University of Nebraska - Lincoln
DigitalCommons@University of Nebraska - Lincoln

Presentations, Working Papers, and Gray Literature: Agricultural Economics

Agricultural Economics Department

7-16-1997

Defining the Financial Capacity of Rural Communities to Meet Sewer and Water Needs

Ray Supalla
rsupalla1@unl.edu

Saeed Ahmad
University of Nebraska - Lincoln

Follow this and additional works at: http://digitalcommons.unl.edu/ageconworkpap

Part of the Agricultural and Resource Economics Commons

Supalla, Ray and Ahmad, Saeed, "Defining the Financial Capacity of Rural Communities to Meet Sewer and Water Needs" (1997). *Presentations, Working Papers, and Gray Literature: Agricultural Economics.* Paper 41.
http://digitalcommons.unl.edu/ageconworkpap/41

This Article is brought to you for free and open access by the Agricultural Economics Department at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in Presentations, Working Papers, and Gray Literature: Agricultural Economics by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.

Defining the Financial Capacity of Rural Communities to Meet Sewer and Water Needs

by

Raymond J. Supalla and Saeed Ahmad
Department of Agricultural Economics
University of Nebraska
Lincoln, Nebraska 68583

A Selected paper submitted for the annual meeting of the Western American Agricultural Economics Association, Reno, Nevada, July 13-16, 1997

ABSTRACT

The relative ability of rural communities to pay for sewer and water systems was analyzed. It was found that median household income, as currently used for many grant programs, is a poor measure of relative need. An alternative approach using measures of wealth and income distribution was developed.

Historically federal funds have been available to help rural communities meet sewer and water needs. Rural communities have used federal grants to meet the capital cost of sewer and water services and have relied upon continuation of these programs for meeting future facility replacement or expansion needs. As the federal role diminishes, these communities face much higher public service costs and/or reduced services unless the state chooses to provide compensating assistance to rural communities in the wake of the federal withdrawal. One of the critical decisions facing many states is how much to subsidize community sewer and water costs and how to allocate limited funds between communities. Small communities frequently have both high per household costs and low per household incomes, thus creating a potential need for significant state subsidies. States also have a responsibility for insuring that community sewer and water systems meet public health and environmental standards. Hence, efficiency and equity considerations call for a program which insures minimal standards, allows community flexibility in meeting standards at least cost, and provides for an equitable level of assistance.

Federal sewer and water programs for rural communities have been sharply criticized for both efficiency and equity deficiencies. Both political interests and analysts have expressed concern about a one size fits all approach that results in inefficiency. Concerns have also been expressed regarding failure to adequately consider ability to pay and, more recently, there have been intense criticisms of unfunded mandates (Yost, 1994; Reeder, 1990). The one size fits all approach has been especially problematic for rural areas where size and density often makes the typical prescribed urban solutions inefficient,

if not ineffective. In response to these problems, the State of Nebraska has initiated a program called the Mandates Initiative, which is focused on finding more efficient and equitable methods of meeting the needs of rural communities.

The general purpose of this analysis was to develop a conceptual framework for a sewer and water community assistance program that was economically efficient and also equitable between communities and between different levels of government. The involved developing a method for defining the ability of small communities to pay for sewer and water services.

There have been several previous studies which addressed the general issue of community ability to pay (Reeder, 1984, 1990; Fergson and Ladd, 1986). Most of these studies have focused on fiscal capacity, defined as the ability to raise tax revenue, rather than "financial capacity" which is defined here as household ability to pay in the form of either user fees or taxes. In most cases, the emphasis of previous studies has been on income and tax base measures, even though many services such as sewer and water are paid for with user fees. No previous studies considered income distribution as a capacity measure and none considered financial capacity implications when user fees rather than tax revenues were used to pay for services.

General Conceptual Framework

Figure 1. Community Assistance Concept

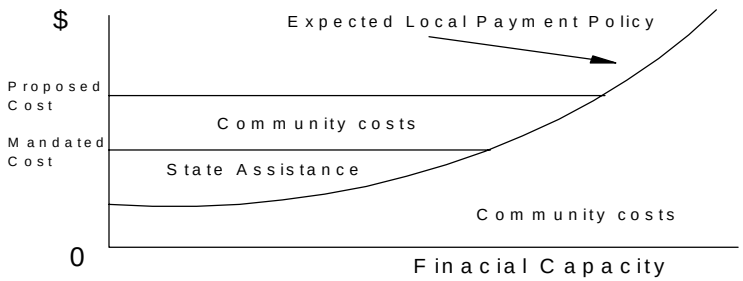
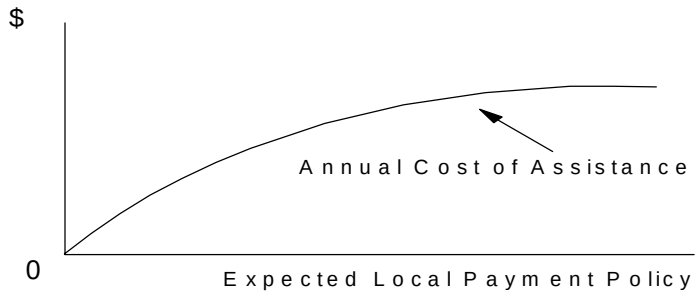


Figure 2. Cost of Assistance



The general conceptual framework for a subsidy program is displayed graphically in Figures 1 and 2. These figures depict the expected local payment (ELP) for a community based upon community financial capacity (FC). Required state assistance is where the dated cost is defined as the minimum cost of meeting sewer and water needs under both federal and state mandated public health requirements. Figure 1 also shows that communities could choose a system that costs more than the minimum, but if they chose to do so they would have to pay all costs above the mandated level, in addition to the costs covered under the expected local payment.

Figure 2 conceptualizes the total annual cost of a state assistance program as a function of mandated cost and the expected local payment policy. The state could choose

to provide no assistance but still mandate relatively high cost systems, or at the other extreme, choose to offer extensive assistance even with relatively low mandated costs. Within the proposed framework alternative measures of financial capacity and the implications of alternative mandated costs can be evaluated. Such evaluations provide a basis for informed political choice regrading community assistance policy.

Definition of Financial Capacity and an Expected Local Payment

The most difficult analytical problem was how to define the financial capacity of a community in a way which reflected equity between communities, was understandable to the public, and could be easily implemented. This dimension of the study was addressed by first identifying alternative measures and then comparing the impact of each measure on a ranking of community need. The general measures considered were: median household income, per capita income, household income distribution, property valuation per household and property taxes levied. A computer model was developed and used to rank communities based on each capacity measure individually and in varying combinations. To facilitate ranking, each capacity measure was defined on a ten point scale where a score of zero was assigned to the lowest capacity value and ten to the highest capacity. This enabled a ranking of communities using multiple measures, with different weights for each measure. In algebraic terms, the ranking process can be described as:

$$S_i = \Sigma W_j M_j$$

where: S_i = score for community I
W_j = weight assigned to measure j, with weights for

all measures, j = 1 to n, summing to 1.0.

M_j = value of measure j, scale 1 to 10.

The ranking model was used to assess the impact of different financial capacity measures on indicated relative community needs. Particular emphasis was given to identifying the differences in ranking associated with different combinations of financial capacity measures. The objective was to develop an index of financial need that was as simple as possible, yet captured any major differences in the relative needs of rural communities.

The results of the ranking analysis, using scores of 1 to 10, showed major differences in rank under the alternative measures of financial capacity (Table 1). Income and property values produced very different rankings when used separately, and weighted household income gave a very different result from median household income. Property taxes influenced the rankings but were rejected as a component of community financial capacity, because there was no way of differentiating between taxes levied for required versus optional services.

The alternative financial capacity measures were also plotted against each other and against population to assess differences between the measures and to provide an equity perspective with respect to community size. Median household income was plotted against property valuation and the results confirm the ranking results (Figure 3). There were many communities with similar income, but much different property values. One of

the more interesting results was the plot of median household income against the percent of households with incomes of less than $10,000 (Figure 4). What this comparison clearly indicates is that the median household income measure does not adequately capture the differences between communities in the number of household which have very limited financial capacity to pay for sewer and water services. Consider, for example, that for communities with a median household income of near $20,000, the percent of households with incomes of less than $10,000 ranged from 5 to 40 percent.

Correlation coefficients between the measures of financial capacity further support the need for using multiple variables to define community financial capacity. The correlation between MHI and real property valuation, for example, is only 0.65 (Table 2). Equally important is the -0.48 correlation between property valuation and percent of

These correlations imply that communities with a high property tax base may still have a significant number of households in poverty, and that high valuations may also have a higher tax rate. Per capita income and per capita property valuation was also plotted and regressed on community population . The results showed a statistically significant but a surprisingly modest relationship between community size and income or property valuation measures, with the smaller communities being only slightly poorer. At all community sizes there was a wide disparity in economic conditions.

Figure 3. Median Household Income Versus Valuation Per Household

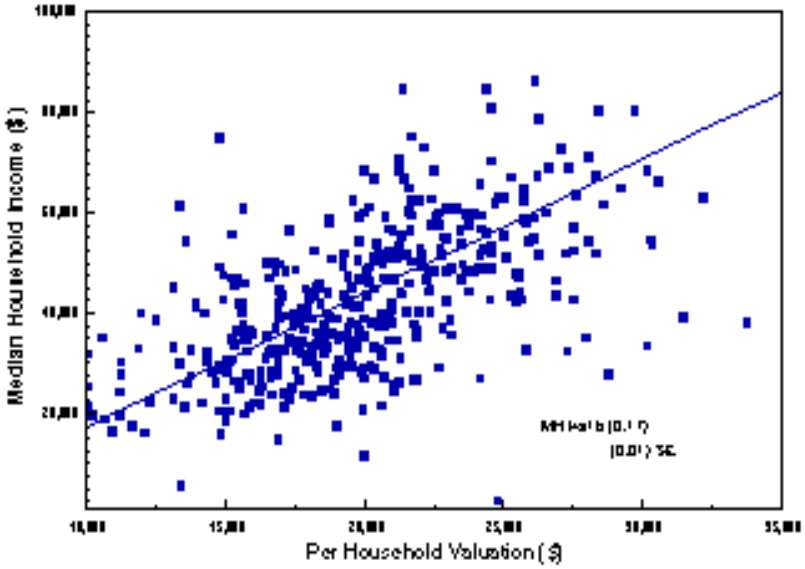


Figure 4. Median Household Income Versus Percent of Households with Income Less than $10,000

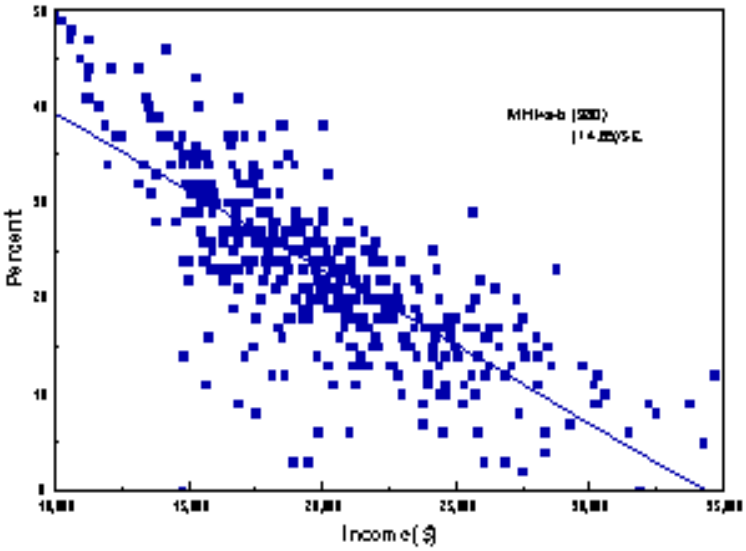


Table 1. Community Comparisons; Using Different Measures of Financial Capacity

	Alda	Burr	Carleton	Garland	Gordon	Nemaha	Primrose	Salem	Trenton
Population	540	75	144	247	1803	188	69	160	656
Median Household Income (MHI)									
Value ($)	21375	13333	13571	30156	18411	21875	15250	10208	13594
Index[a]	6.69	0.75	0.79	9.39	3.89	7.11	1.39	0.19	0.8
Rank[b]	296	25	29	427	171	313	58	7	30
Property Valuation/Household (PV/H)									
Value ($)	84816	61516	54449	33485	44989	26778	55695	19635	25905
Index	9.19	8.87	7.92	3.1	5.99	1.41	8.11	0.76	1.22
Rank	430	389	347	136	260	58	354	14	49
MHI and PV/H Weighted Equally									
Rank	366	222	193	285	230	190	217	5	21
Average Income									
Value ($)	22701	17494	13571	28973	24339	25417	16648	17872	20597
Index	4.22	1.01	2.21	8.54	5.86	6.65	0.98	1.18	2.57
Rank	188	45	100	378	256	295	31	49	118
Financial Capacity									
Value ($)	548	371	370	375	353	285	340	169	232
Index	9.12	6.55	6.52	6.65	6	3.37	5.52	0.57	1.42

Rank	426	281	279	286	264	154	241	11	62

[a]/ Index is the Ş value define d on page 5.

[b]/ Ranked order in communities, from 1 to 439, with 1 being most needy.

Table 2. Correlations Between Different Measures of Financial Capacity:

	MHI	**PVH**	**%HI**	**Population**	**PT**
Median Household Income (MHI)	1.00	0.65	-0.78	0.19	0.21
Property Value, $/Household (PVH)	0.53	1.00	-0.48	0.31	0.34
% of Household with Income <$10,000 (%HI)	0.78	-0.48	1.00	-0.09	-0.11
Population	0.19	0.31	-0.09	1.00	0.31
Property Tax Levy (PT)	0.21	0.34	-0.11	0.31	1.00

The results of the ranking analysis was used by the Mandates Initiative Team to select variables and weights for inclusion in a financial capacity index. A financial capacity index was defined in terms of household income and property valuation, with the income component defined on a distributional basis. The income component was based on the percent of households in each of 10 income classes, rather than on the more conventional median household income. The property valuation term was defined as the average valuation per household. Different weights were assigned to each income class and to property valuation to compute community financial capacity. In algebraic form, the financial capacity index was defined as:

$$\text{Financial Capacity} = \Sigma\, HI_i * PS_i * APP_i + PV * .005$$

where: HI_i = mid point of household income class I
PS_i = share of population in income class I
APP_i = ability to pay percentage for income class I
PV = per household property valuation.

The ability to pay percentages suggested by the Mandates Initiative Team were:

Income Class	**APP**
<5,000	0.0
5,000 to 9,999	0.001
10,000 to 14,999	0.002
15,000 to 19,999	0.003
20,000 to 24,999	0.004
25,000 to 29,999	0.005
30,000 to 34,999	0.006
35,000 to 39,999	0.007
40,000 to 44,999	0.008
45,000 to 50,000	0.009
>50,000	0.010

This approach defines financial capacity based on income and wealth. A city's financial capacity in dollar per household per year is defined as 0.05 percent (½ of one percent) of average household valuation, plus a share of household income that ranges from zero percent for households with income under $5,000 per year to 1.0 percent for incomes $50,000 and higher.

The resulting estimates of financial capacity for 439 communities with population of 5,000 or less ranged from 9 to 110 dollars per month. Twenty-five percent of the communities have a capacity of less than $22 per month and fifty percent have a capacity of less than $26, but the upper quartile of communities has an estimated capacity in excess of $36 per month.

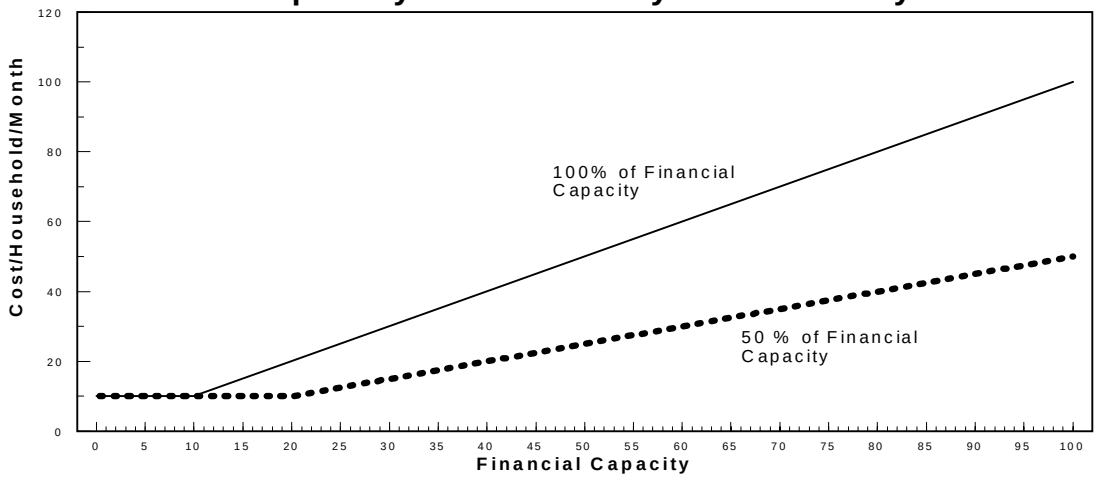
The estimated financial capacity values reflect a weighting of income by class and a weighing between income and wealth. The variables included and the relative weights assigned to each address the issue of equity between communities. Policy makers who believe that this definition unfairly differentiates between the ability to pay of different communities may wish to change the variable or the weights. An equally important dimension, however is the question of equity between state tax payers and between sewer and water rate payers in rural communities. This dimension is most easily addressed by differentiating between financial capacity and the expected local payment (Figure 5).

The expected local payment was defined as financial capacity times a percentage factor to be determined by public policy. Nebraska may choose to subsidy only those costs in excess of 100 percent of financial capacity as defined, or some greater or smaller percentage depending on political judgements regarding both financial capacity (the ability of communities to pay) and the cost to the state (availability of state funds). A major factor in this policy choice is the state cost under alternative payment policies.

State Cost Under Alternative Mandate and Local Payment Policies

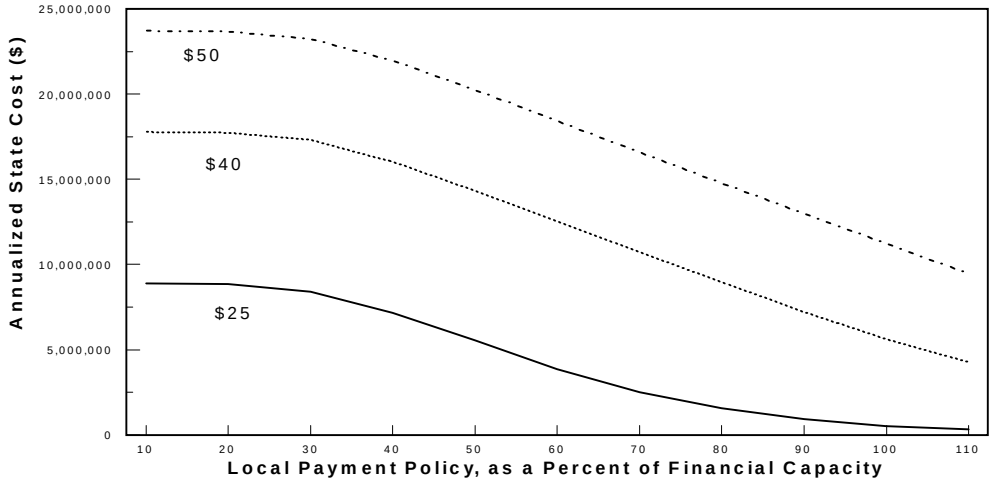
The future cost of sewer and water services for rural communities is very difficult to estimate because of both data problems and uncertainty regarding future public health and environmental policies. Based upon current costs, however, it was estimated that the future cost for sewer and water services would average between 25 and 50 dollars per month, per houseold.

Figure 5. Relationship Between Financial Capacity & Local Payment Policy



The state cost associated with alternative local payment polices was estimated for three different cost assumptions and 10 different local payment levels. The average total cost levels used were $25, $40 and $50 per month per household, and the local payment policies ranged from 110 to 10 percent of estimated financial capacity, with a minimum of $10 per household per month. In calculating the state costs, an average depreciation of 25 years was assumed. The results show modest state costs of about $500,000 per year, when assuming a system cost of $25 and a payment policy of near 100 percent of estimated financial capacity (Figure 6). If actual costs were to average $50, however, annual state costs would rise to $12,000,000 if communities were expected to pay 100 percent of financial capacity and to $20,000,000 if they paid only 50 percent of estimated capacity.

Figure 6. Annualized Cost Under Different Local Payment Policies



Summary and Conclusions

A conceptual framework for a state financial assistance program which meets the needs of rural communities for sewer and water services was developed. The approach meets efficiency objectives by making the level of assistance independent of the cost of service, hence providing no incentive to "over build". Equity objectives were met through the use of a financial capacity index that incorporated income level, income distribution and wealth.

References Cited

Reeder, Richard J., 1984. *Metropolitan Fiscal Indicators: A Review of the Literature*, Economic Research Service, USDA.

Reeder, Richard J., 1990. *Targeting Aid to Distressed Rural Areas*, Economic Research Service, USDA, Washington, D.C.

Fergus on, Ronald E. and H. F. Ladd, 1986. "Measuring the Fiscal Capacity of Us Cities", in *Measuring Fiscal Capacity*, edited by H. Clive Reeves, Oelgeschlager, Gunn & Hain, Boston, Mass.

Yost, Jeffery G., 1996. *Nebraska Mandate Initiative*, Governor's Office, Lincoln, Nebraska.