THE EFFECT OF PUBLIC SECTOR INVESTMENTS ON SOCIOECONOMIC DEVELOPMENT IN TURKEY

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Abstract
In this paper, we analyze the effects of public investments done between years 1999 and 2002 in 76 provinces (*il*) of Turkey on the socioeconomic development of those provinces during the period of 1996-2003. We consider public investments in the areas of agriculture, health, education, transportation and telecommunication and others. Our objective is to find which area of public investments has provided the largest socioeconomic improvement. Given the scarce resources and a history of large deficits of the Turkish government's budget, it is indispensable for the policymaker to know which investment area yields the "largest" improvement per lira invested. In the analysis, we use ordinary least squares and nonparametric estimation techniques. The results obtained from both techniques are robust and point to the same direction: they show that public investments in education area have a significantly positive effect on the socioeconomic improvement of a province per lira invested. Investments in other areas appear to be insignificant in terms of development. The results emphasize the importance of the policymaker's choice of which area to invest.
Keywords: Public Investments, Socioeconomic Development, Turkey

Introduction

Governments' role on development has been debated among economists and policy makers for centuries. There have been very diverse opinions about the issue ranging from proposing very active government intervention on all aspects of economy to confining governments' role as a very small regulatory player. As a general trend in recent decades, developed and developing countries tend to embrace the neoclassical view of government more. However this does not automatically mean that governments' role is really diminishing. On the contrary, when we analyze the long run perspective, we see that ratios of government budgets' to GDPs of nations are increasing. However, modern governments intervene in the markets in different ways than the governments in the past.

Public investments constitute one of the most prominent means of government intervention in markets. They can contribute to the development of a country or a region in a variety of mechanisms. They can provide some public goods which would be underprovided by private markets. For example, infrastructure investments are generally considered as public goods, the social benefits of infrastructure are bigger than social costs, but since appropriating those investments is not technically feasible, private markets do not provide these investments at efficient amounts. Also, public investments

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can provide goods or services which create positive externalities. Primary education and post-graduate level education have been shown to have positive externalities. When markets fail to allocate resources efficiently for a variety of reasons, government investments are needed to improve the allocation of resources. Health services are one of the sectors in which private markets fail to work efficiently and need for government intervention is absolute.[3] Public investments can also provide income transfers to the relatively poor segments of the society. Especially in developing countries agricultural investments can be considered as income transfer to the poor.[4] Thus, public investments can have huge benefits and substantially influence development. However as we all know, financing these investments can be very costly. Governments must either increase current taxes or borrow money by issuing bonds, or obtain seigniorage revenue by increasing the money supply. None of the options seem appealing especially for countries like Turkey. Already high tax rates, large government debt and a high rate of inflation make it very difficult for the government to undertake investment projects. Thus, governments have to analyze the issue very carefully and try to get involved in projects which will have the largest effect on the development.

In this paper, we analyze the effects of public investments made in the provinces of Turkey on the socioeconomic development of those provinces during the period of 1996-2003. The previous literature has mostly used per capita income as the sole indicator of economic development. However; welfare of individuals does not only depend on their private incomes but also on a variety of resources. Public health services, public educational institutions, availability of clean water and sewage systems, reliability of electricity, air quality and many other variables can affect the individual welfare but might not show up on per capita income statistics. Thus in this paper, we use an index of socioeconomic development prepared by State Planning Organization (SPO) that includes a wide array of both economic and social indicators of human development.

We consider public investments in five areas: agriculture, health, education, transportation and telecommunication and others. Our objective is to find out which areas of public investments have provided the highest socioeconomic improvement on average between years of 1996 and 2003.

Turkey has had persistent public sector budget deficits and consequent balance of payments crises since 1980s. Especially after the 2001 crisis however, government's fiscal discipline has been the foremost priority of economic policy. Therefore, it is indispensable for the policymaker to know which investment area yields the "largest" improvement per lira invested.

It seems that empirical papers that have studied development especially in Turkey have used ordinary least squares (OLS) regression as their sole technique of analysis. In addition to using OLS in this paper, we use nonparametric regression (NP) model.

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[3] Asymmetric information, moral hazard, and adverse selection, are a few of the many problems in health services market. For a good review on the issue see Cutler (2002)
[4] In Turkey per capita income of individuals in agriculture is approximately half of per capita of average Turkish population.

Nonparametric regression is a method that is robust to misspecification of the functional form of regression (Li and Racine 2007). Not surprisingly, our estimation results show that nonparametric techniques have performed better than OLS in terms of objective criteria such as mean squared error (MSE) and R-squared. We believe that the application of NP methods to this question is an important contribution to the development literature in Turkey.

The rest of the paper is organized as follows: section 2 describes the data used in the analysis; section 3 describes the methodology, section 4 presents the results and section 5 concludes.

1. Data

We do not attempt to measure levels of development in provinces of Turkey in this paper. Instead, we use two indices of socioeconomic development across 76 provinces of Turkey in years 1996 and 2003. The indices were constructed by the researchers at SPO (Dinçer, Özaslan et al. 2003). SPO has taken a broad view of the development concept by combining 58 economic and social variables that measure various aspects of development. These variables include, for instance, infant mortality rates, literacy rate, electricity consumption rate, and the number of motor vehicles among others. We use the improvement in the two development indices of each province between the years 1996 and 2003 as the dependent variable in the analysis. We measure the improvement (or decline) in levels of development by the difference between the province's index in 2003 and 1996. Denoting improvement of province i by IMP_i,

$$IMP_i = INDEX_{i,2003} - INDEX_{i,1996} \quad i = 1,..,76$$

(1)

where $INDEX_i$ is the development index of province i.

As explanatory variables, we use per capita public sector investment amounts made in each of the 76 provinces and five different areas through years 1999, 2000, 2001 and 2002. The investment data was also obtained from SPO. We consider public investments in five areas: health, education, agriculture, transportation and telecommunication and other investments. Such detailed investment data were not available at SPO for years before 1999; particularly for years 1996-98 that are in the relevant period in this paper. We add up the investments made to each area in each province during the 1999-2002 period. Then, we find the per capita investments by dividing the investment amounts by each province's population.

2. Methodology

We use alternative regression methods to find the relationship between public investments in five areas and socioeconomic development in order to compare and verify results across methods. First, we use OLS regression. The estimated linear model is

$$IMP_i = b_0 + b_1 AGR_i + b_2 HEA_i + b_3 EDU_i + b_4 TT_i + b_5 OTH_i \quad i = 1...76$$

(2)

where IMP_i is the difference in the development index of province i between years 1996 and 2003; AGR_i, HEA_i, EDU_i, TT_i, OTH_i are the per capita investment amounts made to agriculture, health, education, transportation and telecommunication and other areas in province i respectively.

OLS regression as any other parametric method requires the practitioner to specify a functional form prior to estimation regarding the relationship between the dependent variable and independent variables. When the practitioner assumes a functional form (such as a linear function in the OLS case), there is a possibility that this chosen form does not represent the true population from which the data was gathered. Such a possibility can be evaluated using specification tests. If the parametric model is found to be misspecified, then the results obtained from the parametric estimation cannot be valid. Nonparametric (NP) kernel regression method is robust to misspecification of functional form (Li and Racine 2007). For this reason, we have also applied NP regression in this paper. The key issue in NP estimation is the selection of optimal bandwidths. Following Racine and Li (2004) and Li and Racine (2004), we employed least-squares cross validation (LSCV) method in bandwidth selection. The results of both the OLS and NP kernel regression estimation are provided in the next section.

In Turkey, during the period of 1996-2003, the status of five "towns" (*ilçe*) previously under the administration of their respective provinces have been elevated to the province (*il*) status themselves. Those "breakaway" towns are Düzce (Bolu), Kilis (Gaziantep), Yalova (Bursa), Osmaniye (Adana), and Karabük (Zonguldak) with the respective provinces that they used to be a part of written in parentheses. This administrative change has artificially influenced the socioeconomic development indices of those five provinces at varying degrees. The most significant effects were observed for Bolu and Gaziantep. As Düzce has become a province, Bolu has jumped 15 provinces ahead in the socioeconomic development ranking during 1996-2003. In the same period, Gaziantep has left 6 provinces behind in the ranking. The mean and the standard deviation of the *change* in the indices of 76 provinces during 1996-2003 were -0.0016 and 0.13 respectively. The change in the index values of Bolu and Gaziantep were + 0.46 and + 0.26 respectively. Thus it is clear that regression results may unduly be influenced by the administrative division of the five provinces. To control for such an artificial influence, we include a dummy variable with the name *DUM* that takes the value of one for Bolu,

Gaziantep, Adana, Bursa and Zonguldak and zero otherwise. So our OLS model becomes:

$$IMP_i = b_0 + b_1 AGR_i + b_2 HEA_i + b_3 EDU_i + b_4 TT_i + b_5 OTH_i + b_6 DUM_i \quad i = 1...76$$

(3)

2.1. RESULTS

The results of the OLS regression using equation (3) is presented on Table 1.

Variable	Coefficient	t-statistic	Rejection Probability
AGR	-0.000267	-0.26	0.800
HEA	0.000116	0.05	0.960
EDU	0.00291	2.8	0.007
TT	0.000520	0.33	0.743
OTH	0.0000737	0.89	0.376
DUM	0.219	4.66	0.000
constant	-0.0847	-3.13	0.003

R-squared	0.324
MSE	12.5×10^{-3}
Sample size	76
F (6, 69)	6.84
Prob > F	0.0000

Table 1

The results clearly show that only education investments have a significant positive effect on socioeconomic development of provinces. The coefficient of the education variable is also large, considering the fact that the average improvement in the development index (*IMP*) is only -0.0016. This means that on average, a one Turkish Lira (of 1987) increase in the education investment amount made in a province leads to 1.8 times[5] the magnitude of the average improvement across provinces.

A second point to note is that the administrative division of the five provinces Bolu, Gaziantep, Adana, Bursa and Zonguldak into smaller provinces have very significantly affected their socioeconomic status. This was expected because the relative position of the five provinces in the rankings have been altered after the administrative change, as was discussed earlier.

The result is a strong one, however, we need to compare it with the results of an alternative method in order to see if the result is robust to the technique of analysis. Therefore, we have used nonparametric regression with data-driven optimal bandwidth selection for categorical (discrete) and continuous variables (See Racine and Li 2004 and references therein). In particular, our method uses local constant

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[5] 1.8 = 0.00291 / 0.0016

regression estimator with second order gaussian kernel function for continuous variables and Aitchison and Aitken's 1976 kernel function for the dummy which is an unordered categorical variable.

We also use a nonparametric method of significance testing based on Racine, Hart, and Li 2006 and Racine 1997. This method uses the optimal bandwidths found in nonparametric regression in a bootstrap algorithm. This algorithm executes a user-specified number of bootstrap replications and returns the rejection probabilities analogous to a simple t-test in parametric regression. We used 399 bootstrap replications in results reported below. The results of the nonparametric regression and significance tests are presented on Table 2.

Table 2

Variable	Selected Bandwidth	Rejection Probability
AGR	4.70	0.396
HEA	15.4	0.143
EDU	12.9	0.043 *
TT	3.7×10^7	0.642
OTH	109	0.434
DUM	8.7×10^{-17}	0
R-squared	0.535	
MSE	7.9×10^{-3}	
Sample size	76	

We obtain a smaller MSE from nonparametric (NP) regression (7.9×10^{-3}) than OLS regression (12.5×10^{-3}). This shows that NP regression does a better job of fitting the actual distribution than OLS. Also, we get a larger R-squared value with nonparametric method. This implies that the latter method helps explain a larger percentage of the variation in the dependent variable using explanatory variables. In summary, we can argue that NP regression could be a better way of studying the relationship between public investments and socioeconomic development.

As far as the question of which area of investments yield the highest return in terms of socioeconomic development, the results of the two methods support each other. Education investments appear to be the only significant type of public investments that positively contribute to socioeconomic development of a province. The OLS method seems to estimate a greater significance level (less than 1 percent) for education investments than the NP method (4 percent). Both methods do not detect any significant effect from other public investments on development. The implication for the policymaker is clear: public investments on education has to be strengthened and investments on other areas have to be reassessed for their returns in terms of development. Also, NP regression confirms the OLS result that the administrative division of the five provinces has significantly affected their development level.

3. Conclusion

In this paper, we study the effect of public investments made in 76 provinces of Turkey between years 1999 and 2002 on the socioeconomic development levels of those provinces between years of 1996 and 2003. We apply two methods of regression to the problem: OLS and NP regression. Both methods point out that only education investments appear to have a positive and significant effect on socioeconomic development of the provinces of Turkey. We do not detect any significant contribution of public investments to other areas of health, agriculture and transportation and telecommunication on development. Although more research has to be done in order to test our result, the message to the Turkish policymaker is clear: education investments have to be taken more seriously, even if this means that the government has to decrease investments to other areas.

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