multicollinearity diagnostic criteria are given below:

Table 4

Multicollinearity Diagnostic Criteria

Variables	Eigenvalues	VIF	1/VIF
Agglomeration	2.0155	1.0847	0.9219
Road Density	0.8975	1.4904	0.6710
Crime	0.5899	1.3554	.7378
Total Education	0.4971	1.3867	0.7211

Source: Authors own Calculations

The Variance inflation factor (VIF) is most commonly used criteria to identify the problem of multicollinearity in regression analysis. According to Gujarati (2012), if VIF is above 10, then severe problem of Multicollinearity exists among the predictors. However, VIF calculated shows no issue of multicollinearity as all the values for VIF are very lower than 10. If the Eigen values are near to zero than the chances are there that Multicollinearity exists, but none of the Eigen value are zero, so there is no issue of multicollinearity. The 1/VIF is called the tolerance test and if its value is less than 0.10 than there is Multicollinearity but none of the explanatory variables have tolerance value less than 0.10 Gujarati (2009). Since no Multicollinearity exits therefore it shows that **t** values are robust

5. RESULTS AND DISCUSSIONS

The Agglomeration index variable indicates the localization or urbanization effect. If the value of agglomeration index increases, then it means that localization is increasing and if the value of agglomeration index falls then it means that urbanization is increasing. The slope parameter of agglomeration index in regression is statistically significant at 1% level of significance. Thus benefits of industrial development in Punjab are being enjoyed by lower segment of population as well. These positive effects of localization rather than urbanization are supported by many empirical findings (Henderson et al. 2001,Ciccone & Hall, 1996, and Henderson,1990).

Table 5

FE estimates of Agglomeration Model

Variables	(1) Social Inclusion	(2) Social Inclusion	(3) Social Inclusion	(4) Social Inclusion
Agglomeration	0.457***	0.488**	0.494**	0.485**
	(0.165)	(0.179)	(0.180)	(0.177)
Road Density	0.260	0.542**	0.539**	0.535**
	(0.205)	(0.211)	(0.214)	(0.216)
Total Education	0.0806	0.101	0.109	0.117
	(0.157)	(0.144)	(0.143)	(0.140)
Crime Factors	-0.101	-0.0706	-0.0666	-0.0823
	(0.164)	(0.155)	(0.155)	(0.155)
No of Reporting Factories			0.000109	0.000153
			(0.000179)	(0.000187)
Employment Cost				8.18e-07
				(9.84e-07)
Constant	-0.206***	-0.250***	-0.260***	-0.261***
	(0.0703)	(0.0667)	(0.0677)	(0.0677)
District Fixed Effects	Yes	Yes	Yes	Yes
Time Fixed Effects	No	Yes	Yes	Yes
Observations	87	87	87	87
R-squared	0.097	0.123	0.125	0.131

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

(Std. Err. adjusted for 29 clusters in districts)

Source: Authors' own Calculations

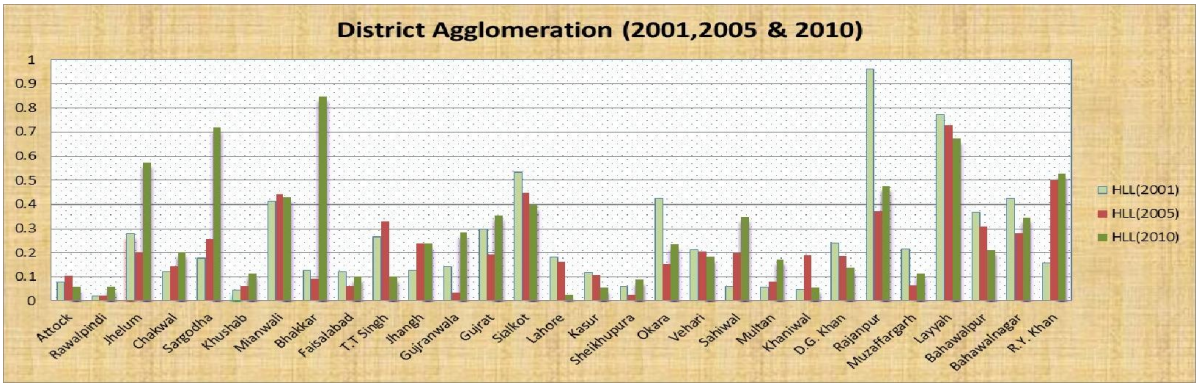
Road Density, Agglomeration and total education have positive relation with social inclusion. Whereas crime factor has negative relation with Social Inclusion. All the signs are as expected. Main variable of interest are statistically significant at 10% level of significance.

Correlation between district efficiency and agglomeration is positive. There are only 42 observations and if fixed effects are used this number will fall to 28. With *n* less than 30 OLS assumptions of normality will be violated. There has been vast literature present to support the

hypothesis that agglomeration increases efficiency of firms. Thus sign and significance may be checked without going into detail of robustness of results.

Figure 3

Agglomeration of Districts in the years 2001, 2005 & 2010



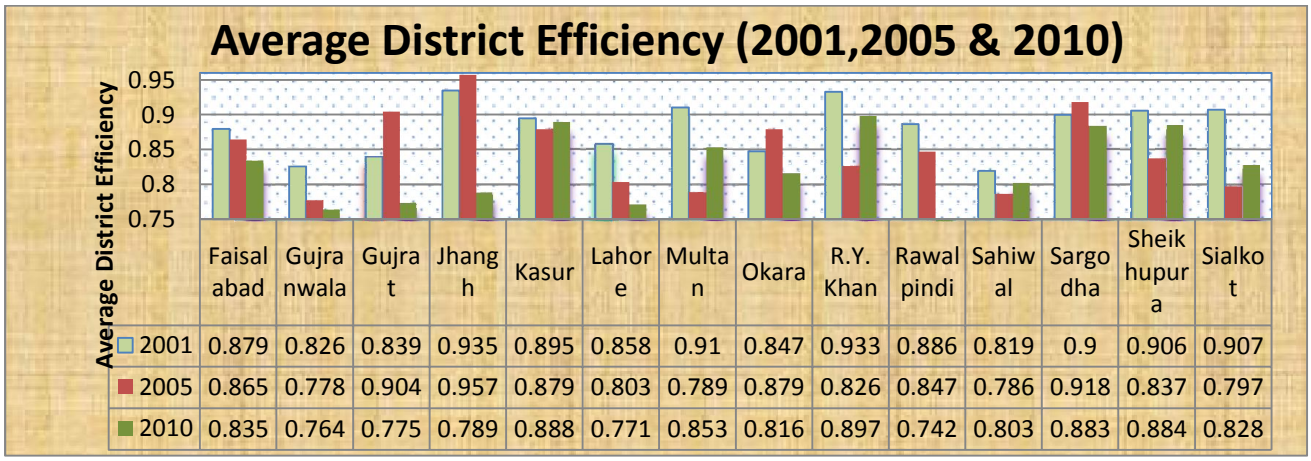
Source: Authors' Own rendering using Panel CMI data

Agglomeration of each of the district in the sample is illustrated above. X axis shows time period (2001, 2005 & 2010) whereas y axis shows agglomeration level. Districts show considerable change in agglomeration level. There is a mixed trend of change in agglomeration levels. There is a rise in agglomeration in Bhakkar, Sargodha & Jehlum whereas Rajanpur & Layyah show a fall in agglomeration level.

- Rajanpur, Layah, Sialkot, Okara show the most level of agglomeration in the year 2001
- Layyah, R.Y. Khan, Sialkot, Mianwali show the most level of agglomeration in the year 2005
- Layyah, Bhakkar, Sargodha, Jehlum show the most level of agglomeration in the year 2010

Figure 4

Average District Efficiency (2001, 2005 & 2010)



	Faisalabad	Gujranwala	Gujrat	Jhangh	Kasur	Lahore	Multan	Okara	R.Y. Khan	Rawalpindi	Sahiwal	Sargodha	Sheikhupura	Sialkot
2001	0.879	0.826	0.839	0.935	0.895	0.858	0.91	0.847	0.933	0.886	0.819	0.9	0.906	0.907
2005	0.865	0.778	0.904	0.957	0.879	0.803	0.789	0.879	0.826	0.847	0.786	0.918	0.837	0.797
2010	0.835	0.764	0.775	0.789	0.888	0.771	0.853	0.816	0.897	0.742	0.803	0.883	0.884	0.828

Source: Authors' Own rendering using Panel CMI data

There has been consistent fall in efficiency in Faisalabad, Gujranwala, and Lahore from 2001 till 2010 whereas there has not been any district that has shown consistent rise in average firm efficiency over the same period. For most district like Gujrat,Jhangh,Okara Sargodha etc. there has been a rise in average efficiency from 2001till 2005 but for the next half decade we see a falling trend of efficiency level.

As stated earlier, results for regression of district efficiency on agglomeration were not robust due to degree of freedom problem. This problem arose because our regressions are run on district basis and not on individual firm. Therefore, this paper utilizes the trend of efficiency (Figure 4) over the years (2001-2010).This will ensure robustness of results as well, since same firms are followed overtime to measure efficiency.

6. CONCLUSION

This paper investigated the district level agglomeration economies in the manufacturing sector of Punjab. DEA bootstrap analysis which incorporated technical efficiency model was applied. Plant level panel data constructed from CMI dataset for the years 2000-01, 2005-06 and 2010-11 was used. Agglomeration Index (Diversity index) was then calculated which measured local scale externalities at district level. The results showed that there exists a positive relation between agglomeration of industries and technical efficiency of firms.

The results indicate that firms in Punjab are benefiting from localization as opposed to urbanization economies. Large Firms benefit by locating in close proximity of each other in order to benefit from positive externalities generated from agglomeration within districts. These

firms are receiving advantage of knowledge spillovers and intra-industry learning in Punjab. Recently, Huang and Wei (2016) found that agglomeration leads to rising efficiency which attracts foreign investment. This foreign investment can intensify uneven economic development thereby leading to spatial (regional) inequality. However Firms in Punjab do not suffer from negative externalities due to increased regional competition, rather are benefiting from each other.

The results also showed that the districts with more agglomeration have higher social inclusion. This dependent was made of multiple variables which then were compressed in to single variable through Principal Component/Factor Analysis. Additionally it was seen that better infrastructure in districts also allows for more social inclusion. The findings of this study are in line with previous work especially that of Barkley and Henry (1997).

7. POLICY IMPLICATIONS

Punjab has immensely benefitted from cluster strategy. This study found that social inclusion and firm efficiency is positively related to agglomeration in districts. Therefore, government may design specialized clusters in such a way that it promotes social inclusion. Government may also focus on provision of better infrastructure facilities for economic and social development (benefits of which will materialize with lag though) as infrastructure has positive effect on social inclusion. Additionally, Better road network will lead to greater connectivity which will reduce costs of businesses, this will lead to increase in average firm efficiency.To get maximum benefit from agglomeration, need based trainings may be provided to the labor force and an enabling environment may be provided to develop social harmony for promoting social inclusion. Government may focus its policies to overcome energy crisis, ensure macroeconomic stability, and ensure availability of adequate workforce and access to raw materials and to eliminate corruption as well. All these measures will provide conducive working environment (through reduction of costs) which will result in smooth operation of businesses.

Appendix

Table 2

Summary Statistic (Mean) from 2001-2010

DISTRICTS	AGGLOMERATION	ROAD DENSITY	SOCIAL INCLUSION
Attock	0.0816	0.233	-0.125
Rawalpindi	0.0335	0.537	1.098
Jhelum	0.351	0.291	0.651
Chakwal	0.156	0.292	-0.224
Sargodha	0.385	0.399	0.655
Khushab	0.0733	0.228	0.576
Mianwali	0.429	0.225	0.659
Bhakkar	0.357	0.197	-0.975
Faisalabad	0.0944	0.508	1.827
T.T Singh	0.232	0.456	0.819
Jhangh	0.201	0.333	-1.43
Gujranwala	0.154	0.598	0.577
Gujrat	0.283	0.49	1.031
Sialkot	0.459	0.579	0.733
Lahore	0.124	0.629	2.171
Kasur	0.0932	0.366	0.261
Sheikhupura	0.0584	0.35	0.946
Okara	0.272	0.501	-0.662
Vehari	0.199	0.481	-0.101
Sahiwal	0.203	0.645	-0.183
Multan	0.103	0.565	-0.46
Khaniwal	0.0974	0.401	-0.452
D.G. Khan	0.189	0.113	-1.776
Rajanpur	0.603	0.0965	-2.337
Muzaffargarh	0.131	0.236	-1.127
Layyah	0.725	0.175	-0.693
Bahawalpur	0.296	0.082	0.0157
Bahawalnagar	0.35	0.23	-0.583
R.Y. Khan	0.396	0.244	-0.893

Source: Authors' own Calculation

Table 6A

Regression of District efficiency on Agglomeration

Variables	District Efficiency
Employment Cost	-1.47e-06***
	(4.90e-07)
No of reporting factories	-0.000325***
	(0.000104)
No of reporting factories squared	1.80e-07*
	(9.09e-08)
Investment	7.06e-07***
	(2.51e-07)
Total Education	0.000530
	(0.0101)
Constant	0.881***
	(0.0138)
Observations	42
R-squared	0.383

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Authors' own Calculation

Agglomeration, investment, and number of reporting factories squared have positive relation with average district efficiency of firms whereas employment cost and number of reporting factories in level form have negative relation with average district efficiency of firms

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