A Note on the Efficiency Effects of Agglomeration Economies: Turkish Evidence

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Abstract: By using a very novel dataset from Turkish SMEs, this paper investigates the effects of agglomeration economies on productive and allocative efficiency. After controlling for unobserved heterogeneity at the time level, our empirical results from ordered panel probit models provide evidence that clusters have no statistically significant effect on productive efficiency but a negative effect on allocative efficiency. We also show that the increase in prices is not due to increased product differentiation; therefore, it is most likely due to collusion.

Keywords: SMEs, Cluster, Competitiveness, Productive and Allocative Efficiency, Ordered Panel Probit Models.

1. INTRODUCTION

Since the seminal work by Porter (1990), academic interest in clusters has been vast. Porter (1998) argues that, in the past, competition was heavily driven by input costs, and therefore location was a factor that could create a comparative advantage for the firm. Today, on the other hand, in an environment of dynamic competition which includes global markets, comparative advantage can only be obtained by more efficient use of inputs, which requires innovation. As external environment is of crucial importance for innovation, many companies choose to be within clusters. Prescott (1998) also points out that it is very difficult to explain international income differences without controlling for the diversity of local conditions fostering or deterring the adoption of new technologies.

As Belleflamme *et al.* (2000) contend that, it is a well-established fact in urban economics that firms belonging to the same sector benefit from an increase in "productive efficiency" when they locate together. We should also note that while a large number of studies have documented the positive externalities stemming from agglomeration economies (Chung and Kalnins; 2001, for instance), there does not seem to be a consensus regarding the effects of clusters on competition, or "allocative efficiency". While one might expect increased price competition (consumers can more easily compare prices) and a decline in rents through geographical proximity, firms in the cluster might prevent competition through collusion (Labrecciosa and Colombo; 2010) or through product differentiation (Belleflamme *et al.* 2000).

In this paper, we empirically test the effects of clusters on productive and allocative efficiency by using a novel dataset that includes 155 Turkish firms from different industries regarding the 2005-2009 periods. The panel nature of our dataset allows us to control for unobserved heterogeneity. Our empirical results from ordered panel probit models provide evidence that clusters have no statistically significant effect on productive efficiency but a negative effect on allocative efficiency. We also show that the increase in prices is not due to increased product differentiation, therefore, the increase in prices is most likely due to collusion.

The remainder of this paper is organized as follows: Section 2 discusses the dataset and the empirical, methodology used, section 3 presents the empirical results and section 4 concludes.

2. DATA AND METHODOLOGY

Our dataset is obtained from sending a survey to 155 firms all operating in OSTIM Industrialized Zone, Ankara, Turkey. 54 of these 155 firms are part of 4 different industrial clusters, while 101 of them are not part of a cluster. All 155 firms are chosen *via* random sampling[1]. The survey asked firms to self-report their costs, prices, product differentiation, and production alongside other variables of interest as a structured scale. Table **1** presents the definitions for all model variables, while Table **2** presents summary statistics.

The empirical model estimated is as follows:

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[1]Initially 500 firms were chosen in 2010 *via* Random sampling from the OSTIM industrial area, and a survey was sent to all firms. A pilot study revealed that firms are not willing to "reveal" their production, cost and price data, and therefore, the firms were asked to report those variables on a scale. Only 70 firms completed the online survey. The remainder of the firms were contacted for a second time, and 85 additional firms accepted face-to-face interviews.

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Table 1: Variable Definitions

Variable	Explanation
	Productive Efficiency Variables
Production	Self-Reported Production (Likert Scale)
Cost	Self-Reported Costs (Likert Scale)
	Allocative Efficiency Variables
Price	Self-Reported Prices (Likert Scale)
Product Diff.	Self-Reported Prod. Diff. (Likert Scale)

Table 2: Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Price	775	1.903	0.743	1	3
Cost	775	1.374	0.654	1	3
Product Differentiation	775	1.167	0.373	1	2
Production	775	1.335	0.604	1	3

$$E_{it} = \alpha_0 + \alpha_1 CD + \alpha_2 I + \in_{it}$$

Where E is the efficiency variable of interest, CD is the cluster dummy which takes the value of 1 if the firm i is located in a cluster (agglomeration economy), I is the vector of year dummies to control for unobserved heterogeneity at the time level and $\in_{it}$ is the normally distributed error term. We should also note that full convergence is not achieved when firm and/or industry dummies are included in the estimations.

3. EMPIRICAL RESULTS

3.1. Benchmark Model

The empirical results for productive efficiency variables are presented in Table **3**. Our empirical results suggest that being in an agglomeration economy had no statistically significant effect on any of the productive efficiency variables. This result is quite surprising and contradicts with the previous literature reporting efficiency gains from geographical proximity. Coulibaly *et al.* (2007) argue that, while the new economic geography literature suggest firms located in an agglomerated area can take advantage from a larger market and the proximity of intermediate products' suppliers (localization and urbanization effects), this positive externality can be counterbalanced by high congestion costs and increased competition. Thus, it becomes really imperative to look at what happens to allocative efficiency.

Table **4** presents the empirical results of regressions that investigate the effects of agglomeration economies on allocative efficiency. Our results suggest that agglomeration economies had a significant positive effect on prices (Regression 3),

Table 3: Effects of Agglomeration Economies on Productive Efficiency

	Dependent Variable: Cost (1)	Dependent Variable: Production (2)
Cluster dummy	-0.008(-0.08)	0.0123 (0.13)
Year Dummies?	Yes	Yes
Constant	-	-
Chi_Sq	0.01	0.02
Psuedo R^2	0.0000	0.0000
Nobs	775	775
Estimation Method	Ordered Probit	Ordered Probit

Table 4: Effects of Agglomeration Economies on Allocative Efficiency

	Dependent Variable: Price (3)	Dependent Variable: Product Differentiation (4)
Cluster dummy	0.264*(3.14)	-0.371*(-3.11)
Year Dummies?	Yes	Yes
Constant	-	-
Chi_Sq	9.86*	10.06*
Psuedo R^2	0.0060	0.0143
Nobs	775	775
Estimation Method	Ordered Probit	Ordered Probit

Note: * denotes the significance level at 1% percent.

while they had a significant negative effect on product differentiation (Regression 4). Hence, we cannot explain the increase in prices with an increase in the product differentiation. It is most likely that the agglomeration economies, when they are unregulated, like they were in Turkey, encourage firms for tacit collusion, which leads to a decline in the allocative efficiency despite standardization of products.

3.2. Robustness Checks

The empirical results by using bootstrap method- which attempts to remedy our relatively small sample size- are presented in Table **5**. Our empirical results remain essentially the same. Neither of the productive efficiency variables, consistent with our previous results, are significantly affected by the cluster dummy. In terms allocative efficiency, firms' perceived prices rise while products are more standardized- pointing, once again, to collusion between firms.

As the cluster dummy might have a statistically significant effect on both productive and allocative efficiency simultaneously, we present Seemingly Unrelated Regression (SUR) estimation in Table **6** as a robustness check. Similar to our bootstrapping exercise, our results remain essentially the same.

Table 5: Effects of Agglomeration Economies-Bootstrap Estimation

Dependent Variable	Cost	Production	Price	Product Differentiation
Cluster dummy	-0.08 (-0.07)	0.012 (0.14)	0.264* (3.00)	-0.372* (-3.26)
Year Dummies?	Yes	Yes	Yes	Yes
Constant	-	-	-	-
Chi_Sq	0.01	0.02	9.19*	10.61*
Psuedo R^2	0.00	0.00	0.01	0.01
Estimation Method	Ordered Probit with Bootstrap			

Note 1: * denotes the significance level at 1% percent.
Note 2: We apply the bootstrap method to obtain critical values of the test statistics. To this end, we report p-values by using 500 bootstrap repetitions.

Table 6: Effects of Agglomeration Economies-SUR Estimation

Dependent Variable	Cost	Production	Price	Product Differentiation
Cluster dummy	-0.06 (-0.12)	-0.03 (-0.07)	0.177* (3.18)	-0.087* (-3.10)
Year Dummies?	Yes	Yes	Yes	Yes
Constant	1.376* (33.73)	1.337* (35.36)	1.842* (39.87)	1.198* (51.56)
Psuedo R^2	0.0000	0.0000	0.0129	0.0123
Estimation Method	SUR			

Note 1: * denotes the significance level at 1% percent.

4. CONCLUSION

The theoretical and empirical urban economics literature is full of praise of agglomeration economies, or, industrial clusters. By using a novel data set from Turkey, we empirically test the hypothesized effects of clusters on productive and allocative efficiency. Our results fail to provide evidence in favour of aforementioned positive productive efficiency gains. Rather, we find that firms tend to standardize their products and possibly collude on prices. These results are quite different than those of Coulibaly *et al.* (2007) who documents a positive effect of urbanization on productivity, also by using Turkish data. However, in our study, we look at both allocative and productive efficiency and we not only fail to document positive productive efficiency gains, but also we provide some negative effects on allocative efficiency. Our results do not suggest that agglomeration economies are harmful, rather they point out that they might need to be regulated. Further avenues of research certainly include empirically investigating the effects of clusters in other countries.

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