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A NOTE ON THE PUBLIC SECTOR OF THE COASTAL PLAINS*

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1. INTRODUCTION

For some time the Coastal Plains region, encompassing the eastern parts of North Carolina, South Carolina, and Georgia, has been considered a separate economic region. Such a determination has been made by comparing private sectors in the various states. In this study, we shall examine the public sector of the Coastal Plains to determine if it is in fact different from public sectors in other regions of the U.S. In so doing, we shall specify a utility maximizing model for the public sector and compare and analyze the resulting response parameters.

Ascertaining whether the public behaves differently in the Coastal Plains is important because should we find no statistical differences among regions, then we may infer that the role of the public sector in the Coastal Plains has been the same as in other regions. If in fact social overhead capital is being built in the Coastal Plains in the same fashion as in other, more developing regions, then the absence of rapid economic growth must be attributed to factors other than social overhead capital. The presumption here is that social overhead capital is an important determinant of economic growth. In point of fact, data limitations[1] will allow us to draw only tentative conclusions about the differences or similarities between regions, and subsequent inferences about the prescribed role of the public sector in the Coastal Plains must then be indirect and tentative in turn. Nonetheless, the methodology to be employed and empirical work to be generated seem sufficiently interesting to justify the effort.

2. A THEORY OF THE PUBLIC SECTOR

To begin the analysis, we must first specify a theory of how the public sector works. We utilize a model due to Henderson [2].[2] The local unit of interest is the population of a county. Collective decisions are democratically made by that population's elected representatives. We hypothesize that observed expenditure

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[1] We are limited in having only 1962 cross-sectional data and in using only total governmental expenditures; however, the expenditure item, from the 1962 Census of Governments, includes all capital outlays.

[2] The development in the text follows Henderson [2].

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and tax decisions may be explained as if they were the result of maximizing a community welfare function subject to a budget constraint.

The elected representatives of the county select expenditure and tax levels. These decisions are influenced by personal income levels, population size, and revenues from higher levels of government. Citizens of the community derive satisfaction from two types of expenditures: public expenditures (G) and private expenditures (X). The latter are defined as personal income less local taxes and thus include state and federal taxes as well as consumption and savings.

Denoting ordinal welfare of the community as W, we express welfare as a convex function of per capita public and private expenditure levels (G and X):

$$(1) \qquad W = (\alpha_0 + \alpha_1 Y + \alpha_2 TNS + \alpha_3 P)\log_e G + X$$

where Y is per capita personal income, TNS is per capita intergovernmental transfers to the locale, and P is population.

Local expenditures are limited by available tax revenues and ability to borrow. The usual accounting identity between expenditures and revenues may be restated to account for intergovernmental revenues or transfers to a locale (a nontax source of revenues) and borrowing:

$$(2) \qquad T = \beta(G - TNS)$$

where T is local per capita taxes and G and TNS are defined as before. If taxes plus transfers equal expenditures, then β must equal one. If debt is incurred, then β will be less than unity.

We may define debt (D) explicitly:

$$(3) \qquad D = G - T - TNS = (1 - \beta)(G - R).$$

Local taxes, T, equal $(Y - X)$, where it is understood that X encompasses consumption, saving, and federal and state taxes. Substituting this into Equation (2), we have $Y - X = \beta(G - TNS)$ or

$$(4) \qquad X + \beta G = Y + \beta TNS.$$

The left-hand side of Equation (4) relates expenditures to income sacrifice. Each dollar of private expenditure utilizes a dollar of income. Each dollar of local expenditures, however, requires a sacrifice of only β dollars for local taxes with the remainder of $(1 - \beta)$ dollars coming from new debt. Intergovernmental transfers are converted to an income equivalent on the right-hand side of Equation (4).

We assume that elected representatives choose values of G and X that maximize welfare subject to resource limitations, i.e., maximize Equation (1) subject to Equation (4). Forming the Lagrange function:

$$(5) \qquad L = (\alpha_0 + \alpha_1 Y + \alpha_2 TNS + \alpha_3 P)\log_e G + X - \lambda(X + \beta G - Y - \beta R)$$

and setting $\partial L/\partial G = \partial L/\partial X = \partial L/\partial \lambda = 0$.

$$\partial L/\partial G = \frac{(\alpha_0 + \alpha_1 Y + \alpha_2 TNS + \alpha_3 P)}{G} - \lambda\beta = 0$$

$$\partial L/\partial X = 1 - \lambda = 0$$

$$\partial L/\partial \lambda = X + \beta G - Y - \beta R = 0.$$

Thus the first order conditions for maximization give:

$$(6) \qquad G = \frac{\alpha_0}{\beta} + \frac{\alpha_1}{\beta} Y + \frac{\alpha_2}{\beta} TNS + \frac{\alpha_3}{\beta} P$$

$$(7) \qquad X = Y - \beta(G - TNS).$$

Second order conditions for a constrained maximum welfare require that Equation (1) be convex. Differentiating Equation (1) totally and substituting Equations (6) and (7) we have:

$$\frac{\partial^2 X}{\partial G^2} = \frac{(\alpha_0 + \alpha_1 Y + \alpha_2 TNS + \alpha_3 P)}{G^2} = \frac{\beta}{G} > 0.$$

We presume that both G and β will be greater than zero for any reasonable interpretation to be made. Hence fulfillment of first order conditions [i.e., Equation (6)] implies optimal values for G and β.

3. DATA BASE AND STATISTICAL TECHNIQUES

Data for the empirical estimation of Equations (2) and (6) are from the U.S. Bureau of the Census [3] and refer to 1962 counties. Per capita 1962 values of G, TNS, Y and T were derived as follows. First, 1962 population was created by taking 1960 population and extrapolating to 1962 under the assumption that the 1960 to 1965 increase was smooth. Denoting the increase in population from 1960 to 1965 as $CHG[CHG = (P_{1965} \times P_{1960})/P_{1960}]$, 1962 population then is:[3]

$$(8) \qquad P_{62} = P_{60}(1 + CHG)^{2/5}.$$

The census data provide 1962 total expenditures, 1962 intergovernmental transfers, and 1962 local taxes. Dividing each by P_{62} yields the desired per capita figures. Per capita income was obtained by assuming that 1959 aggregate county income changed in the same fashion as population. Thus Y_{62} was calculated by creating an aggregate 1962 income figure and then dividing it by P_{62}.

Since the unit of analysis is the county, G includes all expenditures across all governmental units up to and including the county. Similar remarks hold for Y, TNS, T and P. To simplify notation below, we merely subscript the variables with i to denote the ith county in 1962.

We now rewrite Equations (6) and (2) stochastically:

$$(9) \qquad G_i = \frac{\alpha_0}{\beta} + \frac{\alpha_1}{\beta} Y_i + \frac{\alpha_2}{\beta} R_i + \frac{\alpha_3}{\beta} P_i + u_i$$

$$(10) \qquad T_i = \beta(\hat{G}_i - R_i) + v_i,$$

where u_i and v_i are random disturbance terms with zero means and constant variances. Furthermore $E(u_i v_i) = 0$, since we have replaced G in Equation (10) with $\hat{G}$. We shall then estimate Equations (9) and (10) by two stage least squares.

[3] Assume P compounds at unknown annual rate, r, and assume CHG is known: (a) $P_{65} = (1 + r)^5 P_{60}$; (b) $(P_{65} - P_{60})/P_{60} = CHG$, or (c) $P_{65} = P_{60}(1 + CHG)$. Thus (d) $P_{60}(1 + CHG) = (1 + r)^5 P_{60}$ and (e) $(1 + r)^5 = (1 + CHG)$; $r = (1 + CHG)^{1/5} - 1$. (f) $P_{62} = (1 + r)^2 P_{60}$; $P_{62} = [1 + (1 + CHG)^{1/5} - 1]^2 P_{60}$. Therefore $P_{62} = (1 + CHG)^{2/5} P_{60}$.

To ascertain if there are regional differences in public expenditure behavior we first divide the Coastal Plains and all other geographic regions of interest into urban and rural counties. We define an urban county to be one with more than 100,000 population in 1962 in consonance with the 1960 census designation of SMSA-County.[4]

To test for regional differences, we test for the equality of regression coefficients of Equations (9) and (10). (See Chow [1].) Our null hypothesis, H_0, is that the urban Coastal Plains is the same as urban counties in other regions. Let SS be the residual sums of squares from a least squares regression and let there be i Coastal Plain counties and j counties in the other region of immediate interest. Also let k be the number of parameters being estimated. It can be shown that H_0 may be tested by computing the following test statistic:

$$\hat{F}_{k,\, i+j-2k} = \frac{[SS_{i+j} - (SS_j + SS_i)]/k}{(SS_{i+j})/(i + j - 2k)} . \tag{11}$$

We thus pool $i + j$ counties, compute SS_{i+j}, and then separate the counties into i and j parts and compute SS_i and SS_j. If $\hat{F} > F_{.05}$, we reject H_0 and infer that the Coastal Plains is significantly different in public expenditure or tax behavior.

The hypotheses we test are as follows:

TABLE 1: Null Hypotheses to be Tested

H_0	Types of Comparison
$CP = S$[a]	all, urban, rural
$CP = NE$	urban, rural
$CP = NC$	urban, rural
$CP = W$	urban, rural

[a] The South excludes the Coastal Plains (CP).

4. EMPIRICAL RESULTS

Table 2 presents the F test results for the various hypotheses. We find that Coastal Plains public expenditure and tax behavior are significantly different from the South overall, but when we compare the urban Coastal Plains with the urban South, no difference in expenditure behavior occurs, though differences in tax behavior occur. The rural Coastal Plains is significantly different from the rest of the rural South in terms of public expenditure and tax behavior.

Interestingly, the urban Coastal Plains is similar to the urban Northeast and

[4] Region definitions follow usual Census of Population definitions. *North East* (NE): Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont, Delaware, New Jersey, New York, and Pennsylvania. *North Central* (NC): Illinois, Indiana, Michigan, Ohio, Wisconsin, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota. *West:* Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming, California, Oregon, and Washington. *South:* Virginia, Alabama, Arkansas, Florida, Louisiana, Mississippi, Texas, Kentucky, Maryland, Oklahoma, Tennessee, West Virginia, and all of Georgia, North Carolina and South Carolina *except* those counties enumerated as being in the Coastal Plains. (These counties are listed in the Appendix.)

TABLE 2: Tests of Equality of Regression Coefficients between the Coastal Plains and other U.S. Regions

H_0	Expenditure Equation $\hat{F}$	Tax Equation F
$CP_{all} = S_{all}$	9.5**	26.1**
$CP_{urban} = S_{urban}$	.9	16.0**
$CP_{rural} = S_{rural}$	8.6**	30.4**
$CP_{urban} = NE_{urban}$	.5	.9
$CP_{rural} = NE_{rural}$	7.7**	30.4**
$CP_{urban} = NC_{urban}$	2.1*	9.1**
$CP_{rural} = NC_{rural}$	52.0**	153.4**
$CP_{urban} = W_{urban}$	1.1	1.2
$CP_{rural} = W_{rural}$	127.3**	154.6**

* Reject H_0 at the 90 percent level but not at the 95 percent level.
** Reject H_0 at the 99 percent confidence level.

urban West and similar to the urban North Central in expenditures. However, the rural Coastal Plains is quite different in expenditure and tax behavior from the rural sections of the Northeast, North Central, and Western regions. With regard to the tax equation in urban regions, we find the urban Coastal Plains similar to the urban West and Northeast and dissimilar to the urban South and North Central regions.

To highlight these consistent rural differences in expenditure and tax behavior, we examine the underlying expenditure equations. Table 3 presents the rural equa-

TABLE 3: Rural Public Expenditure Equations for Selected Regions in the U.S., 1962
(Standard Errors in Parentheses)

$$G_i = \theta_0 + \theta_1 Y_i + \theta_2 TNS_i + \theta_3 P_i + e_i$$

Equation	H_0 Region	$\hat{\theta}_0$	$\hat{\theta}_1$	$\hat{\theta}_2$	$\hat{\theta}_3$	R^2	μ_G
(1)	CP	2.32	.04527	1.12993	.00007	.42	119.46
			(.00839)	(.11520)	(.00009)		
(2)	S	99.16	−.0090	.62444	—[a]	.06	135.98
			(.00119)	(.07216)	(.00008)		
(3)	NE	−106.84	.14722	1.26513	−.00055	.67	198.94
			(.01995)	(.09102)	(.00017)		
(4)	W	138.68	.00092	1.24185	−.00035	.48	257.16
			(.00037)	(.06898)	(.00019)		
(5)	NC	82.65	.05310	.89667	−.00067	.40	197.34
			(.00432)	(.4116)	(.00008)		

G_i = per capita 1962 local public expenditures, ith county,
Y_i = per capita 1962 income, ith county,
TNS_i = per capita 1962 intergovenmental transfers, ith county,
P_i = 1962 population, ith county, and
μ_G = mean per capita 1962 local public expenditures for a region.
[a] less than 1×10^{-5}.

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tions for the Coastal Plains and the other regions used for comparisons. The rightmost column in Table 3 clearly shows that average rural per capita expenditures in the Coastal Plains are by far the lowest of the five regions being compared. Secondly, it is quite apparent that each vector of $\hat{\theta}$'s is different from the set of Coastal Plains coefficients; compare Equation (1) with Equations (2) through (5).

Another dollar of per capita income leads to quite different increments in public expenditures. In the rural Coastal Plains, 4.5 cents will be spent compared to 14.7 cents in the Northeast, .09 cents in the West and 5.3 cents in the North Central region. This much lower response in the rural West is offset by a very large response to intergovernmental transfers. A dollar of intergovernmental transfers to the rural West leads to 1.24 dollars of expenditures, i.e., an additional 24 cents will be spent beyond the dollar transferred to the locale. This contrasts to a 13 cent increment beyond the dollar transferred in the Coastal Plains.

5. CONCLUSIONS

We have seen that the urban counties in the Coastal Plains exhibit rather similar public sector expenditure behavior when compared to other regions of interest. While average per capita income is lower in these counties than in the other regions, the differences are not as large as they are when we compare rural per capita incomes for the Coastal Plains to other regions. To the extent we are willing to connect causally the disparities in public expenditures with income disparity, we may infer then that a larger role for the rural public sector may hasten growth. An optimal strategy would require information about the payoffs from various expenditures—something this study has not analyzed. It may be that the mix of expenditures is suboptimal as well as the level in the rural Coastal Plains. Extension of this interregional comparison methodology to particular expenditure items would shed light on this question.

APPENDIX: Counties in the Coastal Plains

Georgia

Appling
Atkinson
Bacon
Baker
Ben Hill
Berrien
Bibb
Bleckley
Brantley
Brooks
Bryan
Bulloch
Burke
Calhoun
Camden
Candler
Charlton
Chatham
Chattahoochee
Clay
Clinch
Coffee
Colquitt
Cook
Crawford
Crisp
Decatur
Dodge
Dooly
Dougherty
Early
Echols
Effingham
Emanuel
Evans
Glascock
Glynn
Grady
Houston
Irwin
Jeff Davis
Jefferson
Jenkins
Johnson
Lanier
Laurens
Lee
Liberty
Long

Lowndes
McIntosh
Macon
Marion
Miller
Mitchell
Montgomery
Muscogee
Peach
Pierce
Pulaski
Quitman
Randolph
Richmond
Schley
Screvan
Seminole
Stewart
Sumter
Tattnall
Taylor
Telfair
Terrell
Thomas
Tift
Toombs
Treutlen
Turner
Twiggs
Ware
Washington
Wayne
Webster
Wheeler
Wilcox
Wilkinson
Worth

North Carolina

Beaufort
Bertie
Bladen
Brunswick
Camden
Carteret
Chowan
Columbus
Craven
Cumberland
Currituck
Dare
Duplin
Edgecombe
Franklin
Gates
Greene
Halifax
Harnett
Hartford
Hoke
Hyde
Johnston
Jones
Lenoir
Martin
Nash
New Hanover
Northampton
Onslow
Pamlico
Pasquotank
Pender
Perquimans
Pitt
Robeson
Sampson
Scotland
Tyrrell
Vance
Wake
Warren
Washington
Wayne
Wilson

South Carolina

Aiken
Allendale
Bamberg
Barnwell
Beaufort
Berkeley
Calhoun
Charleston
Chesterfield
Clarendon
Colleton
Darlington
Dillon
Dorchester
Florence
Georgetown
Hampton
Horry
Jasper
Kershaw
Lee
Lexington
Marion
Marlboro
Orangeburg
Richland
Sumter
Williamsburg

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