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Wage Rates, Employment Levels and State and Local Government Expenditures For Health and Education: An Analysis of Interstate Variations

Roy W. Bahl and Richard D. Gustely

Because of a growing concern with equalization in the provision of human services, the substantial variance among and within American states in per capita health-hospital and education expenditures has received much serious empirical analysis. The major policy implications of interstate analysis are clear and well known: how much and what kind of federal assistance is necessary to effect an equalization of service levels, and what kinds of state-local government adjustments ought to be required as a condition of receiving this assistance. The research question underlying these policy concerns is threefold: (1) What is the magnitude of the interstate variations? (2) What are the determinants of the interstate variations? and (3) How are local expenditure levels responsive to federal assistance (i.e., are grants stimulative, neutral or substitutive)?

The intent in this paper is to address these research questions in the context of an analysis of interstate variations in education and health-hospital expenditures. While past studies have generally dealt with per capita expenditures as the variable to be explained, and primarily with a set of demand or needs factors as the determinants, this analysis will consider the wage rate and employment level components of expenditures, and will examine both demand and cost factors as determinants, as well as the effects of federal assistance. The arguments for approaching the analysis this way are numerous, e.g., public sector wage rates and employment levels do not respond to the same factors, or, if they do, they do not respond in the same fashion; if federal grants are stimulative of local expenditures, it makes a difference (in terms of equalization goals) as to how this stimulation is divided between increased employment level and increased wage rate.

The balance of this paper is divided into four parts. The actual interstate variations in employment, wage rates, and expenditures for the education and health-hospital functions are examined, since the explanation of such variance is at the heart of this effort. The historical approach to studying the determinants of education and health-hospital expenditures is then reviewed and an alternative model offered. The results of an empirical test of this model are presented. The concluding section suggests policy results and future research directions.

The scope of this analysis is limited. Only current expenditures for education and health-hospitals are considered, and no breakdown of current nonlabor expenditures is attempted. Moreover, while education data were broken down into local schools and higher education, with a further subclassification of instructional personnel, health and hospital expenditures could not be similarly broken down. Because of this, the analysis below emphasizes the education function. All data have been taken from U.S. government publications.[1]

The Structure Of State-Local Government Labor Costs

The analysis begins with the interstate variations in the level and structure of education and health-hospital expenditures. The distribution among states of average wages and of employment and expenditures per 1,000 population is examined. Then regional differences in these variables are analyzed by comparing the means and coefficients of variation (CV)[2] for the four Census regions with those of the United States as a whole.

Table 1 shows the mean, coefficient of variation and range of the dependent variables for the 50 states in 1971. A number of clear patterns emerge from these data. First, average wages are highest in higher education, followed by local schools, and then health and hospitals. Second, per capita employment and expenditure levels are both greatest for the local schools function, followed by higher

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1. U.S. Department of Commerce, The Bureau of the Census. Governmental Finances in 1970-71, Series GF71-No.5 (Washington, D.C.: U.S. Government Printing Office, 1972); Public Employment in 1971, Series GE71-No.1 (Washington, D.C.: U.S. Government Printing Office, 1972); Census of Population: 1970 (Washington, D.C.: U.S. Government Printing Office, 1971); and U.S. Department of the Treasury, Fiscal Service - Bureau of Accounts, Federal Aid to States: Fiscal Year 1971 (Washington, D.C.: U.S. Government Printing Office, 1972).

2. The coefficient of variation, the standard deviation as a percent of the mean, is a measure of relative variation.

Table 1. The Interstate Distribution of Public Employment, Wages and Current Expenditures for Local Schools, Higher Education and Health and Hospitals: 1971.

	Average for United States	Coefficient of Variation	High for United States		Low for United States	
			State	Amount	State	Amount
Local Schools						
Average Wage	$ 7,239	17.7	Alaska	$ 11,034	Mississippi	$ 5,014
Average Wage--Instructional	$ 7,855	17.9	Alaska	$ 11,700	Mississippi	$ 5,348
Employment per 1,000 Population	17.7	11.9	S. Dakota	23.8	Rhode Island	14.2
Employment per 1,000 Population --Instructional	12.5	12.8	S. Dakota	17.4	Pennsylvania	10.3
Current Expenditures per 1,000 Population	$178,117	22.5	Alaska	$349,836	Alaska	$113,603
Higher Education						
Average Wage	$ 8,733	16.0	Alaska	$ 13,672	Delaware	$ 6,095
Average Wage--Instructional	$ 11,463	14.3	Alaska	$ 16,987	Delaware	$ 8,883
Employment per 1,000 Population	5.1	31.4	Colorado	8.8	Pennsylvania	2.0
Employment per 1,000 Population --Instructional	1.9	31.6	N. Dakota	3.3	Pennsylvania	0.8
Current Expenditures per 1,000 Population	$ 82,105	32.3	Alaska	$144,590	Pennsylvania	$ 42,862
Health and Hospitals						
Average Wage	$ 6,607	20.6	Alaska	$ 11,445	Mississippi	$ 4,330
Employment per 1,000 Population	4.6	30.4	Georgia	8.7	Alaska	2.6
Current Expenditures per 1,000 Population	$ 43,601	33.0	New York	$104,885	S. Dakota	$ 23,324

Source: U.S. Department of Commerce, The Bureau of the Census, Governmental Finances in 1970-71, Series GF71-No. 5 (Washington, D.C.: U.S. Government Printing Office, 1972); and U.S. Department of Commerce, The Bureau of the Census, Public Employment in 1971, Series GE71-No. 1 (Washington, D.C.: U.S. Government Printing Office, 1972).

education and health and hospitals. Third, and most important, is that less variation generally is shown in average wages than in either per capita employment or per capita expenditures, and less in local schools (for all variables) than in either of the other two functions. This implies that there is considerably more to explain in an analysis of per capita employment levels than in an analysis of wage rate levels. This pattern would support a thesis that either collective bargaining or some national demonstration effect has reduced interstate wage rate disparities in these functions. The major discretionary element in state-local government expenditures would then be employment level, and the expenditure response to interstate variations in "need"--as found in earlier studies--primarily an employment response.

In order to analyze further this variation, comparisons are made among the four Census regions in table 2. The variable "region" may reflect a number of influences--per capita income, urbanization, concentration of poverty--and these comparisons may illustrate the influence of that myriad of factors. Nevertheless, a comparative regional analysis, such as that made here, would seem justified on the grounds that remedial public policies often tend to be region-oriented and may or may not take overlapping factors into account.

There are strong patterns of regional disparity in per capita expenditures and employment and in average wage levels. In general, the highest wages are paid in the east and the lowest in the south; however, both per capita employment and per capita expenditures tend to be highest in the west. Per capita employment tends to be lowest in the east, and per capita expenditures lowest in the south.[3] While it is not possible to draw precise inferences from such a comparison, patterns clearly differ. For example, wage rates in the east and west are relatively high, as might be expected, but employment levels in the east appear to be the lowest of any region. Whether this is a result of eastern operational efficiency--e.g., some form of scale economies--or of a more stringent budget constraint is worth exploration.

A comparison of the coefficient of variation for each region with that for the U.S. allows analysis of the relative amounts of intraregional dispersion (see table 3). In average wages, the dispersion is generally above the national average, and greatest, in the west. On the other hand, southern states are more

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3. To determine whether the differences among these regions were significant, a one-way analysis of variance was carried out. As may be seen from the F statistic presented in table 1, a significant regional pattern is evidenced. However, this finding should be interpreted with caution because of the necessary but questionable assumption that the variance within regions be equal.

Table 2. The Regional Distribution of Public Employment, Wages and Current Expenditures for Local Schools, Higher Education and Health and Hospitals: 1971.

	United States	East	Central	West	South	F Statistic in ANOVA
Local Schools						
Average Wage	$ 7,239	$ 7,916	$ 7,368	$ 7,584	$ 6,315	480.2
Average Wage--Instructional	$ 7,855	$ 8,493	$ 7,865	$ 8,138	$ 7,128	414.5
Employment per 1,000 Population	17.7	16.2	18.0	19.3	17.0	1,136.5
Employment per 1,000 Population --Instructional	12.5	11.9	12.7	13.6	11.6	987.3
Current Expenditures per 1,000 Population	$187,117	$178,211	$182,958	$208,875	$144,993	346.9
Higher Education						
Average Wage	$ 8,733	$ 8,833	$ 8,870	$ 9,484	$ 7,843	563.4
Average Wage--Instructional	$ 11,463	$ 11,161	$ 11,889	$ 11,567	$ 11,185	581.5
Employment per 1,000 Population	5.1	3.7	5.3	6.6	4.4	201.6
Employment per 1,000 Population --Instructional	1.9	1.4	2.1	2.5	1.6	169.8
Current Expenditures per 1,000 Population	$ 82,105	$ 71,779	$ 87,465	$106,035	$ 62,284	197.5
Health and Hospitals						
Average Wage	$ 6,607	$ 7,535	$ 6,429	$ 7,122	$ 5,632	384.8
Employment per 1,000 Population	4.6	4.1	4.4	4.4	5.2	146.1
Current Expenditures per 1,000 Population	$ 43,601	$ 44,367	$ 40,254	$ 46,741	$ 43,247	108.7

Source: U.S. Department of Commerce, Bureau of the Census, Governmental Finances in 1970-71, Series GF71-No. 5 (Washington, D.C.: U.S. Government Printing Office, 1972); and U.S. Department of Commerce, Bureau of the Census, Public Employment in 1971, Series GE71-No. 1 (Washington, D.C.: U.S. Government Printing Office, 1972).

Table 3. Coefficients of Variation for Public Employment, Wages and Current Expenditures for Local Schools, Higher Education and Health and Hospitals by Region: 1971.

	United States	East	Central	West	South
Local Schools					
Average Wage	17.7	12.7	15.7	18.7	15.5
Average Wage--Instructional	17.9	13.7	17.1	19.3	17.7
Employment per 1,000 Population	11.9	11.1	12.8	9.8	7.1
Employment per 1,000 Population --Instructional	12.8	8.4	14.2	11.8	6.9
Current Expenditures per 1,000 Population	22.5	20.2	13.3	22.7	15.7
Higher Education					
Average Wage	16.0	18.5	11.6	18.1	7.3
Average Wage--Instructional	14.3	16.2	12.8	17.5	1.2
Employment per 1,000 Population	31.4	51.4	22.6	21.2	13.6
Employment per 1,000 Population --Instructional	31.6	50.0	28.6	20.0	18.9
Current Expenditures per 1,000 Population	32.2	35.7	24.5	24.0	16.4
Health and Hospitals					
Average Wage	20.6	11.3	15.8	24.9	13.9
Employment per 1,000 Population	30.4	36.6	18.2	36.4	25.0
Current Expenditures per 1,000 Population	33.0	51.5	22.5	32.4	23.7

Source: U.S. Department of Commerce, The Bureau of the Census, Governmental Finances in 1970-71, Series GF71-No. 5 (Washington, D.C.: U.S. Government Printing Office, 1972); and U.S. Department of Commerce, The Bureau of the Census, Public Employment in 1971, Series GE71-No. 1 (Washington, D.C.: U.S. Government Printing Office, 1972).

omogeneous in average wage payments in higher education, while eastern states are most alike for health and hospitals. For per capita employment, the dispersion is generally largest in the east and smallest in the south. Finally, the dispersion in current expenditures per 1,000 population is greatest in the east and smallest in the south (higher education) and the central region (local schools and health and hospitals).

In summary, the results reported above show that there is a great deal of variation in state and local government wage, employment, and expenditure rates among the 50 states. Moreover, a pattern of variation in these measures shows significant differences among regions. Such conclusions, however, shed little light on the underlying causes of this variation. To determine whether or not these differences be attributed to particular economic or demographic differences among states requires the formulation of an explanatory model of the level of public expenditures which relates such expenditures to their wage and employment components and, through this relationship, to their underlying determinants. The formulation of such a model follows.

The Model

The impetus for developing a public employment model comes from the failure of the traditional determinants model to explain the process by which expenditure levels are affected by underlying causal factors. Accordingly, a brief statement of the nature of earlier expenditure models will highlight their differences from the present approach. A discussion of the alternative--a public employment approach--follows.

The Determinants Of Health And Education Expenditures

The literature explaining variations in education and health expenditures is voluminous and growing, and no attempt at a detailed summary will be made here.[4] We will contrast the approach taken in these studies with our alternative model.

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4. Reviews of the determinants literature are to be found in: Roy W. Bahl, "Studies on Determinants of Public Expenditures: A Review," in S. J. Mushkin and J. F. Cotton, ed., Federalism: Grants-in-Aid and PPB Systems (Washington, D.C.: State-Local Finances Project of the George Washington University, 1968); Richard M. Bird, "The Determinants of State and Local Expenditures: A Review of U.S. Studies," working paper No. 6907 (Toronto, Canada: Institute for the Quantitative Analysis of Social and Economic Policy, University of Toronto, 1969); and Gail Wilensky, "Determinants of Local Government Expenditures," in J. P. Crecine, ed., Financing the Metropolis (Beverly Hills: Sage Publications, 1970).

Determinant studies of education and health-hospital expenditures are positive rather than normative analyses in that the objective is to identify and measure the relationship between existing expenditure levels and the levels of a set of "explanatory" factors within the jurisdiction. The technique most often used is single equation regression on a cross-section of data, with per capita expenditures the most common dependent variable. If a statistically significant relationship is found between an explanatory variable and per capita expenditures, the variable is argued to be a "determinant" of the spending level for that function, and, consequently, is one factor to which the interstate variance may be ascribed.

The explanatory factors used in education expenditure studies have included at least three general kinds of influence: measures of ability to pay and/or service level demand (e.g., per capita income); measures of needs or requirements (e.g., per capita enrollments or enrollments per square mile); and measures of external assistance (e.g., federal grants). Significant relationships have been uncovered for each of these factors and significant proportions of the variance in per capita education expenditures have been explained.[5]

Such results are of limited policy usefulness, however, unless the process by which expenditures are influenced by these variables is uncovered. Consider the use of per capita income as an independent variable. Conceptual and econometric difficulties aside, underlying these studies is an assumption that sociological, economic or demographic variables such as per capita income indicate community preferences, and somehow these preferences get revealed in expenditure levels. A partial relationship between per capita education expenditures and per capita income is therefore interpreted as responsiveness of the expenditure amount to preferences of the jurisdiction's residents. However, the expenditure change induced by such a change in per capita income may result from increased employment, increased teachers' salaries or increased expenditures on equipment and supplies. Moreover, if the expenditure increase was caused by increased teachers' salaries, for example, the interpretation of the significance of the per capita income variable may have more to do with the maintenance of parity between public and private sector wage rates than with a community preference for a particular level and form of education services. If, on the other hand, the expenditure change was induced by increased employment, the interpretation may well be the demand for higher quality education service through reduced student-teacher

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5. A particularly well conceived determinants analysis of education expenditures, and a review of the earlier literature can be found in: Jerry Miner, Social and Economic Factors in Spending for Public Education (Syracuse, N.Y.: Syracuse University Press, 1963).

ratio or addition of more specialty teachers. Clearly, the meaning of the per capita income influence differs in these two cases.

Given this difficulty in interpreting and analyzing the process by which expenditures are responsive to community, or state, characteristics, or to federal assistance, an alternative approach would seem necessary.

An Alternative Approach

A model can be formulated to explain expenditure variations while taking account of the wage rate and employment level components of such variations. The model presented here is relatively straightforward, involving separate equations to explain the level of wage rates, the level of employment and the relationship between total expenditures and total labor cost. More specifically, the approach may be described in four equations:

$$\hat{W} = f(X_i) \quad (1)$$

$$\hat{E}_p = f(Z_i, \hat{W}) \quad (2)$$

$$\hat{LC}_p = \hat{W}\hat{E}_p \quad (3)$$

$$\hat{X}_p = f(\hat{LC}_p) \quad (4)$$

where:

W = the average public sector wage rate

X_i, Z_i = the determinants of wage and employment levels respectively

E_p = public employment per capita

LC_p = labor costs per capita

X_p = current expenditure per capita

Equation 1 estimates average wage levels as a function of exogenous variables related conceptually to the average level of state-local government compensation in the education and health-hospitals functions. Equation 2 relates per capita employment in these functions to the estimated wage and to a set of employment-determining variables. Equation 3 calculates per capita labor cost. Equation 4 links per capita expenditures to their determinants through the wage rate and employment level components. Again, a basic problem is the absence of a separate analysis of nonlabor current expenditures.

Before justifying the specific variables to be included in these estimating equations, an underlying assumption must be drawn about the public employment process (i.e., the process of state and local government wage and employment level determination). The supply curve of state and local government employment is assumed to be perfectly elastic. The justification for this assumption is twofold. If the public sector is highly unionized, the wage might be set through the negotiation process, with the union giving wide latitude to the governmental unit to determine the level of employment. If public sector employees are not unionized, the government, within bounds, might hire any number of employees at the going, market-determined wage. In either case, the assumption of a highly elastic supply curve seems justified.

The demand curve is assumed to have a downward slope, based upon the usual assumption of diminishing marginal productivity of labor. This is consistent with the operation of a local government budget constraint. In extremely tight financial situations, governmental units might be constrained in money allotted to labor. Under these conditions, a given percentage increase in wages would result in the same percentage decrease in employment (a demand curve of unitary elasticity), other factors remaining constant. A more likely situation is one in which the constraint is not as tight so that a given percentage increase in wages causes employment to fall, but not by the amount of the increased wage (an inelastic demand curve).

The dynamics of the employment decision, given these assumptions about the slopes of the demand and supply curves, can be described quite simply. The governmental unit takes the wage as given (determined by market and the negotiating processes) and hires workers to the point described by its demand curve.

With this process in mind, and with the objective being to estimate the determinants of state and local government wage and employment levels, these relationships should be specified in a form appropriate and amenable to empirical analysis. More specifically, five factors are seen here as determinants of interstate variations in the average wage (W): (a) a "wage rollout" effect from the private sector; (b) the bargaining strength of labor; (c) the level of federal assistance; (d) the level of resources available to the government; and (e) "regional" factors. The choice of a set of measurable variables to serve as proxy for these general factors is complicated by collinearities and by particular variables representing a priori more than one factor. Per capita personal income (Y_p) is included as a measure of the "opportunity wage," i.e., as proxy for the interstate variance in the opportunity cost of accepting public sector employment. An alternative measure, average earnings of professional workers, was also tried but rejected because of an almost perfect correlation with per capita income. Clearly, a problem with the per capita income variable is its indication of resource levels available to the public sector; it will not be possible to disentangle the government income effect

from the "wage rollout" effect on average public sector wages.[6] The null hypothesis is that per capita income will not exert a positive effect on average wages.

The rate of unemployment (U) is introduced as an explanatory variable which works against the operation of a favorable "wage rollout" effect, and is expected to show a negative relationship. That is, the extent to which higher private sector wages are transmitted to government employees may be mitigated by the level of idle resources in the state. The percent of private sector labor force unionized (Z) will serve as a proxy for union strength in the public sector. A set of dummy variables for the four Census regions (R) are included, hopefully to account for some of the variations due to nonquantifiable factors such as culture and style, which may be important determinants--particularly in the case of education.[7]

The resource base available for public use is partially included in the personal income measure, but it is also reflected in federal aid variables. Ten different variables for federal assistance are used to measure the relative responsiveness of employment and wage rate levels to per capita federal aid variations. The federal assistance categories considered here are listed in chart 1. The conceptual and econometric problems with using grants as an independent variable are well covered in the literature,[8] and the case against the conventional use of the grants variable is persuasive. Still, there is need to investigate the "grants effect" in this framework, and there is no clear demonstration in the literature that more sophisticated and appropriate estimation methods yield results markedly different from the "naive estimates" attempted here and elsewhere. In any case, the federal aid variables do not enter below as significant determinants.

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6. There are real problems with arguing an interstate relationship between public and private sector wage levels, because of the implication that the state area is somehow a local labor market. The influence of such a rollout effect could be argued much more persuasively in a metropolitan area context.

7. See Sherman Shapiro, "Some Socioeconomic Determinants of Expenditures for Education: Southern and Other States Compared," Comparative Education Review 6 (October 1962): 160-166.

8. See, for example: Edward M. Gramlich, "The Effect of Federal Grants on State-Local Expenditures: A Review of the Econometric Literature," in Proceedings of the Sixty-Second Annual Conference of the National Tax Association (Columbus: National Tax Association, 1970); and Elliott R. Morss, "Some Thoughts on the Determinants of State and Local Expenditures," National Tax Journal 19 (March 1966): 95-103.

Chart 1. Federal Assistance Variables by Function.

Local Schools

- Cooperative Vocational Education
- Educational Improvement for the Handicapped
- Elementary and Secondary Educational Activities
- School Assistance to Federally Affected Areas

Higher Education

- Higher Education Activities

Health and Hospitals

- Comprehensive Health Planning Services
- Health Manpower Education and Utilization
- Maternal and Child Health Services
- Mental Health Research and Services
- Regional Medical Programs

Source: U.S. Department of the Treasury, Fiscal Service - Bureau of Accounts, Federal Aid to States: Fiscal Year 1971 (Washington, D.C.: U.S. Government Printing Office, 1972).

The final version of wage equation (1), then, is:

$$\hat{W} = f(Y_p, U, Z, R, A_p) \qquad (1a)$$

where:

Y_p = per capita income

U = unemployment rate

Z = percent labor force unionized

R = regional dummy variables

A_p = per capita federal aid.

The demand for labor function (the employment equation) is viewed as being related to five general factors: resource base of the government, average wage levels, demand or needs factors, population distribution, and "regional" effects. Since it is difficult, statistically, to distinguish between the effects of ability to pay and wage rate on labor demand, the average wage rate (W) must serve as a measure of the internal resource base of the government as well as the price government pays for workers. Using only the wage variable makes it impossible to separate the price and income effects on employment level.

The categories of per capita federal aid named above (A_p) are used as measures of the external resource base of the area. Regional dummy variables (R) are employed as proxies for other determining characteristics of labor demand which are not quantified here and are possibly unique to various regions. Different measures of demand or needs factors (N_p) are used, depending upon the functions analyzed. The number of students enrolled per 1,000 population serves as a proxy of need in local schools; the number of college students enrolled per 1,000 population serves as a proxy in higher education; and the number of residents over 65 and under 5 years of age per 1,000 population serves as a proxy in the case of health and hospitals. Finally, population density (D) will be used as a measure of population distribution.

The final form of the employment equation, then, is:

$$E_p = f(\hat{W}, A_p, N_p, D, R) \qquad (2a)$$

where:

$\hat{W}$ = estimated average wage

A_p = per capita federal aid

N_p = measure of need for service per capita

R = regional dummy variables.

Clearly, there are collinearities among these explanatory variables which will affect the interpretation of the statistical results obtained. The extent of the problem is suggested by the simple correlation matrix among the independent variables presented in table 4. As indicated previously, the high correlation between the wage and income variables necessitated the exclusion of one in each equation. Further, the correlation between the wage variables and aid makes the interpretation of the coefficient of aid difficult and generally results in nonsignificance of the latter.

Public employment data by state for local schools, higher education and health and hospitals are used as measures of the dependent variables. Specifically, state and local government average wage and employment for each function per 1,000 population for 1971 are used in estimating equations. While this form of the employment variable is easily obtained by division from the basic data source, some adjustment is required for the average wage data. Since only monthly payroll data are available, the translation of these figures to obtain an annual payroll is based upon the assumption that instructional personnel are employed on a ten-month basis, while noninstructional personnel are paid on a twelve-month basis. Because some teachers are employed on a twelve-month basis, labor costs are probably understated.

Statistical Results

The Determinants

The wage and employment equations described above were estimated using ordinary least squares. Results, shown in tables 5 and 6, show that a significant amount of the interstate variation could be explained.

As indicated by the wage equation results in table 5, in every equation both personal income and the unemployment rate were significant and positively related to wages. The strong positive influence of the income variable is expected; however, it is not possible to disentangle the extent to which this reflects the availability of government resources and the extent to which it reflects a "wage rollout," or demonstration, effect. The positive importance of the unemployment rate coefficient is more difficult to interpret. The null hypothesis was that a greater unemployment rate would imply a lower wage rollout; hence, given some level of per capita income, a lower average wage. These results suggest some influence other than that hypothesized here. The intercorrelations in table 4 do not immediately suggest such an influence. The federal aid variable was significant only in the case of health and hospitals. In the higher education instructional equation, the central region dummy was significant and positive. In the health and hospital equation, the west regional dummy was significantly negative. Since the east region

*Table 4. Simple Correlations and Mean and Standard Deviation of Independent Variables.**

	WEDI	WIED	WIEDI	WIIOS	EAIDP	CAIDP	HAIDP	SOUTH	WEST	CENT	PI	UNEM	UNION	DEN	AGEPC	ENRLP	COLLP	MEANS	STANDARD DEVIATION
WED	9815	7551	5367	8950	1020	0416	0056	-4550	1614	0604	7772	2517	5942	4295	-1508	-2219	1982	$ 7,238.96	$1,278.56
WEDI		7145	5375	8646	0815	-0259	-0152	-3262	1205	0041	7489	2274	5254	4377	-1276	-2536	0039	7,855.00	1,403.99
WIED			7805	6873	2904	0031	0008	-4046	3223	0588	6384	3257	4805	2171	-2300	-0787	1232	8,732.63	1,395.71
WIEDI				4357	3150	-1998	-3190	-1067	0382	1558	3831	2293	3226	1312	-0738	-0636	-1577	11,462.71	1,639.40
WIIOS					1918	1034	1613	-4525	2269	-0783	7230	3420	4754	3823	-2076	-1661	1942	6,607.07	1,357.86
EAIDP						2486	0126	1177	3023	-2035	-0316	5369	-1815	-2312	-3134	4862	-3462	15.78	9.99
CAIDP							2028	-3577	2605	0794	0124	1782	-1202	-1455	-0870	4040	3444	1.63	0.50
HAIDP								-2078	3663	-2364	0782	-0318	-1129	-0546	-0625	1877	5365	3.07	1.30
SOUTH									-3696	-3696	-4341	-1530	-3594	-1216	0730	-0359	-5502	0.28	0.45
WEST										-3513	1009	5919	1040	-3111	-2805	5272	3208	0.26	0.44
CENT											-0188	-2016	1861	-1620	0484	0005	1811	0.26	0.44
PI												-0789	4511	5017	-2262	-3884	1205	3,654.10	572.93
UNEM													3078	-2775	-1566	4429	-0138	4.48	1.25
UNION														2365	0499	-3253	0742	23.78	8.81
DEN															0894	-6017	0287	144.56	218.98
AGEPC																-2671	0000	178.77	24.57
ENRLP																	1275	229.54	19.65
COLLP																		33.90	7.71

* An explanation of these abbreviations can be found in Appendix A.

Source: U.S. Department of the Treasury, Fiscal Service - Bureau of Accounts, Federal Aid to States: Fiscal Year 1971 (Washington, D.C.: U.S. Government Printing Office, 1972).

Table 5. Results of the Wage Regressions.[a]

	Per Capita Personal Income	Unemployment Rate	Aid[b] per Capita	Percent Unionized	Central Region	West Region	South Region	Constant	Multiple Correlation
Local Schools									
All Employees	1.7030* (0.255)[a]	397.8* (147.2)	- 0.0127 (14.5)	8.191 (17.3)	155.5 (320.6)	- 475.2 (300.4)	-238.6 (350.5)	- 811.2	0.8587
Instructional Employees	1.9694* (0.310)	459.7* (178.8)	- 7.729 (17.6)	9.591 (21.0)	183.6 (389.4)	- 451.1 (437.8)	255.1 (425.8)	-1,506.9	0.8237
Higher Education									
All Employees	1.6287* (0.320)	376.4* (156.4)	-300.9 (314.8)	3.365 (21.2)	727.3 (432.1)	578.9 (488.1)	183.7 (486.2)	1,116.5	0.7716
Instructional Employees	1.6411* (0.465)	599.9* (227.7)	-815.6 (458.2)	-17.78 (30.8)	1,422.4* (628.8)	17.3 (710.3)	842.3 (707.5)	3,924.4	0.6156
Health and Hospitals									
All Employees	1.6832* (0.247)	615.6* (123.8)	198.7* (95.5)	- 1.745 (15.6)	-297.4 (340.6)	-1,082.6* (392.7)	-563.6 (364.5)	-2,351.8	0.8635

* Denotes significance at the 5 percent level of confidence.

a Figures in parentheses represent standard errors of the coefficient.

b The sum of aid in all categories listed in Chart 1 for each function was used as the independent variable.

Table 6. Results of the Per Capita Employment Regressions.[a]

	Per Capita[b] Service Load	Estimated Average Wage	Aid[c] Per Capita	Density	Central Region	West Region	South Region	Constant	Multiple Correlation
Local Schools									
All Employees	0.0032* (0.020)[a]	0.00056 (0.00031)	0.00588 (0.0303)	-0.0017 (0.0016)	0.102 (0.880)	1.051 (1.042)	-0.213 (0.836)	-0.688	0.7269
Instructional Employees	0.0431* (0.0144)	0.00004 (0.0002)	0.030 (0.022)	-0.0054 (0.011)	-0.194 (0.625)	-0.417 (0.723)	-1.393* (0.609)	2.439	0.7262
Higher Education									
All Employees	0.0777* (0.0237)	-0.0003 (0.00018)	0.5290 (0.315)	-0.002* (0.0009)	0.617 (0.527)	1.741* (0.592)	0.393 (0.562)	3.842	0.8235
Instructional Employees	0.0418* (0.0102)	-0.00006 (0.00016)	0.155 (0.162)	-0.0007 (0.0004)	0.410 (0.243)	0.613* (0.260)	0.313 (0.239)	0.649	0.7954
Health and Hospitals									
All Employees	-0.0047 (0.009)	-0.00004 (0.0002)	-0.0176 (0.168)	0.001 (0.001)	0.010 (0.737)	0.628 (0.785)	1.368 (0.738)	4.875	0.3471

* Denotes significance at the 5 percent level of confidence.

a Figures in parentheses represent standard errors of the coefficient.

b Service load for local schools was enrollment per 1,000 population; for higher education it was enrollment per 1,000 population, and for health and hospitals it was population under 5 or over 65 years of age per 1,000 population.

c The sum of aid in all categories listed in Chart 1 for each function was used as the independent variable.

was omitted, these dummy variables may be interpreted as showing a significant difference from the east.[9]

Table 6 presents the results of the employment regressions. Service load is significant and positive in both of the equations for local schools and for higher education, i.e., employment levels are responsive to indicators of workload needs. Population density is significantly negative in the employment equation for higher education, suggesting different average student-teacher ratios in the more highly urbanized states, or different mixes of public-private responsibility for higher education. The coefficient of the western regional dummy is significantly positive for higher education and that of the southern regional dummy is significantly negative for instructional personnel in local schools.

No significant relationship between the estimated wage and the level of employment per capita is found here. One explanation is that the offsetting price and income effects have resulted in this nonsignificant coefficient. Indeed, when per capita income is included in this equation, the wage rate takes on the expected negative sign.

Table 7 shows the mean values of estimated labor costs (the product of estimated average wages and estimated per capita employment) as well as the results of regressions of current expenditures on these estimated values. The regression equations in this table indicate that the coefficients of labor costs are significantly positive and greater than unity for every function. The finding of a coefficient greater than unity suggests that there is a more than proportionate, and perhaps causal, relationship between labor and total expenditures. This could occur if, for example, supplies, materials and other nonlabor costs were related to the number of teachers and/or the salary (seniority) of a teacher.

From the results presented above, it is possible to infer the importance of the explanatory variables on total expenditures. For purposes of illustration, consider the marginal responsiveness of per capita expenditures to differences in per capita income. Note that:

$$\frac{X_p}{Y_p} = \frac{X_p}{LC_p} \cdot \frac{LC_p}{Y_p} \qquad (5)$$

and

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9. For an interpretation of this use of dummy variables, see Daniel Suits, "Interpreting Regressions Containing Dummy Variables," paper presented at the Research Seminar in Quantitative Economics, The University of Michigan, Ann Arbor, Michigan (May 1962).

Table 7. Mean Values and Results of the Per Capita Current Expenditure Regressions.[a]

	Mean Estimated Labor Cost	Mean Current Expenditures	Regression Results: Per Capita Labor Cost	Regression Results: Constant	Regression Results: Simple Correlation
Local Schools					
All Employees	$128,375	$178,117	1.3513* (0.121)[a]	4,647.25	0.8507
Instructional Employees	$ 97,980	$178,117	1.9186* (0.165)	- 9,871.30	0.8585
Higher Education					
All Employees	$ 44 127	$ 82,105	1.4992* (0.230)	16,260.63	0.6832
Instructional Employees	$ 22,140	$ 82,105	2.9755* (0.495)	16,229.19	0.6553
Health and Hospitals					
All Employees	$ 29,983	$ 43,601	1.2077* (0.376)	7,390.41	0.4206

* These coefficients are significant at the 5 percent level of confidence.

a Figures in parentheses represent standard errors of the coefficients.

$$\frac{LC_p}{Y_p} = \frac{W}{Y_p} \cdot E_p + \frac{E_p}{W} \cdot \frac{W}{Y_p} \cdot W \qquad (6)$$

Substituting equation (5) into equation (6) and taking the values of $\frac{X_p}{LC_p}$, $\frac{W}{Y_p}$ and $\frac{E_p}{W}$ from tables 5 and 6, the marginal (per capita income) rate of education expenditures is \$0.039. This translates to a (partial) expenditure-per capita income elasticity (n_y^x) of 1.102, as estimated from:

$$n_x^y = \frac{X_p}{LC_p} \frac{LC_p}{Y_p} \frac{\bar{Y}_p}{\bar{X}_p} = (1.35)\ (39.805)\ (0.0205) = 1.102 \qquad (7)$$

Considerably higher elasticity is found here than in other cross-section studies.[10] Most cross-section analyses find inelastic response of education expenditure differences to per capita income differences.

The Impact Of Federal Aid

In the analysis above, little relationship was found between the levels of federal aid and the interstate variation in employment and wage rate levels. Explanations for this lack of significance include collinearities in the variables and the appropriateness of the estimating technique. Since the early work of Sacks and Harris,[11] which argued such a relationship and attempted to estimate its magnitude, considerable attention has been given to measuring this covariation. While there has been much debate on how to estimate the grants expenditure coefficient, and on the direction of causation, there seems general agreement that the relationship does exist. In any case, the results presented above do not prove no relationship. Rather, the issue clearly requires more research.

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10. Miner, Social and Economic Factors in Spending; Werner Hirsch, "Determinants of Public Education Expenditures," National Tax Journal 13 (March 1960): 29-40; Harvey E. Brazer, City Expenditures in the United States (Washington, D.C.: National Bureau of Economic Research, 1959).

11. Seymour Sacks and Robert Harris, "The Determinants of State and Local Government Expenditures and Intergovernmental Flows of Funds," National Tax Journal 17 (March 1964): 75-85.

In order to shed more light on this issue, the presentation in this section attempts to assess the impact of federal aids for health and education on state-local average wage and public employment levels. In the first part, the magnitude of the aid programs is examined by regional incidence. In the second part, simple correlations of the various aid programs with per capita public employment, average wages and personal income are discussed.

Chart 2 describes the various major aid programs used for this study. Per capita aid to local schools is clearly greatest ($15.78), followed by aid to health programs ($3.07) and aid to colleges and universities ($1.63). Within the local schools category, the elementary and secondary school programs are the largest ($8.74 per capita), followed by aid to federally-affected areas ($4.46 per capita). Within the health and hospitals category, the comprehensive health planning activities program is largest ($0.98 per capita), followed by mental health research and services ($0.81 per capita).

Table 8 shows the regional distribution of per capita federal aid for each of these programs. The west received the largest amounts of aid in each of the three functions, the cental region received the least aid to local schools and health and hospitals, and the south least for higher education.

As for individual aid programs, aid for elementary and secondary school activities to the south was almost twice that received by the central region, and more than $5 per capita greater than the amount received by any other region. Aid to federally-affected areas was largest in the west and more than four times that received by any other region. Also notable is the fact that health and hospital aid in the form of comprehensive health planning activities in the west was 50 percent greater than that received by any other region.

Table 9 presents the simple correlation coefficients of each of the aid programs studies, with the average wage of public employees for the corresponding functions in each region. For the total of each set of programs, there is a small positive correlation with the average wages for the nation as a whole. However, there are relatively large negative correlations in total local schools assistance for the central and southern regions, and in higher education for the eastern and central regions. That is, per capita aid tended to be higher where average wages were lower. By contrast, there is a relatively high positive correlation between average wages and local school aids in the west. What these results suggest is that the distribution of grants among states is related to average wage levels in different ways in different regions. The level of grants may support higher average wages for local schools in the west and offset higher average

Chart 2. Description and Magnitude of Federal Aid Programs in Health and Education.

Local Schools	Dollar Amount[a] (in thousands)	U. S. Mean Per Capita Amount
ED34 Cooperative Vocational Education	$ 409,775	$ 2.40
ED36 Educational Improvement for Handicapped	28,987	0.18
ED38 Elementary and Secondary School Activities	1,797,322	8.74
ED43 School Assistance in Federally Affected Areas	492,589	4.46
Total Education Aid Programs	$2,728,673	$15.78
Higher Education		
COL41 Higher Education Activities	$ 309,106	$ 1.63
Health and Hospitals		
H47 Comprehensive Health Planning Activities	$ 161,839	$ 0.98
H50 Health Manpower Education and Utilization	99,089	0.44
H51 Maternal and Child Health Services	117,177	0.55
H52 Mental Health Research and Services	178,106	0.81
H53 Regional Medical Programs	46,038	0.28
Total Health Aid Programs	$ 602,249	$ 3.07

a includes aid to the District of Columbia, Puerto Rico, Virgin Islands and U.S. Territories not included in per capita figures.

Source: U.S. Department of the Treasury, Fiscal Service - Bureau of Accounts, Federal Aid to States: Fiscal Year 1971 (Washington, D.C.: U.S. Government Printing Office, 1972).

Table 8. Mean Per Capita Federal Aid by Region and Program: 1971.

		U.S. Mean	East	Central	West	South
Local Schools						
[illegible]	Cooperative Vocational Education	$ 2.40	$ 2.28	$ 2.16	$ 2.75	$ 2.40
[illegible]	Educational Improvement for Handicapped	0.18	0.19	0.17	0.22	0.15
[illegible]	Elementary and Secondary School Activities	8.74	7.61	6.90	7.22	12.65
[illegible]	School Assistance in Federally Affected Areas	4.46	1.81	2.48	10.63	2.45
Total Local Schools		$15.78	$11.89	$11.71	$20.82	$17.64
Higher Education						
COM11	Higher Education Activities	$ 1.63	$ 1.66	$ 1.70	$ 1.85	$ 1.35
Health and Hospitals						
[illegible]7	Comprehensive Health Planning Activities	$ 0.98	$ 0.93	$ 0.73	$ 1.52	$ 0.76
[illegible]6	Health Manpower Education and Utilization	0.44	0.35	0.51	0.54	0.35
[illegible]51	Maternal and Child Health Services	0.55	0.58	0.40	0.56	0.65
[illegible]52	Mental Health Research and Services	0.81	1.15	0.67	0.87	0.66
[illegible]53	Regional Medical Programs	0.28	0.30	0.25	0.37	0.24
Total Health and Hospitals		$ 3.07	$ 3.31	$ 2.56	$ 3.87	$ 2.65

Source: U.S. Department of the Treasury, Fiscal Service - Bureau of Accounts, Federal Aid to States: Fiscal Year 1971 (Washington, D.C.: U.S. Government Printing Office, 1972).

Table 9. Simple Correlations[a] Between Average Wage Rates and Mean Per Capita Aid by Region and Aid Program: 1971.

		United States	East	Central	West	South
Local Schools						
ED34	Cooperative Vocational Education.	-2069	-7771[a]	-6439[a]	2654	-5671[a]
ED36	Educational Improvement for Handicapped	-1530	-2984	-5477[a]	-3155	-2327
ED38	Elementary and Secondary School Activities	-4760[a]	5405	-3438	-1649	-7543[a]
ED43	School Assistance in Federally Affected Areas	3699[a]	-4625	-7750[a]	6902[a]	5544[a]
Total Local Schools		1020	-0451	-5972[a]	6351[a]	-6657[a]
Higher Education						
COL41	Higher Education Activities	0031	-4175	-2839	-0361	0041
Health and Hospitals						
H47	Comprehensive Health Planning	2340	-4827	-3629	2513	-2014
H50	Health Manpower Education and Utilization	1083	3474	-0057	-1777	6467[a]
H51	Maternal and Child Health Services	-0707	4697	0858	-4504	2700
H52	Mental Health Research and Services	2236	-0231	2622	-0502	4160
H53	Regional Medical Programs	-0394	-4159	-1383	-0909	0643
Total Health and Hospitals		1613	-0825	-0302	-0797	3617

a To be significant at the 5 percent level, a correlation coefficient must be at least .2793 for the United States, .6189 for the east, .5459 for the central and west, and .5263 for the south.

Source: U.S. Department of the Treasury, Fiscal Service - Bureau of Accounts, *Federal Aid to States: Fiscal Year 1971* (Washington, D.C.: U.S. Government Printing Office, 1972).

wages in the central and southern regions.[12]

For individual aid programs, there are even greater disparities between regions in the correlation coefficients. As for aid to elementary and secondary school activities, while more aid went to states with higher wages in the east, the reverse was the case in the other regions. Further, more aid to federally-affected areas went to states with lower wages in the east and central regions, but to states with higher wages in the west and south. For comprehensive health planning aid, the higher levels of aid appear to go to states with higher wages in the west, but to ones with lower wages in the other regions. Finally, aid in the area of mental health research and services flowed in the central and southern regions to the states with higher wages, but to states with lower wages in the other two regions studied.

Table 10 presents correlations of the aid categories with per capita public employment in the various regions. For the entire U.S., aid for local schools and higher education is positively correlated with employment, but slightly negatively correlated in the case of health and hospitals. In the individual aid categories, there are generally large positive correlations reported for each region, except the south, where employment and aid are negatively correlated. Further, higher education aid went to states within each region which had high employment levels, except for the west. Finally, health and hospital aid is generally positively correlated with employment in the east and central regions, but negatively correlated with employment in the west and south.

Table 11 shows the correlation coefficients for the aid categories with per capita income in each state. Educational aid to local schools generally is negatively correlated with per capita income, with the notable exception of aid to federally-affected areas in the south and west. Finally, aid to higher education and health and hospitals was negatively correlated with per capita income in all regions except the south, but positively correlated for the nation as a whole.

A number of general results emerge from this simple analysis. First, although per capita aid to local schools and higher education is positively related to both per capita employment levels and average wage rates, the stronger correlation is with employment levels. Second, per capita aid to health and hospital activities is generally positively correlated with average wage rates and negatively correlated with per capita employment levels, but the stronger correlation coefficient is with wages. Third, the relationship between per capita aid and per capita employment vs. average wages differs widely from

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12. The size of the correlation coefficients, on which these results are based, is not strictly comparable across regions because of the differing numbers of states analyzed (see footnote to table 9).

Table 10. Simple Correlations[a] Between Per Capita Public Employment Levels and Mean Per Capita Aid by Region and Aid Program: 1971.

		United States	East	Central	West	South
Local Schools						
ED34	Cooperative Vocational Education	2981[a]	2857	5275	4476	-5258
ED36	Educational Improvement for Handicapped	3181[a]	-0754	6488[a]	5186	-2975
ED38	Elementary and Secondary School Activities	0376	5025	5249	4419	-1583
ED43	School Assistance in Federally Affected Areas	3818[a]	-2253	5226	3786	1112
Total Local Schools		3819[a]	4535	5937[a]	4541	-2020
Higher Education						
COL41	Higher Education Activities	3951[a]	6914[a]	3211	-1394	3323
Health and Hospitals						
H47	Comprehensive Health Planning Activities	-2517	-3764	-3948	-2383	-1964
H50	Health Manpower Education and Utilization	0844	6719[a]	3097	-0457	-0846
H51	Maternal and Child Health Services	2366	5156	1445	2365	0840
H52	Mental Health Research and Services	-0990	1022	3666	-1467	-0698
H53	Regional Medical Programs	-1866	-3407	3220	-2703	0198
Total Health and Hospitals		-0935	1334	2069	-1576	-0221

a To be significant at the 5 percent level, a correlation coefficient must be at least .2793 for the United States, .6189 for the east, .5459 for the central and west, and .5263 for the south.

Source: U.S. Department of the Treasury, Fiscal Service - Bureau of Accounts, *Federal Aid to States: Fiscal Year 1971* (Washington, D.C.: *U.S. Government Printing Office, 1972*).

Table 11. Simple Correlations[a] Between Per Capita Income and Mean Per Capita Aid by Region and Aid Program: 1971.

		United States	East	Central	West	South
Local Schools						
ED34	Cooperative Vocational Education	-3168[a]	-7201[a]	-5520[a]	0348	-7063[a]
ED36	Educational Improvement for Handicapped	-1041	-2927	-6276[a]	-1362	-2235
ED38	Elementary and Secondary School Activities	-4977[a]	4014	-4676	-2946	-7905[a]
ED43	School Assistance in Federally Affected Areas	2388	-4578	-5357	4864	5834[a]
Total Local Schools		-0316	-1499	-5665[a]	4111	-7124[a]
Higher Education						
COL41	Higher Education Activities	0124	-4043	-3823	-0688	2602
Health and Hospitals						
H47	Comprehensive Health Planning Activities	-0012	-6786[a]	-4927	-0168	-0450
H50	Health Manpower Education and Utilization	2612	3987	1159	2583	3620
H51	Maternal and Child Health Services	0114	2342	-1659	-0037	1327
H52	Mental Health Research and Services	1619	-0667	2199	-1337	1227
H53	Regional Medical Programs	-1193	-4047	-0255	-2073	-0755
Total Health and Hospitals		0782	-2229	-1209	-0638	1497

a To be significant at the 5 percent level, a correlation coefficient must be at least .2793 for the United States, .6189 for the east, .5459 for the central and west, and .5263 for the south.

Source: U.S. Department of the Treasury, Fiscal Service - Bureau of Accounts, Federal Aid to States: Fiscal Year 1971 (Washington, D.C.: U.S. Government Printing Office, 1972).

aid category to aid category, and from region to region. These findings reaffirm that federal distribution formulas are not cognizant of possible differing wage rate and employment level responses on the part of state-local governments, or of the differing equalization results implied.

Future Research Directions

The nature of the relationship between human service expenditures, labor costs, and the underlying determinants of variation among states is clearly complex and not fully understandable from the results of prior research. The growing importance of collective bargaining in the public sector makes imperative the analysis of the public employment dimensions of government expenditures. To the extent that per capita expenditure disparity among states changes, it is important to know the extent to which such changes result from average wage level changes as opposed to per capita employment level changes. Clearly, the distribution formulas for federal grants in aid must acknowledge such differences, if a goal of such formulas is the equalization of real service levels.

The statistical analysis presented above is preliminary--considerably more work is required to establish the wage-employment-expenditure level in more detail. What is provided is a framework for such study. What this analysis shows is a strong income effect on average wages; the significance of the per capita income variable in earlier studies stems from this wage rate effect. On the other hand, interstate variations in per capita employment levels are significantly related to general needs factors such as enrollment levels. There is evidence of significant effects of per capita federal grants on government employment levels, and of regional effects. However, while a substantial amount of the variance in both the employment and wage rate variables is explained in this analysis, a combination of multicollinearity problems and the need for a more complete estimation model have obscured the explanatory powers of certain important variables. Particularly relevant here is the determination of the nature of the relationship between federal assistance and the wage and employment components of public expenditures.

While this empirical study centers on interstate analysis, the approach is equally applicable to intrastate analysis. Indeed, the question of intrastate equalization of education expenditures is of considerable policy importance, and state aid distribution policy requires knowledge of the wage rate and employment level components of interjurisdictional expenditure variations for the same set of reasons as given for federal assistance.

APPENDIX A

WED	Average wage for local school employees
WEDI	Average wage for instructional personnel in local schools
WHED	Average wage for higher education employees
WHEDI	Average wage for instructional personnel in higher education
WHHOS	Average wage for health and hospital employees
EAIDP	Per capita federal aid to local schools
CAIDP	Per capita federal aid to higher education
HAIDP	Per capita federal aid to health and hospitals
SOUTH	Regional dummy
WEST	Regional dummy
CENT	Regional dummy
PI	Per capita personal income
UNEM	Unemployment rate
UNION	Percent of private labor force unionized
DEN	Population density in thousands per square mile
AGEPC	Population over 65 or under 5 per 1,000 population
ENRLP	Enrollment in local schools per 1,000 population
COLLP	Enrollment in higher education per 1,000 population