Porter's Theory, Innovation and Local Productivity: A Meta-Analysis for Turkey

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Abstract

According to Porter, the five forces, rivals, customers, suppliers, potential entrants, and substitute products, shape not only the industry competition but also co-operation. Cluster formation is impeded by low local education and skill levels, weaknesses in technology/information technology, international trade and firm relations. These elements define the nature of innovation and processes. Industry-University-Institute Cooperation is an effective way to promote the diffusion of technical innovation in industrial cluster; nevertheless, University and technical school curricula, centrally dictated, fail to adapt to cluster needs.

This study aims to measure relationship between productivity and underlying competitive forces, in Turkey. For productivity measurement GDP per capita is taken and for competitive forces: Human capital, R&D, Patent Numbers and Organizational Industrial Zones (OIZ) are considered as independent variables. According to the regression results, the OIZ and human capital are significant while Patent number and R&D in universities are insignificant.

Keywords: Innovation, Competitiveness, Local Productivity, Porter's Theory, OLS

Introduction

Current flow of innovations will reshape prevailing industry economics (Porter, On Competition, 2008) because productivity and competitivenessincreases with innovation.Most of the literature on competition explains competitiveness with Michael Porter, where he discusses relations between competitiveness, productivity and innovation. (Simmie, 2008, s. 19). According to Porter (2008, s. 80), the five forces, rivals, customers, suppliers, potential entrants, and substitute products, shape not only the industry competition but also co-operation (Porter, On Competition, 2008). Thus, agglomeration forces affect the productivity(Menzel, Henn, & Fornahl, 2010). According to Moreno, Paci and Usai(2005) in the innovative activity,there are strong and a positive spatial correlation at geographic and sectoral level.

Porter explainedrivalry occurs within the industry arena (Porter, The Five Competitive Forces that Shape Strategy, 2008, s. 79; Stringa, 2008).For the firms, the industry is the most important part of the competitive environment that innovation specialization in one region is highly dependent on specialization of production in the same region (Moreno, Paci, & Usai, Geographical and sectoral clusters of innovation in Europe, 2005). Today's complex, knowledge-based, and dynamic economy need clusters in developing economies.

The cluster concept represents a new way of thinking about national and city economies, and points to new roles for companies, governments, and other institutions (Porter, On Competition, 2008). Since these clusters are seen as the "centers of economic activity and important elements in economic development in general and in regional development in particular" (Menzel, Henn, & Fornahl, 2010, s. 1), scholars try to understand and explain competitiveness of locations and geographic concentrations. For instance, some scholars discuss "the access to networks (Owen- Smith and Powell 2004), to a local science base (Zucker et al. 1998) and/ or to local knowledge in general (Malmberg and Maskell 2006), but also 'buzz' in the sense of a diffuse and pervasive sharing of information (Bathelt et al. 2004), the co-ordination of complex tasks (Torre and Rallet 2005), local competition (Porter 1998), supportive institutions (Kenney and von Burg 1999) and the characteristics of regional cultures (Saxenian 1994)."(Menzel, Henn, & Fornahl, 2010, s. 1)

Focusing on productivity and innovation, the main aim of a nation providing "a high and rising standard of living for its citizens" (Simmie, 2008, s. 20). Nevertheless, productivity cannot be developed in a vacuum, the system concept is useful for explaining the dynamics of innovation(Preissl & Solimene, 2003).

In developing economies, cluster formation is impeded by low local education and skill levels, weaknesses in technology/information technology, international trade and firm relations, lack of access to capital, and poorly developed institutions. These elements define the nature of innovation and processes(Preissl & Solimene, 2003; Porter, On Competition, 2008).

As knowledge and competencies needed for innovation,human capital interaction is necessary. The strength of the competitive forces affects prices, costs, and the investment required to compete; thus the forces are directly tied to the income statements (Porter, On Competition, 2008). Rates of investment are important elements in explaining growth and observed GDP gaps (Liberto, 2007).The effect of the interaction between the initial per-capita income and the corresponding spatial lag suggests that regions with organized areas have higher expected growth rates than the regions without organized areas.(Basile, 2007)Thus,a society witha homogeneous increase structure benefits more from competitiveness and innovations(Mueller, Rosenbusch, & Bausch, 2013).

When growth may be mainly caused by imitation activities, it does not require a highly skilled labor force but growth in economies driven by innovation activities, which rely more on the most educated individuals (Liberto, 2007).

Advanced technology or innovations are not by themselves enough to make an industry structurally attractive (or unattractive)(Porter, 2008). Patents and patented innovations may have heterogeneous economic value (Moreno, Paci, & Usai, 2005, s. 718) and they affectperformance of a company. (Cotic-Svetina, Jaklic, & Prodan, 2008, s. 341) External support from local government, industry associations, and financial institutions can promote the diffusion of innovation in industrial cluster (Wei, Li-ran, & Xue-mei, 2010).

Lastly, Industry-University-Institute Cooperation is an effective way to promote the diffusion of technical innovation in industrial cluster; nevertheless, University and technical school curricula, centrally dictated, fail to adapt to cluster needs (Porter, 2008).

This study aims to measure relationship between productivity and underlying causes as discussed in Porter's theory, in Turkey. In the next section, details about the research method will be provided. Then, research results and concluding remarks will be discussed.

Method

As in Porter's works, in this study, the existence of industrial clusters, human capital patents and R&D in a region are accepted as indicators for explaining the local productivity and innovation. In this case study, general differences in the existence of industrial clusters, human capital, patents, R&D and industry-university relations effectsamongcities in Turkey are explained by using a meta-analysis. There are eighty-one cities in Turkey and all of them are included to the study (Appendix A).

The sample data set also the universe contains only data from the year 2014; therefore, the whole data set is included to OLS regression and analysis.Though local productivity is regressed with OLS taking log of local productivity relaxes the linearity of regression between regressed productivity and regresses. actually as the number of OIZ increases this can cause an increase in local productivity but obviously this increase is not linear. After some point the local productivity will converge and extra number of OIZ will not increase local production any more.

Hypotheses and Variables

Main objective of this study find out relationship between productivity and explanatory variables. For productivity measurement GDP per capita is taken and for competitive forces: Human capital, R&D, Patent Numbers and Organizational Industrial Zones (OIZ) are considered as independent variables. So hypotheses are below:

H1: there is a positive relationship between local productivity and Human capital.

H2: There is a positive relationship between local productivity and OIZ.

H3: There is a positive relationship between local productivity and R&D in universities.

H4: There is a positive relationship between local productivity and Patent number.

The data for GDP per capita is taken from Turkish Statistical Institute (TUIK)(Turkish Statistical Institute, 2015) to use it as an indicator for measuring income.

Similarly, the data for human capital is collected from TUIK. The data of university and higher education graduates for each cityisincluded to the study by dividing the sum to the population of eachcity, in order to get human capital representation.

For the University R&D data, the list of "the Most Entrepreneurial and Innovative Universities in Turkey", which is prepared and recently released by The Scientific and Technological Research Council of Turkey (TUBITAK)(2015), is included to the study.The existence of "innovative universities" in each city is collected from the list. "Having an innovative university" is used as a dummy variable: If an innovative university exists in a city then the Dummy takes the value 1, otherwise 0.Lastly, Organized Industrial Zones in each city is taken as indicators of industrial clustersand the data for it is drawn from the Association of Organizational Industrial Zones (OIZ). The data for patents is drawn from the Turkish Patent Institute Statistics.

The model is regressed as OLS with White heteroscedasticity-consistent standard errors & covariance, because it's cross sectional nature and probable heteroscedastic problems,where GDP per Capita data and education data are taken in logarithmic scale.

Research Findings

The linear regression model equation for the study is:

$$LGDP\ (productivity) = \alpha + \beta_1 LEDUC\ (HC) + \beta_2 PATENT + \beta_3 R\&D + \beta_4 OIZ + \varepsilon$$

LGDP (Local productivity) is taken as the logarithm of GDP per capita(LogHCis taken as the logarithm of Human Capital data),Patent is the number of patents taken from each city,R&D is the representative of R&D capacity of the universities of a particular city, and OIZ are the number of Organized Industrial Zones (Table 1).

The regression is estimated with the help of E-Views program and the results are:

Table 1: E-Views Results
Dependent Variable: LOG(GDPPER)
Method: Least Squares
Sample: 1 81
Included observations: 81
White heteroscedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
OIZ	0.052757	0.017150	3.076271	0.0029
LOG(HC)	0.846605	0.175659	4.819594	0.0000
PATENT	0.053537	0.058426	0.916328	0.3624
R&D	0.075663	0.094897	0.797317	0.4278
C	10.92470	0.371849	29.37943	0.0000

R-squared	0.366582	Mean dependent var	9.369539
Adjusted R-squared	0.333245	S.D. dependent var	0.532989
S.E. of regression	0.435213	Akaike info criterion	1.233777
Sum squared resid	14.39516	Schwarz criterion	1.381582
Log likelihood	-44.96796	Hannan-Quinn criter.	1.293078
F-statistic	10.99600	Durbin-Watson stat	1.998085
Prob(F-statistic)	0.000000		

According to the regression results, the OIZ and LogHC (HC) are significant while PATENT and R&D are insignificant at 5% significance level. F-stat shows that the model is significant, nevertheless R-squared is 0,36 meaning that only 36% of the innovation can be explained by OIZ, HC, PATENT AND R&D variables. By being aware of the fact that there might be other factors that can cause the GDP per capita to be higher such as health or nearness to seashores,it should be stressed that this model tries to explain mainly the innovative effect of the GDP per capita.

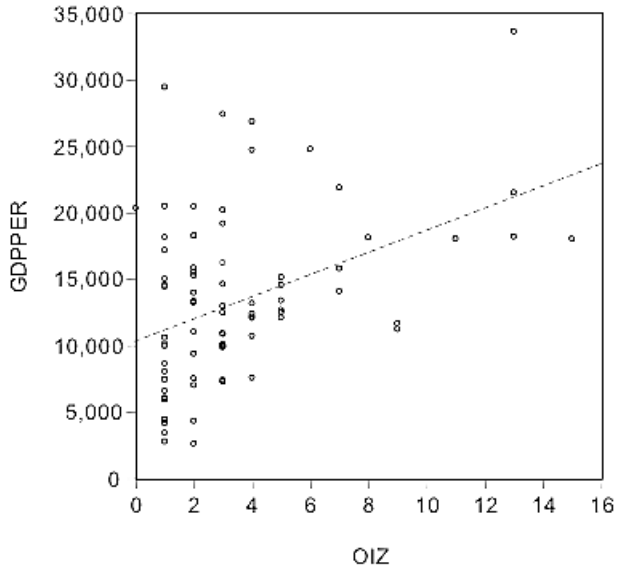
The first hypothesis was claiming the positive relation between local productivity and HC. In table 1 it was found out that LogHCis positively related with log Local productivity and coefficient is significant since the t-test result 4,82 is greater than the t critical value at 5% significance level. so the local productivity and HC are correlated with each other according to the coefficient of HC it can be concluded that a 1% increase HC ratio will increase Local productivity 0,84%.

The second hypothesis tests the relation between local pro. and OIZs. as the number of OIZs increases local productivity increases according to results in Table 1. the relation is significant according to t-test and probability value at 5%. OIZ built in a local city causes 0.05-point increase in local productivity.

The R&D in local regions also can cause increase in local pro. however our dataset denies the existence of a positive relation because of t-test and p value at 5% significance level.

Also the number of patents taken from a local city does not cause a local productivity increase according to table 1. t value and p value at 5% sig. level does not give a significant relation.

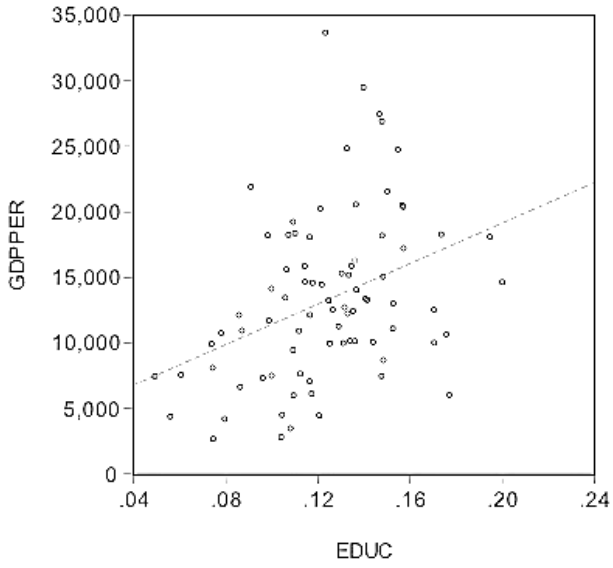
Figure 1: Scatter diagram of GDP per capita and Organizational Industrial Zones



As it can be seen from Figure 1, there is a positive relationship between Organized Industrial Zones are and GDP per capita in Turkish cities.

Similarly, human capital is the other major explanatory of capacity increase and innovation (Figure 2).

Figure 2: Scatter diagram of GDP per capita and Human Capital (education)



Conclusion

Main aim of this paper is to find out local productivity of firms in Turkey by using indicators such as R&D in universities, patent numbers, human capitaland industrial organization zones in line with Porter's theory. Productivityis measured by GDP per capita in Porter's theory; it is taken as a dependent variable in this study as well.

The existence of organizational industrial zones in Turkish cities is related to local productivity.Human capital, taken as higher education graduate proportion in local population, is also related how the city performs economically.

From, OLS results it can be seen that R&D and patent numbers are statistically insignificant over GDP per capita because there are not enough regional data for R&D in Turkey. To collect the data can be an aim of future studies. In this study, this year's patent numbers and R&D are insufficient to explain current year's income. In future studies, the data set of this study can be extended by including R&D and Patents numbers of several years, and the coefficients may become significant in these studies.

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Appendix A: The main data set.

	Cities	GDPperCapita	Human Capital	OIZ	Patentper	RandD
01	Adana	15521	**10.68%**	2	0.52	1

02	Adıyaman	7554	11.27%	4	0.30	0
03	Afyonkarahisar	11199	12.93%	9	0.83	0
04	Ağrı	4118	8.00%	1	0.00	0
05	Aksaray	5912	10.98%	1	0.00	0
06	Amasya	10000	14.43%	3	0.00	0
07	Ankara	18009	19.51%	11	2.06	8
08	Antalya	15231	13.07%	2	0.30	1
09	Ardahan	10583	17.62%	1	0.00	0
10	Artvin	20320	15.75%	0	0.00	0
11	Aydın	15784	11.46%	7	0.21	0
12	Balıkesir	14527	11.81%	5	0.18	0
13	Bartın	5944	17.74%	1	0.00	0
14	Batman	6562	8.67%	1	0.00	0
15	Bayburt	14998	14.87%	1	0.00	0
16	Bilecik	24758	13.29%	6	0.67	0
17	Bingöl	4374	12.10%	1	0.00	0
18	Bitlis	3394	10.84%	1	0.00	0
19	Bolu	24689	15.51%	4	0.00	0
20	Burdur	12933	15.31%	3	1.95	0
21	Bursa	17990	11.68%	15	4.45	1
22	Çanakkale	18206	17.40%	2	0.36	0
23	Çankırı	12465	12.68%	5	0.00	0
24	Çorum	14591	11.48%	3	0.88	0
25	Denizli	19162	10.96%	3	0.45	1
26	Diyarbakır	8029	7.47%	1	0.00	0
27	Düzce	9900	12.56%	3	3.57	1
28	Edirne	17150	15.75%	1	1.14	0
29	Elazığ	10097	13.44%	1	0.26	1
30	Erzincan	9922	17.09%	1	0.00	0
31	Erzurum	7255	9.65%	3	0.59	1
32	Eskişehir	20435	15.71%	2	1.07	2
33	Gaziantep	9843	7.41%	3	0.43	2
34	Giresun	13309	14.10%	2	0.80	0
35	Gümüşhane	8610	14.88%	1	0.00	0
36	Hakkari	4441	10.49%	1	0.00	0
37	Hatay	12060	8.61%	5	0.15	0
38	Iğdır	6051	11.78%	1	0.00	0
39	Isparta	12447	17.08%	3	1.50	1
40	İstanbul	18101	14.83%	8	3.80	13
41	İzmir	21479	15.06%	13	1.11	5
42	Kahramanmaraş	10681	7.84%	4	0.21	1
43	Karabük	29419	14.01%	1	0.61	0
44	Karaman	14392	12.20%	1	0.00	0
45	Kars	7396	14.81%	1	0.00	0
46	Kastamonu	12358	13.57%	4	0.00	0

47	Kayseri	10847	11.22%	3	0.59	3
48	Kırıkkale	20170	12.14%	3	1.86	0
49	Kırklareli	26828	14.81%	4	0.00	0
50	Kırşehir	10060	13.65%	3	0.65	0
51	Kilis	18126	9.86%	1	0.00	0
52	Kocaeli	33620	12.37%	13	3.49	2
53	Konya	11637	9.91%	9	1.48	1
54	Kütahya	15119	13.38%	5	0.00	0
55	Malatya	12054	11.69%	4	0.43	1
56	Manisa	21843	9.13%	7	4.47	0
57	Mardin	7494	6.10%	2	0.30	0
58	Mersin	18285	11.04%	2	0.32	1
59	Muğla	20477	13.69%	1	0.00	0
60	Muş	2743	10.44%	1	0.73	0
61	Nevşehir	15811	13.49%	2	1.30	0
62	Niğde	13210	14.19%	2	0.60	0
63	Ordu	10862	8.74%	3	0.15	0
64	Osmaniye	6986	11.68%	2	0.00	0
65	Rize	13966	13.71%	2	0.00	0
66	Sakarya	14064	10.02%	7	1.66	1
67	Samsun	13363	10.63%	5	0.26	0
68	Siirt	7423	10.03%	1	0.59	0
69	Sinop	11009	15.28%	2	0.97	0
70	Sivas	12164	13.33%	4	0.25	0
71	Şanlıurfa	7380	4.97%	3	0.00	0
72	Şırnak	2595	7.49%	2	0.00	0
73	Tekirdağ	18178	10.76%	13	2.06	0
74	Tokat	12645	13.19%	5	0.30	1
75	Trabzon	13151	12.51%	4	0.00	1
76	Tunceli	14550	20.04%	1	0.00	0
77	Uşak	9905	13.15%	3	0.46	0
78	Van	4311	5.64%	2	0.00	0
79	Yalova	27388	14.71%	3	0.69	0
80	Yozgat	9376	10.97%	2	0.42	0
81	Zonguldak	16208	13.64%	3	0.61	0