ABSTRACT

THE EFFECT OF INTERGOVERNMENTAL GRANTS ON LOCAL GOVERNMENT SPENDING AND PRODUCTION DECISIONS: A PRELIMINARY ECONOMETRIC MODEL*

by

John F. Savage and Bruce A. Weber **

OLS regression results from a theoretically based model of county spending indicate that mental health (MH) grants stimulate MH spending. 3SLS regression estimates of a simultaneous MH wage-labor-output model indicate that grants stimulate MH employment, that wages are not endogenous, and that production relationships need better specification.

* Contributed paper presented at the annual meetings of the American Agricultural Economics Association, Pullman, Washington, July 1979.

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Ten years ago, Edward Gramlich wrote that "(the) explosion in federal grants and grant programs is nothing compared to the explosion in the literature dealing with the effects of federal grants" (Gramlich, 1969, p. 569). In the intervening years, federal and state grants to local governments have increased at rates outpacing the growth in property taxes. The research rate has slowed some, but is still steady. If any lesson has been learned by policymakers and researchers in those ten years, it is that the response of local government and their residents to different grant programs is not well understood.

Robert Inman, in his recent review of the literature, argued that the competing theories of local fiscal choice, as applied in the empirical studies of the effect of grants, proved too restrictive "for the complicated processes they were meant to describe." (Inman, 1977, p. 3) According to Inman and others, researchers have failed to incorporate public service technologies and administering bureaucracies into their models, have failed to develop output measures for public goods, and have failed to account for the influence of the budget decisions on wages, grants, the tax base, and the number of persons served. In addition, many studies have suffered from aggregated data. This aggregation has taken three forms: (1) the melding of different grant types into a single grant variable; (2) the combining of different units of governments into a single data base; and (3) the lumping of distinguishable public services into a single service category. The tendency of researchers to analyze aggregated data, coupled with the possible specification errors in their estimating equations, has left

"gaps in our knowledge" about the effects of grants (ACIR, 1977).

The purpose of this short paper is twofold. Firstly, it presents the regression results from a theoretically based model of the effects of different grant types on the spending for, and production of, a single service by a single type of local government. Specifically, the model and its accompanying estimating equations are used to determine the effect of matching and non-matching mental health grants on the expenditure, input, and output decisions made for western Oregon counties during the 1975-1976 fiscal year.

Secondly, it seeks to describe the shortcomings of the research, particularly with respect to the treatment of grants and output choices.

Oregon County Mental Health Programs and Grants: An Overview

In fiscal year 1975-76, there were 31 county mental health programs serving the residents of all 36 Oregon counties. Seven eastern Oregon counties had joint programs. Because of the statistical manipulations required to include these 7 counties in the data base and because all 13 eastern Oregon counties received a special federal grant to underwrite staffing costs that year, the observations for the 13 counties were omitted from the analysis.

The county-administered programs provide care, guidance or therapy to 3 types of patients: (a) persons who are mentally or emotionally disturbed; (b) persons who are mentally retarded or developmentally disabled; and (c) persons with alcohol or drug dependencies. In some counties, the county administrators contract with a private agency to care for patients with a particular handicap.

The state and federal governments fund over 20 different services for the mentally handicapped. Only a handful of the larger counties offer the complete package of services. These services include: community clinics, inpatient treatment, and day treatment for the mentally and emotionally disabled; work

activity centers and public school programs for the mentally retarded; and detoxification centers and halfway houses for the alcohol and drug dependent.

The state reimburses the costs of community clinics, detoxification centers and halfway houses on a 50:50 basis, providing a dollar of state money for every two dollars spent. The costs incurred by the county for the remaining service programs are reimbursed fully by the state and federal governments (i.e., non-matching grants). The amount of state matching and non-matching aid received by Oregon counties is determined through contractual arrangements made with the Oregon Mental Health Division. The county bureaus submit applications, often over 20 pages in length, that contain a standardized narrative about the socio-economic characteristics of the county, the number of patients treated in the previous year, the proposed service programs for the coming year, and the actual dollar amount requested. After reviewing the aid requests, the state determines the final aid allocations, by service programs, to each of the counties.

A Model of Oregon County Spending, Input Mix and Output Responses to Mental Health Grants

Following Robert Inman (1977), the mental health spending and production decisions are asserted to be separate budget decisions. Accordingly, we distinguish between the expenditure stage decisions--dictated by the county commissioners--and the output stage decisions--dictated by the mental health administrator.

Expenditure Stage

In the expenditure stage of the budget process, county commissioners are asserted to decide how much to tax residents and how much to spend for the county programs in a manner analogous to a process of constrained preference maximization. Their preference structure[1/]--rooted in their desire for (re)election, for out-of-office and in-office income, and for the power and prestige associated the

expenditure mix and size--is assumed to contain, among other arguments, the per capita expenditures for mental health programs, and the per capita expenditures for non-mental health programs. Maximizing this utility function subject to a budget constraint yields the demand equations[2/]:

$$E_{MH} = f_1(G_{MH}, G_{NMH}, G_U, G_N, INC, CB, RES) \quad (1)$$

$$E_{NMH} = f_2(G_{MH}, G_{NMH}, G_U, G_N, INC, CB, RES) \quad (2)$$

where

E_{MH} = per capita county mental health expenditures
E_{NMH} = per capita county non-mental health expenditures
G_{MH} = per capita matching mental health grants
G_{NMH} = per capita non-matching mental health grants
G_U = per capita unconditional grants
G_N = per capita non-mental health grants
INC = per capita income
CB = per capita county cash balance at beginning of fiscal year
RES = residential assessed valuation as a percentage of county assessed valuation.

Wilde (1977) and others have argued that open-ended conditional matching grants should be entered as price terms (generally, some form of the matching rate) in the expenditure-demand equations. Matching mental health grants have not been entered as price shifters in equations (1) and (2) for 2 reasons. First, results from an earlier study of mental health grants in Oregon (Weber and Savage, 1977) suggest that the ex post matching ratio for these grants did not affect county mental health expenditures. Secondly, the ex ante price for these grants is a constant up to the limit on the amount of aid appropriated by the donor government. It is that limit and not the matching ratio that is shifted by the preferences of the donor government and competed for by the directors of the county mental health departments.

Output Stage[3/]

"Production decisions" (i.e., decisions about input mix and output) for county mental health programs are asserted in the model to be made by the mental health program administrator. These administrators are hypothesized to gain utility from the number of professionals on their staff and the success of the program in treating patients. Administrators maximize this utility function subject to a production technology and the program budget constraint. "Output" (percentage of patients successfully treated) in the model is hypothesized to be determined by the quantity and mix of professional and non-professional staff, the level of non-labor inputs and the number of patients served.

$$TR = f_3(L_P, L_{NP}, K, N)^{4/} \tag{3}$$

where TR = percentage of patients considered improved at end of treatment
L_P = county mental health professionals per 10,000 population
L_{NP} = county mental health professional staff per 10,000 population
K^{NP} = non-personnel costs of county mental health program per capita
N = number of patients treated by county mental health department.

The budget allocated to mental health programs by the commissioners acts as a constraint that limits "production" of mental health services as well as the number of professional staff. Maximizing the administrator's preference function subject to the production function and budget constraint yields a series of demand equations for professional and non-professional staff.

$$L_P = f_4(G_{MH}, G_{NMH}, G_U, G_N, INC, CB, W_P, W_{NP}, N) \tag{4}$$

$$L_{NP} = f_5(G_{MH}, G_{NMH}, G_U, G_N, INC, CB, W_P, W_{NP}, N) \tag{5}$$

where all terms are defined as in equations (1), (2), and (3) and

W_P = annual earnings of county mental health professionals
W_{NP} = annual earnings of county mental health non-professional staff.

In most earlier studies of local fiscal decisionmaking, the supply of labor has been assumed to be perfectly price elastic. That is, the wage rate for public

employees has been assumed to be determined in a larger competitive labor market or through labor negotiations outside the budget process. When wages are endogenously determined within the budget process, then grants may lead to increased wages as well as increased employment (Inman, 1977, p. 53). The hypothesis that wages for county mental health staff are determined in a local market setting and that they are not perfectly price elastic is examined in this study by estimating the following wage determinant equations.

$$W_P = f_6(L_P, G_{MH}, G_{NMH}, INC, N, OWS, POPD, PSY) \quad (6)$$

$$W_{NP} = F_7(L_{NP}, C_{MH}, G_{NMH}, INC, N, OWS, POPD, PSY) \quad (7)$$

where the variables are defined as above and

OWS = annual earnings of service sector workers in the county
POPD = population density of the county
PSY = mental health professionals in private practice in the county per 10,000 population.

The variables were selected to represent the effects of program size, program emphasis and labor market characteristics on mental health program wages.

Finally, the number of patients treated by county programs in fiscal year 1975-1976 is hypothesized to be determined by two sets of factors. On the one hand, the number of patients that a staff is physically able to care for in a year is determined by technological factors, i.e., as a supply phenomenon. Thus, wages, employment, and patient numbers are simultaneously determined. On the other hand, user numbers are influenced by traditional demand factors--the price for a quantity of service, population, and the price for private alternatives among others. Accordingly, the hypothesized function is:

$$N = f_8(G_{MH}, G_{NMH}, PS, INC, POP, POPD, SUB, PSY) \quad (8)$$

where variables are defined as above and

PS = percentage of county mental health staff with professional training $\frac{L_P}{L_P+L_{NP}}$

POP = population of county
SUB = per capita mental health grants to sub-contract agencies (alternatives to the county program).

Empirical Results

The expenditure equations were estimated using ordinary least squares (OLS) estimation procedures on fiscal year 1975-76 data for the 18 western Oregon counties.[5/] Results (see Table 1) suggest that the submodel explains a significant amount of the variation in E_{MH} ($\bar{R}^2$ = .835) and E_{NMH} ($\bar{R}^2$ = .95). As expected, income is postively related to E_{MH}. Similarly, a higher percentage of the assessed value of a county in residential property is associated with a lower level of spending on mental health programs. Finally, grants are significant determinants of mental health spending. An additional dollar per capita of matching mental health grants (G_{MH}) is associated with a $2.23 per capita increase in county mental health spending. The coefficient is significantly different from 1, implying that such grants are at least partially stimulative, in Gramlich's terms. An additional dollar per capita on non-matching mental health grants (G_{NMH}) is associated with an additional $1.67 per capita of mental health spending. Although the point estimates of the two types of grants appear to differ, this difference is not statistically significant. Interestingly, an additional dollar per capita of unconditional grants is associated with an additional $0.025 in per capita mental health spending. This suggests that a portion of the unconditional grants was directed into spending for mental health programs.

The output stage equations are a simultaneous system of 6 equations, in which the mix of professionals and non-professionals on the county mental health staff is jointly determined with their salary levels, the number of patients served by the staff and the rate of successful treatment. Since all of the equations are over-identified, it is necessary to use a two-stage or three-stage least squares

Table 1. OLS Regression Results: County Government Expenditures 18 Western Oregon Counties, Fiscal Year 1975-76.

Dependent Variable	INDEPENDENT VARIABLES									
	G_{MH}	G_{NMH}	G_U	G_N	INC	RES	CB	Constant	Adj R^2	F
E_{MH}	2.232*** (.385)	1.671*** (.400)	.025** (.01)	-.0009 (.008)	.00026* (.00018)	-3.267* (2.149)	-.011 (.0065)	-1.066 (1.189)	.835	13.20***
E_{NMH}	14.914 (10.795)	-.0695 (11.22)	.987*** (.274)	1.267*** (.222)	.0035 (.0050)	-7.036 (60.244)	.471** (.182)	-3.2 (33.332)	.95	46.1***

Table 2. 3SLS Regression Results: County Mental Health Employment 16 Western Oregon Counties, Fiscal Year 1975-76.

Dependent Variable	INDEPENDENT VARIABLES										
	G_{MH}	G_{NMH}	G_U	G_N	W_P	W_{NP}	N	INC	RES	CB	Constant
L_P	1.254*** (.285)	.670** (.247)	.0227** (.0077)	.0046 (.0033)	-.00024** (.000081)	.00013 (.00012)	.00041 (.00026)	-.000025 (.000091)	-4.189 (2.388)	-.0102** (.0039)	2.840 (1.097)
L_{NP}	1.389*** (.412)	.654* (.326)	.0184 (.010)	.0027 (.0054)	-.00015 (.00012)	.00016 (.00019)	.0006 (.0004)	.00020* (.00012)	-8.59 (3.67)	-.013* (.006)	1.615 (1.69)

Table 3. 3SLS Regression Results: County Mental Health Wages 16 Western Oregon Counties, Fiscal Year 1975-76.

Dependent Variable	INDEPENDENT VARIABLES								
	G_{MH}	G_{NMH}	L_P (for W_P) L_{NP} (for W_{NP})	N	INC	OWS	POPD	PSY	Constant
W_P	2861.25* (2014.55)	-1909.87 (2240.48)	-2426.52 (3215.88)	2.863 (1.807)	.187 (.751)	1.934 (1.425)	-11.583 (19.435)	-4203.61 (3448.05)	5426.51 (9856.16)
W_{NP}	503.43 (922.38)	-194.78 (747.93)	400.97 (1119.13)	.1205 (.793)	.262 (.380)	.666 (.583)	-12.906 (8.475)	2114.17 (1907.75)	1386.17 (3959.08)

Table 4. 3SLS Regression Results: County Mental Health Program "Output": Number of Patients 16 Western Oregon Counties, Fiscal Year 1975-76.

Dependent Variable	INDEPENDENT VARIABLES								
	G_{MH}	G_{NMH}	POP	POPD	PSY	SUB	INC	PS	Constant
N	-242.47 (218.13)	467.96** (159.56)	.011** (.0044)	-10.88*** (2.80)	844.94* (431.42)	-144.4** (161.96)	.262 (.380)	-2742.47** (987.62)	2331.30 (963.01)

Table 5. 3SLS Regression Results: County Mental Health Program "Output": Patient Improvement 16 Western Oregon Counties, Fiscal Year 1975-76.

Dependent Variable	INDEPENDENT VARIABLES				
	L_P	L_{NP}	K	N	Constant
TR	5.85 (7.48)	1.42 (6.14)	-.0007 (.0007)	-.0007 (.0055)	22.49* (12.06)

Standard errors in parentheses.

* Indicates coefficient is significant at .90 level.
** Indicates coefficient is significant at .95 level.
*** Indicates coefficient is significant at .99 level.

estimation technique to overcome the problem of correlation between the error terms and the endogenous variables. The method of three-stage least squares (3SLS) is justified when there is correlation among the disturbances of the different structural equations. Because this condition is expected to exist in equations (3)-(8), 3SLS estimation procedures are applied to data obtained for 16 western Oregon counties for fiscal year 1975-1976.

Results are reported in Tables 2 - 5. The demand and supply of labor equation results reported in tables 2 and 3, taken together, generally support those who have argued that the supply of labor is perfectly price elastic and that counties are price takers in the mental health labor market, and that mental health professionals face a negatively sloping demand curve for their services. The evidence tends to suggest that mental health grants (both matching and non-matching) induce additional employment in mental health programs, but have little effect on mental health wages. The one exception to this is the result on the effect of matching mental health grants on the annual salary of mental health professionals. This result weakly suggests that higher per capita grants are associated with higher professional salaries.

The number of patients treated by county mental health programs appears to be significantly related to a number of demand factors. The coefficients on population and the availability of sub-contract alternatives are significant and of the expected sign. The coefficients on population density (presumably a measure of urban stress) and private practitioner alternatives (presumably a measure of substitutes for public mental health programs) are significant with signs opposite of those anticipated. The coefficients on G_{NMH} and PS are both significant, suggesting that increases in non-matching aid and decreases in the proportion of staff with professional training are associated with greater numbers of patients treated.

The results from the hypothesized "production function" suggest that either the percentage of improved patients was a flawed measure of outputs or that the traditionally assigned inputs of labor, capital, and materials--as specified in this equation--did not explain any significant variation in the percentage of successful treatment. One other possibility is that this treatment level function is too aggregated. This is discussed in the next section.

The Output Stage Analysis and Suggestions for Future Research

Aside from questions of omitted variables, restrictive assumptions, or econometric violations, there are two factors, in some sense findings, that may explain some of the regression findings and that are worthy of future investigation. The first relates the production function of a mental health service and the need to disaggregate the county bureaus' work program. The second relates to the way researchers have traditionally differentiated grant types.

Throughout the analysis, the county programs for the mentally retarded, the alcohol and drug dependent, and the mentally and emotionally disturbed were combined and treated as if the counties provided one service, with a uniform technology, to a homogeneous set of patients. This undifferentiated approach ignores the fact that each service program, such as a work activity center for the mentally retarded, is staffed by a given mix of professionals and non-professionals and serves a relatively fixed number and type of patient at a relatively given percentage of successful treatment. As the mix of services and programs varies among counties, the number of patients served and the percentage of successful treatment varies. Thus, for example, the treatment level function may not have "worked" because the counties with the same number of professional and non-professional staff may have had a different program mix (i.e., one county may have emphasized services for the mentally retarded while another county emphasized alcohol treatment), and consequently, served different numbers and types of patients who were more or less likely to be improved after treatment.

Mental health bureaus, like most local government bureaus, should be understood as multi-product suppliers. A fruitful direction in research was suggested by Bradford, Malt, and Oates (1969) when they distinquished between D outputs--the services directly produced by local governments--and C outputs--the thing or things of primary interest to the citizen-consumer. In this analysis, the number of patients treated is, roughly, a C output while the percentage of successful treatments would represent the D outputs.[6/] Combining the supply of C outputs with the demand for C outputs would help to explain how and why the county administrators allocate money and resources to different programs. Such an approach would lead researchers into the production technology for each program and the factor substitutions among psychiatrists, psychologists, aides, and other mental health employees.

How should conditional grants be treated in this research? Traditionally, conditional grants, when separated at all, have been differentiated as matching or non-matching for reasons identified by Wilde (1977). As in the case for mental health grants, though, the output conditions may be overriding in explaining how grant dollars are translated into staff, materials, and services. Non-matching mental health grants, for example, are dispensed for over ten specific activities, some for each of the three types of patients. In this instance, it might be best to look at the non-matching aid on a grant by grant basis or by functional categories. Whatever the proper approach, the results of this study do suggest that researchers should give more attention to the output conditions attached to grants.

NOTES

1/ It is assumed that the county commissioners act as a single voice.

2/ See Savage (1979, p. 16-49 and 89-103) for a more complete discussion of the utility function, the county budget constraint, and the derived demand equation. In the original research, also, the expenditure stage contained two equations attempting to explain the amount of matching and non-matching aid

received. These equations are not discussed.

3/ See Savage (1979, p. 106-113) for a more complete discussion of the output stage and the justification for the exogenous variables.

4/ Because TR is a qualitative dependent variable, a logit form of the variable $L_n(\frac{TR}{100-TR})$ is used.

5/ Details of data collection and data sources can be found in Savage, 1979, pp. 119-20, 187-194.

6/ Bradford, Malt, and Oates argue that $Q = Q(C,Z)$ where Z represents other factors and $C_k = g_k(D,E)$ where k represents the kth service program and E represents environmental conditions. In this study, population density and the unemployment rate represent these environmental factors. On the flip side, they express individual preferences in the form $U = U(C,Z)$ where Z here represents the level of provision of other public and private goods. Then $C_k = F_k(D,E)$.

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