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STATED FINANCING POLICIES OF GOVERNMENT AGENCIES AND THE EXPERIENCE OF RURAL WATER SUPPLY SYSTEMS

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STATED FINANCING POLICIES OF GOVERNMENT AGENCIES AND THE EXPERIENCE OF RURAL WATER SUPPLY SYSTEMS

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RAMESH VAIDYA AND DAVID J. ALLEE*

I. INTRODUCTION

Rural community water supply systems often find it difficult to internally finance the cost of constructing physical facilities. Typical rural community systems adopt a pricing policy to produce just enough revenue to break even with operating and maintenance costs. No retained earnings are held for future construction. Often the policy is required by state law. The search for funds is from external sources in the state and federal agencies and in the commercial markets. Debate on the propriety of major public grants for water suppy is heating up and appropriate information is scarce.

*We are indebted to Dr. Joe D. Francis for valuable suggestions and for permission to use the rural water survey data from the National Statistical Assessment of Rural Water Conditions. We are grateful to Ms. Wendy F. Graham for her help in preparing specific data files for this research from the overall rural water survey data. We are also thankful to Ms. Anne E. Johnson for editing this report. Financial support from the U.S. Department of Interior's Office of Water Research and Technology is gratefully acknowledged.

A study at Cornell University--National Statistical Assessment of Rural Water Conditions--has developed a profile of the sources of financing used by rural community systems. For an estimated population of 25,385 systems, 94 percent of the total funds for construction activity were obtained from external sources (see Table 1). Out of the total of external funds, 45 percent were obtained from public sources, 50 percent from municipal bonds and 5 percent from private financial institutions.

The hypothesis to be explored in this study is that the successful funding of construction activity by a rural community system is related to a number of system characteristics. We will examine the relationships between these characteristics or policy variables, and the amount of funding as either grants or as loans.

Table 1. Estimated Amount of Funds Secured by Rural Community Systems From Various Sources

Source of Funds	Systems	Average per system	Total all systems	Percent
		(Thousands 1978 Dollars)		
External:				
Government Agency Grants	3,204	361	1,157	22
Government Agency Loans	4,297	290	1,246	23
Municipal Bonds	2,950	912	2,690	50
Private Institutions	3,524	76	268	5
Subtotal			5,361	100
Internal:	13,987	25	350	
Total	27,962*		5,711	

* Some systems obtained funds from more than one external source.

The two dependent variables measure the availability of funds.

The scope of this study is limited to the funding of rural community systems by grants and loans obtained from public sources. The public sources of interest are: Farmers Home Administration (FmHA), Economic Development Administration (EDA), the Housing and Urban Development Department (HUD); multistate regional agencies such as the Appalachian Regional Commission; and state agencies such as the rural water financing programs in Wyoming, Kansas and Vermont. The three federal agencies are considered separately, while the regional and state agencies are treated as groups.

In section II, stated financing policies of government agencies are reviewed. Next, in section III, factors influencing the availability of funds are identified. The methods used to standardize data for dependent variables, i.e., the amount of grants and loans, are described in section IV. Then, Section V presents regression equations obtained by regressing the independent variables, or the factors, on these dependent variables. The results of these equations are used in section VI to discuss how much progress government agencies have made toward their stated policies of relevance to water supply systems. Finally, the summary and conslusions of the report are presented in Section VII.

II. STATED FINANCING POLICIES OF GOVERNMENT AGENCIES

Farmers Home Administration (FmHA)[1/]

FmHA provides funds in the form of both grants and loans to rural community systems. FmHA's recent program requires that only communities of not more than 10,000 are eligible for its funds. This requirement dates to the Rural Development Act of 1972 (PL 92-419). A similar program with an eligibility requirement of 5,000 was started in 1965. Prior to 1965, only loans were available and were provided for under the consolidated Farmers Home Administration Act of 1961 (PL 87-128). Rural areas with populations of less than 2,500 were eligible. Such a loan program was first introduced in 1937 under the Water Facilities Act to provide loans for 17 western states where droughts were common. That program was administered jointly by the then Resettlement Administration with the Soil Conservation Service and by the Bureau of Agricultural Economics. In 1954, the Act was amended and the eligibility was extended to all states.

The recent financing policies of FmHA give priority to rural community systems with the following characteristics:

1) facility alterations for compliance with Safe Drinking Water Act standards,
2) systems under public or private nonprofit ownership,
3) systems undergoing merger or regionalization of physical treat facilities or administrative support operations,

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1/ Information on FmHA from; G. N. Gilbert and N. L. Smith, The Farmers Home Administration: Its Operation and Programs (Wash., DC: Cong. Res. Serv. Lib. of Cong., Mar. 24, 1976) pp. 56-58, 86; and J. N. Collins, The Impact of Loan-Grant Combinations on Local Governments, ESS Staff Rep. (Wash., DC:, US Dept. of Ag., Oct. 1980) pp. 7-9.

4) systems serving fewer than 5,500 people, and

5) systems serving areas with low-income families.

In addition, FmHA uses a number of criteria for deciding on funding a specific community system and on the mix between grants and loans to be awarded to that system. First, to be eligible for FmHA financing, the community must be unable to secure funds from regular commercial sources. The second criterion is used to decide how much of the funds should be provided in the form of loans: the loan amount should be such that the annual repayment by the community to FmHA is 0.75, 1.000 or 1.25 percent of its annual income, depending on whether the median family income in that community is, respectively, less than $6,000, in the range of $6,001 to $10,000, or greater than $10,000. Any difference between the project cost and the loan amount calculated on the basis of this "modified one percent rule" is made up by a grant. But the loan may be increased and the grant reduced by the same amount if the funds made available under the mix of FmHA's grant and loans are likely to result in a water-user charge less than that for similar systems. Similarity among systems is judged by construction costs and by the economic condition of the community served by it.

The procedure for obtaining loans from FmHA is similar to private placement of municipal bonds by a system. FmHA buys the bonds of the municipality in the case of a public system and the promissory note or a deed of trust in the case of a private nonprofit system. FmHA then sells Certificates of Beneficial Ownership to the Federal Financial Bank of the US Treasury. Under this arrangement loans are not direct outlays from the federal budget. The terms on FmHA loans were established in 1961 and

in 1980 were still valid at an interest rate of 5 percent and maturity up to 40 years.

Economic Development Administration (EDA)[2/]

EDA provides funds both in the form of grants and loans to rural community water supply systems. EDA's recent program dates to 1965 when it was created within the US Department of Commerce under the Public Works and Economic Development Act of 1965. The EDA programs relevant to water supply are: (1) grants and loans for public works and development facilities, (2) grants and loans under titles I, II, III, IV and IX activities, and (3) grants under Public Works Impact Program. The funding under Title II is available to systems under private profit, private nonprofit and public ownership, while those under the other EDA programs are available only to systems under private nonprofit or public ownership. The third program is oriented toward short-term funding and the other two toward long-term funding.

2/ Information on EDA from; US Dept. of Commerce, EDA Handbook (Wash., DC: GPO, June 1968); Northeast-Midwest Institute, Guide to Federal Resources for Economic Development (Wash., DC: NMI, Apr. 1980), pp. 13-24.

The recent policies of EDA provided funds for:

1) construction of public facilities, including water supply projects;

2) private and publicly owned organizations;

3) benefit areas with low-income families; and

4) assisting in the creation of additional long-term employment opportunities.

Housing and Urban Development Department (HUD)[3/]

The HUD program relevant to the rural community water supply systems is the Community Development Block Grants/Small Cities Program. Grants were made available to rural community systems under this program since 1974 under Title I of the Housing and Community Development Act of 1974 (PL 93-383). Earlier, grants and loan guarantees were provided under Title IV of the Housing and Urban Development Act of 1968. (Applications for funds under this program were not being accepted as of February 1980.) Although specific authorization acts were not clearly mentioned, HUD has apportioned monies for water and sewer grants as early as FY 1967.

The goals of HUD's Block Grants Program relevant to the rural community water supply systems are: 1) to assist communities in providing a suitable living environment (eg., "to correct deficiencies in public facilities such as water and sewer, which affect the public health or

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3/ Office of Management and Budget, Executive Office of the President, 1980 Catalog of Federal Domestic Assistance (Wash., DC: GPO, May 1980), pp. 519-523.

safety"), 2) to provide grants to systems under public ownership and 3) to provide grants for communities with low and moderate income households.

A special feature of the HUD grants is that the rural community systems can use these grants to match federal grant programs. Several federal financing agencies require that the local community contribute a specified minimum percentage of the total project cost. The community can use HUD grants as a substitute for local contributions.

Rural systems, however, are at a disadvantage in competing for HUD grants. The Small Cities Subprogram of the Block Grants Program is funded through discretionary funds left after allocating money to its other subprograms: subprograms that typically provide funds to communities of more than 50,000. Thus, only a small proportion of the total funds in this program may be available for rural systems. In FY 1979 and in 1980, the funds available for the Small Cities Program accounted for 15 to 20 percent of the total Block Grant funds.

Multi-State Regional Agencies[4/]

The multistate regional agencies of primary concern are regional commissions, whose goal is to promote economic growth in underdeveloped regions through provision of grants to public and private nonprofit agencies. The first regional commission to be established was the Appalachian Regional Commission under an act of 1965 of the same name. This commission is an independent agency and appropriation of funds is made to it directly. Eight other regional commissions were subsequently established under Title V of the Public Works and Economic Development Act of

4/ Northeast-Midwest Institute, op. cit., pp. 99-102.

1965. Unlike the Appalachian Commission, these commissions were not autonomous and their long-range plans were subject to approval by the Department of Commerce. These eight agencies are: New England, Ozarks, Coastal Plains, Upper Great Lakes, Four Corners, Old West, Pacific Northwest, and Southwest Border Commissions.

Most of these regional commissions have supplemental grant programs, funds from which can be used by states and local entities to match federal grant programs when the entities lack full matching share to contribute from their own reserves. The five commissions that have actually used supplementary grant programs are: Appalachian, Coastal Plains, Four Corners, Ozarks, and Upper Great Lakes.

Of these five commissions, Appalachian was authorized funds in 1971 to develop water supply facilities in addition to funds it could use under its supplemental grant program. Therefore, projects that are eligible to receive grants under federal programs but are unable to do so because of lack of funds in those programs could be considered for funding by this commission.

State Agencies

The state agency funds became available for water supply systems mainly in the seventies, although some funds were available as early as the forties. Some states have only grant programs (eg., Alabama, Kansas, Wisconsin, Pennsylvania, Washington) and others (15 in 1977) have only loan programs (eg., Arkansas, Tennessee, Ohio, California, Oregon); still others (9 in 1978) have both grant and loan programs (eg., New Mexico, Wyoming, Vermont, North Dakota). The terms and conditions for awarding

grants and for making loans differ among the states, but the factors on which conditions are set are similar. Some of these conditions are:

Population Served: This seems to be the most restricted factor for most states. The upper limit on the number of people that the system could serve and still be eligible for funds varies over a wide range. In some states like South Carolina, it is 1,500; in most others such as South Dakota, it is 5,500; and in some, like Pennsylvania, it is as high as 12,000.

Type of Ownership: Most states provide support to publicly owned systems only. Some, such as Wisconsin and Missouri, explicitly mention ownership, while others do not. South Dakota is one exception specifying that any nonprofit system is eligible.

Debt Financing Capability: Some states, like Colorado and Tennessee, have shown concern about the debt-financing capability of community systems. These states provide loans only to those community systems that through their municipality can levy taxes on the community.

Matching Funds: Some states prefer to match their funds with those from federal programs; South Carolina is an example. Others have specified a particular federal agency they would like to match their funds with. For example, Kansas, North Dakota and South Dakota have mentioned Farmers Home Administration.

III. FACTORS INFLUENCING AVAILABILITY OF FUNDS

On the basis of the information on the financing policies of various government agencies and on a review of relevant literature, the following factors have been identified as influencing the availability and cost of funds:

(1) the amount of funds required for the construction activity;

(2) the type of construction activity;

(3) the type of system ownership;

(4) the type of system organization;

(5) the best available surrogate for debt financing capability of the community (in 1978); and

(6) the best available surrogate for population served by the system.

Amount of Funds Required for the Construction Activity

The amount of grants or loans a rural community system could secure from government agencies and the cost of loans may depend on the total project cost for the construction activity. Some agencies have restrictions on the proportion of the total project cost they would fund, while others have limited the maximum amount of funds they would provide. For example, FmHA's charter allows it to award grants up to 75 percent of project cost, and EDA's Public Works Impact Program can make grants up to 80 percent. Others, such as the state agency in Georgia, do not have any restriction on the proportion, but grant size for a project cannot exceed $150,000. Explicit statements have not been made on the proportional amont of the loan which a community system can secure from an agency. But state level agencies such as the one in California have specified the

maximum amount of a loan that can be issued to a system; in California it cannot exceed $400,000. The amount of funds required is treated as a continuous variable for analysis and does not need to be categorized.

Type of Construction Activity

The amount of grant or loan that a community system could secure and the cost of the loan may depend on the type of construction activity proposed. For purposes of analysis, the types of construction activity are classified as the original construction of a facility and the major alteration of an existing facility, e.g., the addition of new treatment facilities for improving water quality to meet interim primary drinking water regulations. Because the concern for improving water quality has been high in the government since the passage of the Safe Drinking Water Act in 1974, it is expected that a system is more likely to be successful in securing grants or in obtaining loans (and at a lower cost) if the request is for major alterations in existing facility to improve water quality.

Type of System Ownership

The success of securing grants or loans may also depend upon the type of ownership of the water supply facility. These types are classified into three categories: public, private nonprofit, and private profit.

The public category includes ownership structures with the power to tax the community for the purpose of a major construction activity on the system. The private nonprofit category includes ownership structures in which a private citizen or a group of users own the community system

jointly and operate it with a nonprofit objective. Finally, private profit includes systems that are owned by a profit-making group, which may be comprised of both users and nonusers of the system's facilities.

Government agencies may more willingly provide grants and loans to systems owned by some public body such as the local government compared with those owned by private organizations.

Type of System Organization

The types of system organization are classified as consolidated and independent. There are similarities and differences between the definition of consolidation of systems in this study and that of regionalization and merger of systems in the literature. In the literature, regionalization is used to mean the sharing of a common physical facility, such as a treatment plant, by a number of community systems with the objective of benefiting from the economies of scale in that operation.5/ During the regionalization of a number of systems, administrative and management support facilities may still be carried on independently. On the other hand, merger is used to mean the development of common administrative and management support facilities among community systems that had been operated independently. The similarity between the consolidated category and the regionalized or the merged category is that both the regionalized systems and the merged systems fall into the consolidated category. The difference, however, is that if the same system is both regionalized as well as merged, it would be classified as an independent system.

5/ Robert M. Clark, "Water Supply Regionalization: A Critical Evaluation," J. of the Water Resources Planning and Management Div. (Sept. 1979) pp.279-294.

Community systems that are operated on a consolidated structure are more likely to be successful in securing government agency funds or compared with the independent ones. Government agencies would prefer consolidated systems to the independent ones, because the consolidation of physical or administrative operations may result in the improvement of water quality accompanied by only marginal increments in the user charge because of the scale economies. The literature, however, also points out the diseconomies in scale that may arise in the cost of transmission and distribution of water in consolidated systems due to the larger distances from the treatment plant to the centers of the service area zones.

Debt Financing Capability

The availability of grants and loans and the cost of loans to systems may depend upon their capability to finance debt. The debt-financing capability can be measured by the debt-service coverage ratio which is defined as the number of times that the revenue, after deducting operating and maintenance expenditures, can cover interest and principal payments. Since the policy of a number of government agencies is to provide assistance to systems that cannot raise funds from capital markets or private financial institutions, systems are more likely to be successful in securing government agency grants or loans or loan guarantees if they have a low value for this ratio. Typically, community systems will not be able to raise funds from capital markets or private financial institutions if they have low debt-financing capability.

The debt-financing capability variable is continuous and thus needs no classification.

For the purposes of this study, the Debt Service Coverage Ratio has been simplified. Only the revenue component that deals with water charges represents the system revenue because data are not available for the other component. A bias will be introduced because of this simplification; the ratio for the systems receiving local government transfers would appear to be less than what they actually are. The Ratio is defined as: 100 [(Operating and Maintenance Cost) + (Debt Service Charges)] ÷ Revenues.

Population Served

The availability of grants and the availability and cost of loans to a system may depend upon the number of users in that community. It is not certain, however, how important this variable will be for explaining variability regarding the availability and cost of funds to the rural systems of concern in this study, because here the rural community is defined as a community with a population less than 2,500. During the survey of the policy statements of government agencies, it has been found that the cutoff point for preferential treatment is above 2,500 for most agencies. Typically, the cutoff point is around 5,000 and only two cases have been observed where this point is below 2,500: the state agencies in South Carolina (1,500) and in Indiana (1,250).

Nevertheless, the population served is included as a variable because some of the rural communities of concern in this study are served by systems which have a total number of users exceeding 2,500.

Because population data are not available for communities with less than 2,500 people, the number of connections served by each system is used as a surrogate for the population served. This variable needs no classification because it is continuous. This surrogate variable, however, introduces a bias in cases of communities with a large number of nonresidential connections.

IV. MEASUREMENTS FOR DEPENDENT VARIABLES

The dependent variables are the availability of grants and the availability of loans. These variables are measured, respectively, by the amount of grant obtained and the amount of loan secured.

Data are available on the following: (1) the cost of construction activity on the system at current prices and (2) the proportion of such cost that is financed by grants and loans. The construction cost data were standardized to 1978 dollars for calculating the measures of the dependent variables. For analytic purposes, the standardized data can be compared with each other and they act as observations in a sample. The procedures adopted for standardization are in the following paragraph.

The costs for the construction activity in systems are standardized by using implicit price deflators for the purchases of structures. Deflators are specifically selected for the category of the new construction of water supply facilities by government organizations. These data on deflators are obtained from two statistical sources published by the Bureau of Economic Analysis.6/ Such deflators are not available separately for the major alteration of facilities or for works conducted by private organizations. So the same set of deflators are used for all community systems, regardless of the types of construction activity or of ownership.

The following equations are used for these calculations:

6/Bureau of Economic Analysis, The National Income and Product accounts 1929-1974: Statistical Tables, Wash., DC: GPO, 1974, pp. 294-295; and Survey of Current Business, Wash., DC, July 1979, p. 65.

(1) standardization index = f(Age of the System), and

(2) standardized cost = $\frac{\text{system cost x 175.0}}{\text{standardization index}}$

where 175.0 is the standardization index for 1978 using 1972 as the base.

V. MULTIPLE REGRESSION ANALYSIS OF GRANTS AND LOANS

The interrelationships between the dependent and independent variables are examined by using multiple regression techniques. The dependent variables are: the amount of grant obtained, the amount of loan secured and the present value of loan repayments for a $100 loan. The independent variables are: the amount of funds required for the construction activity, the type of construction activity, the type of system ownership, the type of system organization, and the best available proxies for the debt-financing capability of the community in 1978 for the population served.

The results of the regression analyses are presented in three sections, one each for two of the three dependent variables. The results of the analysis using the cost of loan as a dependent variable is not presented. Farmers Home Administration was the only agency for which data for a sufficient number of observations on cost of loan were available, yet, a regression equation with a very low corrected R^2 (0.08) was obtained. Regression equations are presented separately for the relevant funding agencies except loans from HUD and Urban Development because a sufficient number of observations were not available in the data base. The relative importance of the independent variables in explaining the dependent variable is also reported.

Grants Obtained: Regression Equations

Farmers Home Administration: During the multiple regression analysis, the amount of grant obtained from the FmHA by community systems is introduced in logarithmic form. Also, logarithmic forms are introduced for two of the explanatory variables: amount of funds required for construction and number of connections served, a proxy for the population served. Logarithmic forms reduce the number of large residual errors that may arise because of the wide range of their numerical values. In addition, three of the explanatory variables are introduced as dummy variables: type of construction activity, type of system ownership and type of system organization. The value for the type of construction activity variable is set at '1' for major alteration and at '0' for original construction. Similarly, the value for the system ownership variable is set at '1' for public ownership and at '0' for private ownership. All privately owned systems were private nonprofit type. Finally, the value for the system organization variable was set at '1' for consolidated systems and at '0' for independent systems.

The equation presented in table 2 shows the relationship between the log value of the amount of grant obtained from FmHA and the variables influencing it. This equation is estimated using weighted data from 32 water systems. The independent variables are relatively important in the equation for explaining the log value of the amount of grant. These rankings of independent variables are obtained using stepwise regression techniques.

Table 2. FmHA Multiple Regression Equation Explaining Log Amount of Grant Obtained from the Farmers Home Administration*

Variable/Intercept	Coefficient	T-ratio	Relative Importance
Intercept	-2.6618		
Log Funds Required	0.8772	(63.56)	1
System Ownership	0.2117	(10.28)	2
Debt-Financing Capability	-0.0967	(5.06)	3
Log No. of Connections	-0.1201	(5.41)	4
Construction Activity	0.0343	(2.07)	5
System Organization	0.0164	(1.12)	6

* The corrected R^2 value is 0.89.

The coefficients of debt-financing capability and the log value of number of connections have negative signs while those of the log value of the amount of funds required, the type of system ownership, the type of construction activity and the type of system organization have positive signs. The amount of grant obtained by water systems from FmHA increased as the amount of funds required for construction activity increased. Such an amount of FmHA grant, however, decreased as the debt financing capability of systems increased and the number of connections served by them became larger. Finally, systems under public ownership obtained larger size grants compared with those privately owned; systems undergoing major alteration secured larger size grants relative to those undertaking original construction; consolidated systems received more funds than did the independent systems.

Table 3. EDA: Multiple Regression Equation Explaining the Amount of Grant Obtained from the Economic Development Administration*

Variable/Intercept	Coefficient	T-ratio	Relative Importance
Intercept	361.7539		
Amount of Funds Required	0.0002	(20.00)	1
Construction Activity	-165.7547	(3.69)	2
No. of Connections	0.0484	(9.49)	3
System Ownership	-107.1865	(2.18)	4
Debt-Financing Capability	28.4432	(0.78)	5
System Organization	-16.0636	(0.41)	6

* The corrected R^2 value is 0.65.

The type of system ownership, the type of construction activity and the type of system organization are negatively related to the amount of grant obtained by water systems from EDA, while the amount of funds required, the debt-financing capability and the number of connections are positively related. These positive and negative signs indicate relationships. The amount of EDA grant increased as the amount of fund required for construction activity increased. Unlike the case of FmHA grant, however, such an amount of EDA grant also increased as the debt-financing capability of systems and the number of connections served by them became larger. The t-ratio for the coefficient of the debt-financing capability variable is less than unity, 0.78, indicating that the standard error of this coefficient is greater than its value. Furthermore, the amounts of EDA grants were larger for private systems than for public systems and for original construction activity than for

the consolidated systems, but the t-ratio of the system organization variable's coefficient is less than unity.

The most important variable explaining the amount of EDA grant is the amount of funds required followed by the type of construction activity and the number of connections. The three remaining variables, in order of decreasing importance, are the type of system ownership, debt financing capability and the type of system organization.

Department of Housing and Urban Development: For the analysis of grants obtained by water systems from the Department of Housing and Urban Development (HUD), the amount of HUD grant obtained is introduced in logarithmic form as an amount of funds required for construction activity and the number of connections. Of the remaining variables, all introduced in natural form, debt-financing capability is introduced in numerical form, but the type of construction activity and the type of system organization are introduced in categorical forms. The value for the type of construction activity is set at '0' for original construction and at '1' for major alterations. Furthermore, the value for the type of system organization is set at '0' for independent and at '1' for consolidated systems. The type of system ownership is not an explanatory variable for the amount of HUD grant, because only public systems are eligible for HUD grants.

Table 4 reports the interrelationships between the log value of the amount of HUD grant obtained and the explanatory variables. This equation is estimated using weighted data from 28 water systems. The table also presents the relative importance of the explanatory variables. These rankings were obtained by using stepwise regression analysis.

Table 4. HUD: Multiple Regression Equation Explaining Log (Amount of Grant Obtained from the Department of Housing and Urban Development)*

Variable/Intercept	Coefficient	T-ratio	Relative Importance
Intercept	-2.3240		
Log Funds Required	0.8836	(77.51)	1
Construction Activity	0.2692	(9.45)	2
Log No. of Connections	-0.1684	(6.48)	3
System Organization	0.0749	(3.23)	4
Debt-Financing Capability	0.0460	(1.16)	5

* The corrected R^2 value is 0.95.

The log value of number of connections is the only variable with a negative coefficient. The amount of HUD grant obtained increased as the amount of funds required for construction activity and debt-financing capability increased, but the amount of HUD grant decreased as the number of connections increased. Furthermore, the amount of HUD grant was smaller for original construction than for major alterations and for independent systems than for consolidated systems.

The results of the stepwise regression analysis indicate that the log value of the amount of fund required is the most important variable for explaining the log value of the amount of HUD grant followed by the type of construction activity. The three remaining variables, in order of decreasing importance, are the log value of the number of connections, the type of system organization and debt-financing capability.

Multistate Regional Commissions: Multiple regression analysis was conducted for the grants obtained by water systems from multistate regional commissions (MRC). All the dependent and independent variables are introduced in natural forms. The type of construction activity is introduced as a dummy variable. Its value is set at '1' for major alterations and at '0' for original construction. The type of system ownership variable has been excluded from this analysis because all the water systems in the data base that were successful in obtaining MRC grants were publicly owned. Furthermore, the type of system organization is also excluded from the analysis because, during the stepwise regression analysis, the tolerance of this variable is zero. (The tolerance of an independent variable is defined as the proportion of the variance of that variable not explained by the independent variables already included in the regression equation.) This zero value implies a perfect linear combination of other independent variables.

Table 5 presents the equation showing the interrelationship between the amount of grant obtained from MRCs and the independent variables. This equation is estimated using weighted data from 15 water supply systems. The relative importance of the independent fariables are indicated and were obtained by using stepwise regression analysis.

Table 5. MRC: Multiple Regression Equation Explaining the Amount of Grant Obtained from Multistate Regional Commissions*

Variable/Intercept	Coefficient	T-ratio	Relative Importance
Intercept	49.6425		
Amount of Funds Required	0.0001	(10.00)	1
No. of Connections	0.0116	(2.32)	2
Construction Activity	24.4607	(2.43)	3
Debt-Financing Capability	46.6497	(1.54)	4

* The corrected R^2 value is 0.53.

All the independent variables in the regression equation are positively related with the amount of MRC grant. The amount of MRC grant increased as the amount of fund required for construction activity and the number of connections increased. It also increased as the debt financing capability of systems increased. And, finally, the amount of MRC grant was larger for major alterations activity than for original construction.

The amount of fund required is the most important variable for explaining the amount of MRC grant. The remaining variables in decreasing order of importance are the number of connections, the type of construction activity and debt-financing capability.

State Agencies: Multiple regression analysis was undertaken for the grants obtained by water systems from government agencies at the state level (SA). The amount of SA grant obtained is introduced in logarithmic form. Of the five explanatory variables, the amount of fund required for construction activity and the number of connections is introduced in logarithmic forms. Debt-financing capability is introduced in numerical form and the two remaining variables, the type of system organization and the type of construction activity, are introduced as dummy variables. The value of the type of system organization has been set at '1' for consolidated ones and at '0' for independent systems. The value of the type of construction activity is set at '1' for major alteration and at '0' for the original construction activity. Finally, the type of system ownership is not excluded in the analysis because there is only one water system under private nonprofit ownership in our data base and the remaining 26 systems are all publicly owned.

Table 6 presents the regression equation showing interrelationships between the log value of the amount of SA grant and the independent variables. This equation is estimated using weighted data from 27 water supply systems. The relative importance of the independent variables are also reported and were obtained from the results of stepwise regression analsis.

All the independent variables, except the type of construction activity, are positively related with the log value of the amount of SA grant. These relationships indicate the following. The amount of SA grant increased with increases in the amount of fund required, the number of connections and debt-financing capability. In addition, the amount of SA grant was larger for consolidated than for independent systems, but

smaller for major alteration than for original construction activity.

Table 6. SA: Multiple Regression Equation Explaining Log (Amount of Grant Obtained from State Agencies)*

Variable/Intercept	Coefficient	T-ratio	Relative Importance
Intercept	-2.6804		
Log Funds Required	0.5552	(21.52)	1
Log No. of Connections	0.5122	(7.69)	2
Debt-Financing Capability	0.2749	(3.96)	3
System Organization	0.0259	(0.50)	4
Construction Activity	-0.0102	(0.17)	5

* The corrected R^2 value is 0.70.

The log value of the amount of fund required is the most important variable for explaining the amount of SA grant. The other four variables, in decreasing order of importance, are the log value of the number of connections, debt-financing capability, type of system organization and type of construction activity.

Loans Obtained: Regression Equations

Farmers Home Administration: In the regression equation, the amount of loan secured by water systems from the Farmers Home Administration is introduced in logarithmic form. In addition, logarithmic forms are used

for two of the explanatory variables: the amount of funds required for construction activity and the number of connections served. All the remaining explanatory variables are introduced as categorical variables, except the debt-financing capability variable. The values for the type of construction activity and the type of system organization variables are set at '1' or '0' depending on the category into which a system falls and using the same procedure as the one adopted for FmHA grants. The procedure used for setting values for the type of ownership variable, however, was slightly different. Because private profit systems (in addition to private nonprofit and public systems) have also obtained FmHA loans the private profit ownership was used as the reference category and two categorical variables were created: public and private nonprofit. Values were set at '1' if the water supply system was under that type of ownership and at '0' if not.

Table 7 presents a regression equation showing the relationship between the log value of the amount of loan secured from Farmers Home Administration and the explanatory variables. This equation is estimated using weighted data from 99 different water systems. Also, the relative importance of the explanatory variables are determined using stepwise regression techniques. Debt-financing capability and the type of system ownership (public=1) are negatively related to the log value of the amount of loan secured from FmHA, while the remaining variables are all positively related. Thus, the amount of FmHA loans increased as the amount of fund required increased and as the number of connections served by systems increased. Also, the amount of FmHA loans were higher (1) for

systems undergoing major alteration than for those undertaking original construction and (2) for consolidated systems than for independent systems. Further, the amount of FmHA loans decreased as the debt-financing capability of systems increased. Finally, the amount of FmHA loans were both higher for private nonprofit systems and lower for public systems relative to loans for private profit systems.

Table 7. FmHA: Multiple Regression Equation Explaining Log (Amount of Grant Obtained from the Farmers Home Administration)*

Variable/Intercept	Coefficient	T-ratio	Relative Importance
Intercept	-2.2071		
Log Funds Required	0.8038	(110.11)	1
Debt-Financing Capability	-0.1146	(10.32)	2
Log No. of Connections	0.0798	(7.82)	3
System Ownership: (public = 1)	-0.0529	(4.20)	4
Construction Activity	0.0323	(4.25)	5
System Ownership: (private nonprofit = 1)	0.0427	(3.05)	6
System Organization	0.0062	(0.76)	7

* The corrected R^2 value is 0.88.

The log value of the amount of funds required was the most important explanatory variable followed by debt-financing capability and size of systems.

Economic Development Administration: Using a procedure similar to the case of FmHA loans, the amount of loan obtained by water systems from the Economic Development Administration (EDA) is introduced in logarithmic form, as are the two explanatory variables: amount of fund required for construction activity and number of connections served. In addition, three other explanatory variables are included: debt-financing capability in numerical form and the type of ownership and the type of system organization in categorical forms. The value for system ownership is set at '1' for public ownership and at '0' for private ownership and the value for system organization is set at '1' for consolidated and at '0' for independent systems. Unlike the case of EDA grants, the type of construction activity variable is not explicitly included because it is highly correlated with the type of system ownership variable. Therefore, the system ownership variable in the equation represents a group consisting of itself and the type of construction activity. Also, unlike FmHA loans, a second system ownership variable is not included in the final form of the equation, because data were available for only seven water systems and this was the sixth most important variable according to the results of stepwise regression analysis.

Table 8 presents an equation showing the relationship between the amount of loan secured from EDA and the independent variables. Only seven observations were available for estimating this equation with five variables. The degrees of freedom, however, are 169 because weighted data were used. The relative importance of the independent variables are determined using stepwise regeession analysis.

Table 8. EDA: Multiple Regression Equation Explaining Log (Amount of Loan Secured from the Economic Development Administration)*

Variable/Intercept	Coefficient	T-ratio	Relative Importance
Intercept	-2.2898		
Log Funds Required	0.8895	(57.76)	1
System Ownership	-0.7804	(25.42)	2
System Organization	-1.8616	(58.73)	3
Debt-Financing Capability	3.7111	(53.94)	4
Log No. of Connections	0.1973	(8.85)	5

* The corrected R^2 value is 0.99.

The type of ownership and the type of system organization variables have coefficients with negative signs, while the log value of the amount of fund required, debt-financing capability and the log value of the number of connections have coefficients with positive signs. These signs indicate that the log value of the amount of EDA loan increased as the log values of the amount of fund required for construction activity and of the number of connections and the value of debt-financing capability variables increased. In addition, the log value of the amount of EDA loan is smaller for publicly-owned systems than for private systems and for major alterations than for original construction. Finally, the log value of the amount of EDA loan was smaller for consolidated than for independent systems.

The most important variable explaining the log value of the amount of EDA loan is the log value of the amount of fund required followed by group consisting of the system ownership and the type of construction activity variables. The three remaining variables, in order of decreasing importance, are the type of system organization, debt financing capability and the log value of the number of connections.

VI. RESULTS AND POLICY IMPLICATIONS

This section will disclose how much progress government financing agencies have made toward their stated policies of relevance to rural community water supply systems. Information from the review of financing policies of government agencies in Section II will be used to summarize stated policies and to derive policies based on stated goals. Further, the results of the regression analysis will be used to show what the data obtained from various rural water systems reveal.

Farmers Home Administration

Table 9 presents the interrelationships between the amount of fund obtained by water systems from the Farmers Home Administration and the explanatory variables. The signs and preference criteria for the stated policies of this agency have been summarized in Section II from a review of its financing policies. In addition, similar information has been developed from the results of multiple regression analyses regarding the acquisition of FmHA grants and loans by water systems. These results will be used to discuss the Farmers Home Administration's accomplishments toward meeting its stated policies.

Since the stated FmHA policy is to award grants or loans up to a certain percentage of project cost, once a water system becomes eligible for FmHA funds, how much it gets depends on how much it needs. This policy is in agreement with the results of our analysis which show that both the amount of grant or loan obtained by water systems increase as the amount of fund required increases.

Table 9. FmHA: Stated Policies of Farmers Home Administration and Results of Data Analysis

Characteristic	FmHA's Stated Policy	Results of the Analysis	
		FmHA Grants	FmHA Loans
Amount of fund required	+	+	+
Type of system ownership	1/	2/	3/
Debt-financing capability	-	-	-
Number of connections	-	-	-
Type of construction activity	+	+	+
Type of system organizaton	+	+	+

1/ Preference to public and private nonprofit systems.

2/ Preference to public systems over private nonprofit systems.

3/ Preference to private nonprofit over private profit systems, and to private profit systems over public systems.

Closely linked to project cost as a basis for deciding on the award of FmHA funds is the shares of the FmHA funds awarded as grant and as loan. The relationship of interest is that between the number of connections served and the amount of FmHA fund awarded. If population served were the only criterion for FmHA awards, the number of connections, a proxy for the population served, would not have been a relevant variable because most of the water systems included in the analysis serve less than 5,500 people, the population level for the eligibility for FmHA funds. Number of connections, however, does appear to be relevant. It is positively related to the amount of FmHA loan secured and negatively related to the amount of FmHA grant obtained. These interrelationships can be explained by the FmHA's stated policy of "modified one-percent rule" described in Section II.

The annual income of a community depends on, among other things, the number of households living in that community. And the proportion of FmHA funds a community receives as a loan depends upon, among other things, the annual income of the community. Thus, the larger the number of households, the larger will be the FmHA fund secured in the form of a loan. Assuming number of connections as a proxy for number of households, the larger the number of connections, the larger the proportion of loan and the smaller the proportion of grant in the FmHA fund awarded to water systems. The results of our regression analysis conforms with this expectation based on FmHA's stated policy of the one-percent rule.

The relationship between the type of system ownership changes with the amount of FmHA fund depending on whether the fund is a loan or a grant. This behavior is similar to that for community size. The stated policy of Farmers Home Administration is to give priority to public and private nonprofit systems in awarding funds and the policy does not specify any preference between these two types of ownership. From the results of the regression analyses, the public systems have acquired a larger amount of grants than have the private nonprofit systems. Private nonprofit systems, however, have secured a larger amount. Along with the explicit one percent rule discussed earlier, Farmers Home may also have implicitly used the ownership criteria to decide on the mix of its awards between grants and loans.

The relationship of debt-financing capability, the type of construction activity and the type of system organization indicated that the stated FmHA policies are in agreement with that shown by the results of the analysis. Both grants and loans obtained by system decrease as the debt-

financing capability of the systems increase. In addition, systems undertaking major alteration or organized in a consolidated form do receive higher amounts of loans than those either undergoing original construction or organized in an independent form.

Economic Development Administration

Table 10 reports the interrelationships between the amount of fund obtained by water systems from the Economic Development Administration (EDA) and the independent variables. The stated EDA policies of concern to various system characteristics were summarized or derived in Section II from a review of EDA's financing policies. The analytic information for these same characteristics was obtained from the results of the multiple regression analyses conducted earlier. Results of the analyses reveal how much progress EDA has made toward its stated (or derived) goals.

Table 10. EDA: Stated or Derived Policies of Economic Development Administration and Results of Data Analysis

Characteristic	EDA's Stated Policy	Results of the Analysis	
		EDA Grants	EDA Loans
Funds required	+	+	+
System ownership	1/	2/	3/
Debt-financing capability	-	+	+
No. of connections	-	+	+
Construction activity	-	-	-
System organization	-	-	-

1/ Preference to public and private nonprofit systems.

2/ Preference to public systems over private nonprofit systems.

3/ Preference to private nonprofit over private profit systems, and to private profit systems over public systems.

The stated EDA policy is to award grants or loans up to a certain percentage of the project cost. Because the project cost is the base line, the larger the project cost the larger will be the amount of EDA fund obtained. This stated EDA policy is in agreement with the results of our analysis for EDA grants and loans.

Another stated EDA policy is that private as well as public systems are eligible for EDA funds. Because the primary objective of EDA's financing program is to encourage economic development in depressed regions by attracting industrial and commercial enterprises, it is implicit that EDA may give preference to private over public systems. From the results of our analysis, this is exactly the kind of priority observed. For EDA loan financing, private systems, both profit and nonprofit types, were given preference over the public systems regarding the amount of loan. For EDA grants, private nonprofit systems were again given preference

There were, however, no cases involving EDA grants to private profit systems in the data base. These systems were likely awarded loans instead of grants.

A negative relationship was expected between the amount of EDA funds and debt-financing ability because it is EDA's stated policy to help communities with low income families. Yet, the results of our analyses indicated otherwise. This discrepancy may be due to 1) a lower level of significance (because of t-ratio less than unity) of the coefficient for the debt financing capability variable in our EDA grants equation (Table 3), 2) the limited number of water systems available for the EDA loans equation, or 3) inadequate progress by EDA toward meeting the goal of helping low income communities.

Fourth, regarding the relationship between the amount of EDA fund and the three remaining characteristics, there are no stated EDA policies. Policies were derived, however, on the stated EDA policy to give priority to additional employment generation. Because smaller projects tend to be more labor intensive than larger projects, EDA should show priority for water systems with smaller numbers of connections. In addition, because original construction is likely to be more labor intensive than a major alteration, EDA should show preference for original construction. Finally, because the operation of independent systems tend to be more labor intensive than consolidated systems, EDA should give preference to the independent systems.

The behavior of EDA fund award agrees with expectations derived from EDA's stated policies for type of construction activity and type of system organization, but disagrees for the number of connections. This may be caused by insufficient applications from very small communities, which

may not have the necessary information or the preliminary skills for preparing an application.

Department of Housing and Urban Development

Table 11 presents the interrelationships between the amount of fund secured by water systems from HUD and the independent variables. It also contains the results of regression analysis relevant to the same system characteristics. In the following paragraphs, we will discuss how much progress HUD appears to have already made toward its stated goals.

Table 11. Stated or Derived Policies of the Department of Housing and Urban Development and Results of Data Analysis

	Amount of HUD Fund	
	HUD's Stated Policy	Results of the Analysis
Characteristic		HUD Grants
1. Amount of fund required	+	+
2. Type of system ownership	1/	2/
3. Debt financing capability	-	+
4. Number of connections	-	-
5. Type of construction activity	+	+
6. Type of system organization	+	+

1/ Provides grants to public systems only.

2/ Only one classification available; variable excluded.

The stated HUD policy is to award grants even up to 100 percent of the project cost through its Community Development Program. Because project cost is the base line, the larger the project cost, the larger will be the amount of HUD grant obtained. There might, however, be

small HUD grants for a large project because HUD grants can be matched with other federal grants where those federal financing agencies require that the community contribute a certain minimum percentage of the project cost from other sources. The results of the analysis seem consistent with the general HUD policy.

Another stated HUD policy is to provide grants for communities with low and moderate income persons. It is not clear whether HUD has a family income standard to decide on the eligibility of communities or that the agency operates on a case-by-case basis by giving preference to communities with lower median family incomes. Nevertheless, once a community becomes eligible for a HUD grant, the expectation would be that the lower the level of median family income, the higher will be the amount of the HUD grant. The analysis, however, indicates that among the water systems that have received HUD grants, the higher the debt-financing capability of the systems, the higher the amount of HUD grant.

Because the Small Cities Grants is the group within HUD's Community Development Program that is most likely to award grants to rural water systems, it is expected that as the number of connections--a proxy for population served--increases, the amount of HUD grant will decrease. This is, in fact, what was observed in the analysis. The Small Cities Grants group further states as a goal the correction of deficiencies in public facilities which affect public health or safety. The inference here is that the amount of HUD grant will be larger for major alteration than for original construction. This prior expectation is also in agreement with the analysis.

Finally, because of its emphasis on correcting deficiencies in public health facilities, the HUD policy was expected to encourage consolidation of water systems to improve water quality and to benefit from scale economies at the water treatment phase. The results of the analysis also indicate that the amount of HUD grant awarded was higher for consolidated than for independent systems.

Multistate Regional Commissions

Table 12 presents the interrelationships between the amount of funding obtained by water systems from multistate regional commissions (MRCs) and the independent variables. The signs reflecting stated policies were summarized in Section II from a review of MRCs' financing policies. In some cases, the signs were derived from the financial policy statements because the statements were not explicit.

The relationship between the amount of MRC grant and the amount of fund required led to a prior expectation that the larger the amount of fund required the larger the MRC grant because the base line for deciding the award appears to be the project cost. In addition, MRCs also emphasize supplemental grant programs for matching funds with federal grants. As a result, for cases that involve matching between federal and MRC grants, larger projects may receive small MRC grants as well. The analysis indicates a general trend of large MRC grants for systems with large project costs.

Table 12. MRC: Stated or Derived Policies of Multistate Regional Commissions and Results of Data Analysis

Characteristic	Amount of MRC Fund	
	Stated or Derived Policy	Results of the Analysis
		MRC Grants
Funds required	+	+
System ownership	1/	2/
Debt-financing capability	-	+
No. of connections	+	+
Construction activity	+	+
System organization	+	3/

1/ Public and private nonprofit systems are eligible.
2/ All water systems in the data base are publicly owned; therefore this variable was excluded from the analysis.
3/ Excluded because this variable is a perfect linear combination of other independent variables.

Policies are not explicit in mentioning the relationship between the amount of MRC grant and the remaining variables except for system ownership. Yet, the policies can be derived by relying on MRCs' primary goal of promoting economic growth in underdeveloped regions. If this were the MRCs' primary goal, it would be expected MRCs would encourage larger amount of grants to 1) systems serving a large number of connections within rural areas (i.e., communities with a certain "critical" population level), 2) systems with low debt-financing capability, 3) systems undertaking major alteration to improve water quality, thereby encouraging enterprises to move in, and 4) systems considering consolidation with other systems at a regional level.

The results of the analysis are in agreement with these derived policies regarding the number of connections and the type of construction activity. Contrary to expectations, MRCs have been giving larger grants to water systems with higher debt-financing capability. Finally, no explicit result can be shown regarding the type of system organization because, for the data base used, this variable is a perfect linear combination of other independent variables.

State Agencies

Table 13 presents the sign relationship between the amount of SA grant and the system characteristics, wherever possible. First, it presents signs based on stated policies or on derived policies based on stated goals or policies. Then it presents signs for the same characteristics based on the results of the regression analysis conducted earlier. The purpose of this task is to find out how much state agencies have already been able to accomplish toward their stated goals. However, we may not be able to be specific in our discussions because there is a wide variation among the stated policies of various state programs. We will therefore assume the stated policies to be the ones that are likely to be the ones spelled out in most state programs.

Table 13. SA: MRC: Stated or Derived Policies of State Agencies and Results of Data Analysis

Characteristic	Stated Policy	Results of the Analysis: SA Grants
Funds required	+	+
System ownership	1/	2/
Debt-financing capability	3/	+
No. of connections	-	+
Construction activity	3/	-
System Organization	3/	+

1/ Preference to public systems; some states specify nonprofit systems.
2/ Excluded because of only one private nonprofit system in the data base.
3/ Not explicit in stated policies or goals.

Because the project cost is the basis for the award of grants in most states, the expectation is that the the amount of SA grant will increase as the project cost increases. Several state programs, however, have either an upper ceiling on the amount of grant to be awarded to each system, or both such an upper ceiling and project-cost-proportion-based restrictions. The analysis indicates that, on the average, the amount of SA grant increased as the amount of funds required increased.

The size of water systems was the most explicitly mentioned criterion in most state programs. States appear to give preference to systems that serve small rural communities. This would indicate a negative relationship between the amount of SA grant and the number of connections. The analysis shows, however, that these two variables were positively related, on the average, for water systems in the data base.

The type of ownership is another characteristic explicitly mentioned in state programs. Most states specify that only public systems are eligible. Some, however, mention that nonprofit systems are eligible thereby qualifying both public and private nonprofit systems for their grants. In the data base, only one of the 27 systems was under private nonprofit ownership and was excluded. Little information is available to speculate about policies regarding debt-financing capability, the type of construction activity and the type of system organization. The results of the analysis indicate that water systems with higher debt-financing capability, those undertaking original construction and those that are consolidated organization are more likely to get a higher amount of SA grants.

VII. SUMMARY AND CONCLUSIONS

The initiating hypothesis for this study was that the amount of funding a rural water system can obtain from various government financing agencies depends upon a number of factors concerning the system's characteristics. These characteristics were identified from a review of the financing policies of three federal agencies, one group of multistate regional commissions and another group of state agencies. Multiple regression techniques were employed to test the relationships between the amounts of the grants and loans and the independent variables concerning these characteristics. Detailed data from a national level data base for 800 rural water systems were used. The results of the analyses indicate that the system characteristics influence the amounts of funds obtained. Additionally the analyses were used for finding out how much progress government agencies have made towards their stated policies of relevance to water supply systems.

This study has remedied some omissions in the literature by analyzing the interrelationships among the amount of funding secured by successful water systems from various government agencies and the systems' characteristics. Resource constraints have made it possible to make only a modest effort toward developing such analyses for policy decisions. Further efforts are needed before the results of this study can be used for policy making. First, this study has dealt only with water systems that were successful in obtaining funds, specifically from public sources. A natural next step would be to address the issue of what system characteristics influence the success or failure of obtaining external funds, both public and private, by water systems. The conceptual framework and methodology of this study can be applied to this issue.

Second, this study does not deal with the issue of how goals and policies of each government agency will change in a dynamic situation when goals and policies of other agencies change. This issue can be dealt with in a study based on questionnaire surveys of decisionmakers in relevant agencies. Once these two additional pieces are completed, the current study together with those pieces will allow assessment of the implications on systems with specific characteristics of the government's policy changes such as FmHA loan budget cutbacks, proposed EDA dissolution, or additional block grants to the states.

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