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A PANEL ANALYSIS OF PUBLIC EXPENDITURES IN TURKEY

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ABSTRACT

In this paper, throughout a standard Public Choice model for the demand of public goods, we intend to analyze the public expenditures in Turkey. In doing so, we employ a panel approach to test the median voter theorem at provincial level, over the period 1996-2001. To estimate the parameters in the model with panel data, we use fixed effect estimation specification with least squares method (LS). In addition, to compare the results and justify the reliability of our estimates, we also employ generalization method of moments (GMM). To a further look, we also advance our study at regional level. Our findings strongly support the theoretical model. Furthermore, our investigation at the regional level suggests sharp differences across the regions.

JEL Code: H31, H40, H50, H72

Keywords: Median voter theorem, Panel data, Public expenditures, Public Choice.

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1. INTRODUCTION

Analysis of public expenditures constitutes a central issue in the public economics or public finance literature. Considering the public expenditures in form of publicly supplied goods and services, a series of issues has been addressed. Basically, the cost of those goods and services is provided by the community, and the demand of those goods and services decided collectively (Bergstrom & Goodman, 1973). Although those issues refer to problematical matters, having information about the public good demand of the individuals, hence the community's, may be useful in many context. For instance, it may be convenient to estimate the possible effects of demographic and economic changes on the public goods to be provided. Or it may be useful to get information about the degree of publicness of the provided goods, in order to ensure efficiency.

In this paper, throughout a standard Public Choice model for the demand of public goods based on median voter theorem, we intend to analyze the public expenditures in Turkey. In doing so, we employ a panel approach to test the median voter theorem at provincial level over the period 1996-2001. Although such a study at cross-sectional level was made by Pınar (2001), he employs local government (municipalities) expenditures. However, considering the dominance of central government rather than local governments in Turkey, we employ the expenditures executed through consolidated budget.

To estimate the parameters in the model through panel data, we use fixed effect estimation specification with least squares method (LS). In addition to compare the results and justify the reliability of our estimates, we also employ generalization method of moments (GMM). To a further look, we also advance our study at regional level. Our findings strongly support the theoretical model. Furthermore, our investigation at the regional level suggests sharp differences across the regions.

The rest of the paper is organized as follows: While the second section briefly summarizes the theoretical background, the third section exhibits the model. In the fourth section we introduce the data and in the fifth, we deal with the estimations and their results. Finally, the sixth section consists of concluding remarks.

2. THE SIGNIFICANCE AND THE EMPIRICS OF THE MEDIAN VOTER THEOREM

The expenditures of private goods are determined in markets through price mechanism. However, expenditures on public goods are non-market issues and determined through a political process. One of the disciplines exclusively deals with this issue is the *Public Choice Theory* which can be defined as "*the economic study of non-market decision-making or, simply the application of economics to political science*" (Mueller, 1976, p. 395).

In public choice theory, it is assumed that decision-making in a political process is executed through a political-exchange, called *catallaxy*, within the parties of this process. As in exchange in the market between sellers and buyers for private goods, for public goods there exists also a political exchange for the provision. According Buchanan (1985), politics can be considered as an institution for exchange, like markets. Throughout political exchange individuals of a community try to execute their objectives which they cannot execute efficiently without any collective action. As he mentioned clearly, through political exchange, individuals decide their demand for their collective needs, such as justice, security, education, etc., and their contribution for the provision of these publicly provided goods.

In this context, the median voter model appears a useful tool for the Public Choice Theory. It is useful to provide a formal explanation for the expenditure level on public goods. Based on the model median voter theorem suggests that, if

the individuals in a community are ranked according to their most preferred levels of public good expenditure, the most preferred level of the individual at the median will emerge as the determinant, in case of an referendum based on majority voting. In other word, out come of a majority voting procedure in a community will reflects the preferences of the median voter.

However, the validity of the median voter theorem suggests a restriction which implies to preferences with single-peaked. As long as the single peakness assumption is violated, result of the majority voting becomes unstable. Certain restrictions maybe applied for this problem. For instance, when we restrict the choices for a level of single public good the result usually refers to single peaked (Kramer, 1973). On the other hand, restrictions for one issue at each time may also ensure the single peaked preferences (Slutsky, 1975). Furthermore, under some assumptions the theorem has been proofed in multi-dimensional case (Mueller, 2003, pp. 67-72).

Although median voter model has some imperfections, it provides a useful framework for the empirical studies, which aims to investigate the demand of public goods. In most of these empirical studies, the demand of public goods can be computed by examining how the quantity of public goods depends on the relative price per unit of public good, and the median voter's income.

Earlier studies by Borcherding and Deacon (1972); Bergstrom and Goodman (1973) represent a very useful framework for both theoretical and empirical examination of local public spending. Both studies are based on demand analysis of local public goods throughout estimating the median voter's (identified by median income) demand for the public good. In both studies, the median voter assumed to maximize their utility by consuming private and public goods under the

constraint of their budget. In both studies the empirical results suggest significant and expected empirical evidences.[1]

Some of the studies focus on the relevance of the median voter model. One of those refined studies belongs to Holcombe (1989). Holcombe's thesis is that, the median voter model can be used as a foundation to understand the public sector demand, like the pure competition in private sector. According to him, just like in microeconomic theory models, which start competitive models and then impose elements of monopoly, in median voter model various complications, such as multi-peaked preferences and agenda control, on the fundamental model. After reviewing strong arguments both empirical and theoretical, Holcombe suggests that median voter theorem is a good approximation of demand aggregation in the public sector for various issues.

On the other hand, as suggested by Mueller (2003), which implies that empirical test for the median voter model should be based on some comparison of the performance of spending models with median income and tax share variables relative to the performance of spending models using mean income and tax share variables. Pommerehne and Frey (1976) and Pommerehne (1978) can be cited as the major empirical works to compare the performances of the models with mean and median variables. While the study by Pommerehne and Frey (1976) provides empirical evidences on behalf of the spending models with median variables, Pommerehne (1978) gives further information that suggests median income performs well in direct democracy governments, but it in a representative government it does not sustain a distinguish performance against the models with mean income variables.

[1] In both empirical studies (Borcherding and Deacon 1972; Bergstrom and Goodman 1973), income elasticity is positive and significant; price elasticity is negative and significant, which respect to the median voter theorem.

3. THE MODEL

For a pure public good, the median voter's problem can be written as

$$\max_{y,Q} U = U(y, Q) \tag{1}$$

st. $$I_m = p_y y + \tau p_Q Q \tag{2}$$

where y, q, p_y and p_Q are defined as quantity of private good, quantity of public good and their prices, respectively. τ and I_m represents tax share and income of median voter, respectively. Also, Q implies the total provision of public good.

The first order conditions associated with the above maximization problem suggest the following demand function for the public good

$$Q = Q(p_y, \tau p_Q, I_m). \tag{3}$$

The demand function in equation (3) refers to the demand of a pure public good.[2] However, certain public goods may be partially rival; for this intermediate case we barrow a device from Borcherding and Deacon (1972, p. 893) which implies to the level of public good available for consumption,

$$Q^* = Q / N^{\alpha}, \qquad 0 \le \alpha \le 1, \tag{4}$$

where, N represents population. Note that in extreme cases, when $\alpha = 0$ and $\alpha = 1$ the good is purely public and private, respectively. In intermediate cases, the good exhibits impure characteristic, in terms of rivalness in consumption.

Equation (4) allow us to find a price for an ordinary demand function for Q^* as $\tau p_Q N^{\alpha}$. Then, the demand function for Q^* can be written as

$$Q^* = Q^*(p_y, \tau p_Q N^{\alpha}, I_m). \tag{5}$$

By assuming a constant elasticity demand function, barrowing from Bergstrom and Goodman (1973), one can derive the demand function for Q^* as

[2] Pure public goods are the goods neither rival nor excludable in consumption. Non-rivalry in consumption refers to cases for which one person's consumption does not reduce or prevent another person's consumption. Non-excludability, implies that it is either or prohibitively costly to exclude any individual from the benefits of the public good.

$$Q^* = c(\tau p_Q N^{\alpha})^{\delta} I_m^{\eta} p_y^{\phi}. \quad (6)$$

And, substituting equation (6) in equation (4) gives us the total level of purchased Q as

$$Q = c(\tau p_Q)^{\delta} I_m^{\eta} p_y^{\phi} N^{\lambda} \qquad \lambda = \alpha(1+\delta). \quad (7)$$

In logarithmic form equation (7) becomes

$$\ln Q = c + \delta \ln(\tau p_Q) + \eta \ln I_m + \phi \ln p_y + \lambda \ln N. \quad (8)$$

The above equation is very useful in our context in many forms. First of all, the estimation of the coefficients (with the addition of an error term) gives us the elasticity measures of each variable. The price elasticity of demand (δ), income elasticity of demand (η) and elasticity of private good prices (ϕ) can be identified. More over, it has to be emphasized increases in population will influence the public expenditure both in tax shares and depending on the degree of publicness which can be determined by the coefficient λ. More clearly, recalling $\lambda = \alpha(1+\delta)$ where α is the rivalry parameter, as the population increases tax share will decrease at a magnitude depending on the rivalry of the public expenditures.

Although equation (8) exhibits a useful characteristic for an empirical estimation, the price elasticity has been masked by the effects of tax share (τ). Since τ represents the median voter's share of the cost of one unit of public good, empirically measuring τ refers to a problematic issue. Thus, we follow Dudley and Montarquette (1981) and assume an equal cost sharing among the population, which implies

$$\tau = 1/N. \quad (9)$$

Then, substituting equation (9) in equation (8), transforms the equation into form as

$$\ln Q = c + \delta \ln p_Q + \eta \ln I_m + \phi \ln p_y + \theta \ln N, \quad (10)$$

where $\theta = \alpha(1+\delta) - \delta$.

Thus, equation (10) becomes practical to serve us as a model to estimate, with the addition of an error term. And, this econometric specification will serve us a first model to estimate the important determinants of public expenditure.

4. DATA

In most of the seminal papers (Borcherding and Deacon 1972; Bergstrom and Goodman 1973; Dudley and Montarquette 1981) and in the Turkey specific study (Pınar 2001), the median voter demand functions were estimated through cross-sectional data. Conversely, we used panel data with 79 provinces[3] over the seven year period of 1995-2001. The most obvious conveniences of this approach, which distinguish from the cross-sectionals, may be interpreted in two ways. First, it provides a larger number of observations through adding the time dimension. And second, we obtain both inter-province and intra-province variations for all variables.

The data used in this paper has been collected from three official resources: Turkish Statistical Institute (TURKSTAT), Central Bank of Republic of Turkey (CBRT) and General Directorate of Public Accounts (GDPA). From those data sources, we seek the required data with annual period for each 79 in Turkey, considering to create a balanced panel data set. Although we would like to estimate with larger number of observations, we have been restricted by the lack of time-series regional statistics in many variables. Thus, we had to restrict our study with a period of seven years, 1995-2001. In other words, our number of observation has restricted with 553 observations. In many contexts, this observation number may be acceptable.

To empirically measure the dependent variable, quantity of public good (Q), we use consolidated budget expenditures for each provinces deflated by public

[3] We exclude the provinces, Duzce and Osmaniye, because of missing data for earlier years of the period.

sector price deflator (1994 = 100). The consolidated budget consists of both general and annexed budgets. By definition, while an institution, which is financed by general budget, provides pure public goods, and institutions with annexed budgets provide semi or impure public goods, such as education. Although the consolidated budget has ignored the special budgets for local authorities, such as municipalities, as Pınar (2003) suggested, local authorities prefer relying on central government rather than local revenue sources as a way of tax related political risks. Facing with this Turkey specific reality, we argued that expenditures financed by consolidated budget may be a better measure for the quantity of public good.

On the other hand, none of the data sources provide the identity of the voter with median preferences for the public good; hence, her income (I_m) is not known. In earlier studies (i.e. Bergstrom and Goodman 1973), it was argued that there would be some possible systematic errors for particular choices of proxies for the median voter's income. However, following by Murdoch *et al.* (1991, p. 627), we argue that for each provinces we can place a proxy variable that is highly correlated with the income of the median voter, in a panel data which consists of partially by time series data. The most conventional one may be the mean income, based on the results suggested by Pommerehne (1978)[4]. Hence, we use GDP per person. We prefer GDP per person in current prices for each province, in order to capture more the price related issues.

For the unit prices of public (p_Q) and composite private good (p_y), we use public sector price index (1994 = 100) and consumer price index (1994 = 100), respectively. While the former is unique for each year for all provinces, the latter variable is available for some provinces and for all geographical regions. For public goods, it can be reasonable to assume that most of the supplies purchased by provinces are subject to national market. And there is no objection to use unique

[4] As mentioned in section 2, Pommerehne (1978) suggested that median income performs well in direct democracy governments, but it in a representative government it does not sustain a distinguish performance against the models with mean income variables.

indicator for each regions. For instance considering the salaries for officials, they are all the same across the countries, excluding some side payments. However, we cannot argue the same thing for private goods, since local factor prices are more influential on private goods.

The data for population consist of mid-year population estimations, which are calculated based on two consecutive census' definite results. They are both available for each province. The complete list of variables can be seen in Appendix 1.

5. ESTIMATION AND EMPIRICAL RESULTS

In this section, the model outlined in section 3 will be estimated with two alternative methods, least squares (LS) and generalized method of moments (GMM), throughout our panel data. Existence of alternative estimation method aims to compare and justify the reliability of our estimation.

However, before starting the estimations, checking for the muticollinearity problem gives us high pair-wise correlations among some regressors. The indexes chosen for the unit price of composite private good and public good suggest high correlations with each other and with GDP per person, which refers to a proxy of median voter's income.[5]

In order to construct a reliable econometric specification, this problem forces us to drop at least one of the price index variables from the model. As the price of public good is crucial for the model, and desire to estimate its parameter, force us to drop the index used for private goods. At the first look, this action can be seen as a specification bias which implies incorrect specification of the theoretical model. However, as soon as we assume that public goods are not substitutable with private goods, we can manage the problem. In fact, most of the goods and services, which

[5] See Appendix 2.

are provided publicly, have not any private alternative. Then our econometric specification will not refer to any specification bias against the theoretical model.

Another important issue, which will shape our specification, comes from the AR process. Both our doubt and test showed that the dependent variable has an AR(1) process, which refers to explained by its preceding level. Considering the budget principal which implies appropriation of annual allowances and cancellation of the unexpended appropriations, AR(1) process may also be legitimated in reality.

Thus the main econometric specification to estimate appears as

$$ln Q_i^t = c + \delta ln\, p_{Q_i}^{\ t} + \eta ln I_{mi}^{\ t} + \theta ln N_i^t + ln Q_i^{t-1} + u_i^t , \qquad (11)$$

where subscripts show the cross-sections and superscripts imply to time series, years.

Our main intention to discover that our estimates of income elasticity are significant and positive and the estimates of price elasticity are significant and negative. Although the estimates of population elasticity are related with price elasticity parameter and the crowding parameter,[6] its expected sign is must be positive. Considering the earlier studies and assuming that all public goods are not pure then, this expectation can be legitimized.

Estimation with LS method, we use fixed effects specification to exploit the richness of the data. Through using fixed effect specification each cross-sectional unit, here each province has its own intercept value. Thus, by controlling effectively the cross-section effects, we can deal more with the variable of interests. The results are presented in Table 1.

Table 1 here

[6] Recall that $\theta = \alpha(1+\delta) - \delta$

Before interpreting the results some econometric issues must be mentioned about the estimation. First, the results are cross-sectional weighted GLS estimates, to allow heteroscedasticity in a relevant dimension. Second, to attain robust standard errors we employ White's heteroscedasticity–correction.

The results are completely consistent with the theoretical model, in terms of their significances and their signs. In earlier studies (i.e. Bergstrom and Goodman 1973, Borcherding and Deacon 1972), it is reported that income elasticities are less than one and price elasticities in the range of -0.2 to -0.6. Our results are robust and remain in the mentioned intervals.

However, as mentioned earlier, population elasticity consists of price elasticity parameter and the crowding parameter. Considering the estimated measures in Table 1, one can calculate the crowding parameter as 0.07, approximately. This refers to the characteristic of the public goods with a high degree of publicness. In other words, the provided goods are almost non-rival, or pure.

The confirmation of theory across the country motivates us to make some additional tests at regional level. In fact, we were curious about the behavior of the model with different subgroups. Accordingly, we divide the country into three zones, taking into account the level of GDP per person. Accordingly, the first zone consists of the regions Marmara and Aegean (MAR-AEG). The second zone consists of Central Anatolia, Black Sea and Mediterranean (CEN-BLS-MED). And, the third zone consists of East and South East Anatolia (EAS-SEA).

We use the same specification and the same techniques to avoid usual problems, as mentioned in the previous test. The results are exhibited in Table 2, for each zone.

Table 2 here

At the first look, the elasticity measures do not exhibit a derogative view, in terms of their signs and significances. However, a further investigation helps us to state the differences. First, while the income elasticity for EAS-SEA and CEN-BLS-MED follow the same pattern for the general test across the country, the income elasticity for MAR-AEG is significantly greater that the other estimates. Second, the same pattern can be observed for the price elasticities; again the elasticity for MAR-AEG is greater than the other estimates.

More interestingly, the elasticity of population is the most variant in both estimations. Particularly, the extreme values are obtained for MAR-AEG and EAS-SEA districts, 0.93 and 0.43, respectively. Those extreme values also suggest other extreme values for the crowding parameter. The calculations give us the crowding parameters as 0.84 for MAR-AEG and -0.28 for EAS-SEA.[7]

The parameter for MAR-AEG can be interpreted through considering the demographic situation in the zone. Since the population concentration is relatively high in the district, it may be argued that as the population increases the rivalness degree of the provided good increases. Alternatively, as Bergstrom and Goodman (1973) argued, there appear to be no economies of scale to larger provinces in the provision of the public good.

However, the estimated parameter for EAS-SEA, is quite interesting and perhaps, it has to be evaluated as economically nonsense. An alternative interpretation can concern the externalities issue, because of non-rival and non excludable characteristic of public goods. But details of this interpretation may go beyond the frontiers of this paper. However, it must be noted that the crowding parameter increases as the city sizes increases; at least in the sample for this study.

[7] The crowding parameter for CEN-BLS-MED can be calculated as 0.19.

Finally, in order to show the robustness and consistency of the estimated coefficient by LS method, we employ the GMM method. In fact, GMM for a panel data may be a useful tool for our data, with large number of cross-sections and short time series.

For the GMM estimation we use the same econometric specification defined in equation (11). As in the estimation with LS method, we use fixed effects specification. Also, for the heteroscedasticity case, cross-sectional weighted GLS and White's heteroscedasticity –correction are employed. In addition the instruments list, which consists of the lag values of regressors are arranged, which is necessary for the GMM estimation. The results are shown in Table 3.

Table 3 here

At first sight, the significance and the signs of the coefficients completely confirm the results that we obtained through LS. However, the value of the coefficients has increased almost 20 percent, except the coefficient of the lagged dependent variable. Calculations of the estimated crowding parameter also give similar value as the LS, 0.77.

Although GMM provides a useful framework for the comparison of the common estimators, it is a large sample estimator. As we aware of this phenomenon, we do not try to compare the estimated values of the coefficients from the test on zones. In panel data, as the number of cross-sections, hence the number of observations decreases the efficiency of the GMM estimators also decreases.

6. CONCLUDING REMARKS

In this paper we have employed the median voter model of Public Choice Theory as a tool to analyze the government expenditures in Turkey across the provinces. We have tested the model using fixed effect estimation both at country level and region level through LS method. Also a comparison for the validity of the estimated parameters has been checked with an alternative estimation method, GMM. Both estimation results suggest strong evidences for the confirmation of the theoretical model across the country along the mentioned period.

Income elasticity is positive and significant as expected, in all estimations. And the estimates remain the values that reported in other empirical studies. However, the estimation at the regional level gives us some clues, which suggest that income elasticity is decreasing gradually throughout west to east. This, evidence may be interpreted in many ways. For instance, one may argue that urbanization play a major role for the income elasticity. Thus, it would be interesting to measure the effect of urbanization. But we have not encountered a standard source for the data to test this phenomenon, with the scale of our sample. Another argument may be on the ground of politics, but we would not like to make speculations in the limited scope of this paper.

Population elasticity and the price elasticity may be elaborated commonly, since their estimated values define the crowding parameter. As expected, the price elasticity is negative that refers to public good is a normal good. And, the population elasticity is positive, which is consistent with the theory. However, while the price elasticity has not varied across regions, the population elasticity, hence the crowding parameter, are terribly different. This dispersion should be interpreted carefully, since we have a strong assumption which implies equal tax share among the population ($\tau = 1/N$). However, one can argue that in eastern regions, by interpreting the negative value of crowding parameters as close to zero,

there should be large economies of scale in terms of benefits of publicly provided goods.

Finally, there are some comments about this work that we wish to address here. First of all it may be argued that time series that we have used might not be long enough to analyze the dynamic effects for the elasticities. Although our balanced panel fit the model better than the cross-sectional one, more time series may increase the reliability of the model. Secondly, throughout the study, our analysis ignores the political considerations about the public expenditures; but as mentioned earlier, this sort of discussion is further than the scope of this paper.

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APPENDIX

Appendix 1. here

Appendix 2. here

TABLES SUPPOSED TO BE REPLACED

Table 1. Fixed effect estimation with LS

Estimated parameter	*Coefficient*	*Std. Error*	*t-Statistic*
Price elasticity	-0.52***	0.04	-12.42
Population elasticity	0.55***	0.06	9.75
Income elasticity	0.51***	0.05	10.67
Elas. of preceding level	0.54***	0.06	9.40
R-squared: 0.99	*Durbin-Watson stat: 2.11*		*Number of obs: 474*

Table 2. Fixed effects estimation with LS for zones

MAR-AEG			
Estimated parameter	*Coefficient*	*Std. Error*	*t-Statistic*
Price elasticity	-0.59***	0.07	-8.18
Population elasticity	0.93**	0.37	2.56
Income elasticity	0.58***	0.08	6.92
Elas. of preceding level	0.54***	0.09	5.97
R-squared: 0.98	*Durbin-Watson stat: 2.12*		*Number of obs: 114*
CEN-BLS-MED			
Estimated parameter	*Coefficient*	*Std. Error*	*t-Statistic*
Price elasticity	-0.51***	0.03	-14.78
Population elasticity	0.60***	0.08	7.80
Income elasticity	0.52***	0.04	12.53
Elas. of preceding level	0.46***	0.05	9.67
R-squared: 0.99	*Durbin-Watson stat: 2.18*		*Number of obs: 210*
EAS-SEA			
Estimated parameter	*Coefficient*	*Std. Error*	*t-Statistic*
Price elasticity	-0.56***	0.05	-11.09
Population elasticity	0.44***	0.08	5.48
Income elasticity	0.53***	0.06	9.24
Elas. of preceding level	0.58***	0.07	7.74
R-squared: 0.98	*Durbin-Watson stat: 1.98*		*Number of obs: 150*

Table 3. Fixed effects estimation with GMM

Estimated parameter	*Coefficient*	*Std. Error*	*t-Statistic*
Price elasticity	-0.44***	0.08	-5.35
Population elasticity	0.48***	0.03	14.35
Income elasticity	0.41***	0.10	4.26
Elas. of preceding level	0.61***	0.12	4.97
R-squared: 0.99	*Durbin-Watson stat: 2.08*		*Number of obs: 395*

Appendix 1. The list of the variables in the model

Dependent variable
$\mathbf{Q_i}$: Consolidated budget expenditure for the ith province, with the prices of 1994
Independent variables
$\mathbf{P_{Qi}}$: deflator for public sector (1994=100)
$\mathbf{I_{mi}}$: per capita GDP for the ith province, in current prices
$\mathbf{P_{yi}}$: consumer price index for ith province (1994=100)
$\mathbf{N_i}$: population of the ith provinces

Appendix 2. Correlation matrix of regressors

	$\ln Q$	$\ln I_m$	$\ln p_y$	$\ln p_Q$	$\ln N$
$\ln Q$	1.000000				
$\ln I_m$	0.226009	1.000000			
$\ln p_y$	0.097289	0.913458	1.000000		
$\ln p_Q$	0.084887	0.803364	0.997743	1.000000	
$\ln N$	0.897784	0.152925	0.030702	0.021788	1.000000