MEASUREMENT OF THE COST OF LIVING INCLUDING THE PUBLIC SECTOR

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Since 1948 the CPI, Consumer Price Index, has become a less satisfactory indicator of cost of living, COL, as it relates to a limited and declining fraction of government product. This paper analyses the problems in constructing a COL index that makes adequate allowance for changes in the quality and relative importance of government services in the consumer's consumption patterns. A proposal for attitudinal measures of COL is developed. In addition a strategy for using existing expenditure and government data is presented.

1. INTRODUCTION

Government activity constitutes a large and universally acknowledged fraction of the total national product. Accounting for government in a measure of the consumer's cost of living (COL) is clearly essential to understanding the changing welfare of individuals in the economy. Yet, at the present time, neither an official COL indicator for private commodities, nor a system for developing the COL index for public and private goods together exists.

By default the consumer price index (CPI) is used as a measure of the change in real purchasing power of the consumer. Increasing reliance is placed on the CPI to guide macro-policy, to escalate wages in labor contracts, and to compute subsistence standards used in income maintenance payments. Reliance on the CPI has increased despite a secular increase in the role of government in the national product and enormous qualitative shifts in the quality and mix of government services.

I would guess that the change in the consumer price index since 1948 overstates decreases in consumer welfare. I assume (and these assumptions are debatable) that increasing income has caused substitution in favor of government services so that price indices of private products relate to a smaller share of total consumption. I also assume that the quality of government goods has increased substantially so that changes in the cost of inputs included in consumer price indices do not reflect changes in the unit costs of goods enjoyed.

It is because such guesses cannot be challenged by existing studies that economists need to concern themselves with the measurement of the cost of living including the public sector. This paper provides a conceptual framework for addressing the measurement of COL including government and offers a judgement on an appropriate strategy for research in this field. In the process the relevant literature is reviewed. No computations are offered as a solution to the measurement problem; that must be tackled in future work.

We have made little progress in developing price indices for public services since the global scrutiny that was given the problem by the Stigler Commission

(1961). At the same time the field of public finance has advanced its understanding of the theory of public goods, particularly local public goods. I believe it is now possible to point towards a number of lines for research on the prices of public goods that will lead to useful indices of consumer welfare.

To assess the problems that beset the development of indices of the price of public services I shall begin with a review of a number of issues that must be dealt with in any measurement effort. The basic concern of this paper is to discuss the means for assessing the welfare of the consumer. Historically, we have used price indices as a tool to that end—if the bundle of goods consumed last year costs less at today's prices, we surmise that the consumer is better off. The paradoxes created by weighting indexes of prices by different fixed commodity bundles lead to the more natural concept of a cost of living index (Christensen and Manser, 1973). The cost of living is the dollar cost of maintaining a fixed level of utility. Over time the consumer may substitute one commodity for another as relative prices change. The cost of living is invariant to such shifts; the cost of living concept will be the primary frame of reference for the discussion in this paper.

Superficially it would appear that the cost of living framework extends in a logical fashion to the case in which the consumer bundle of goods includes both public goods and goods sold on the private marketplace. In the fourth section of this paper we undertake to explain in what sense such an extension is valid. First we must deal with a variety of ancillary questions that caused me a good deal of confusion, and that have not been discussed in an integrated fashion in connection with the problems of developing indices of consumer welfare.

2. CONCEPTUAL ISSUES IN THE MEASUREMENT OF CONSUMER PRICES IN THE PUBLIC SECTOR

Units of Public Goods and Services

Unfortunately the quantity of public goods and services is not always explicitly defined. While the output of postal services can easily be measured in units comparable to private industry (number of letters delivered, total letter-miles of services produced), the units of output in other areas—e.g. education, health, and police services—have not been completely specified and widely recognized.

Ancillary to measurement of COL including government, units of output must be conceptualized and quantities of output measured.

Quality Change

A second issue in the computation of a cost of living index that spans both public and private goods is change in the quality of the good or service delivered (Griliches, 1971). Over the period since World War II we have seen significant changes in a variety of public services that must be regarded as a shift in the quality of service rendered:

1. In national affairs the space program appears as a new commodity in the mix of the government product.

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2. In transportation the development of the freeway network represents a shift in the quality of transportation, due to its limited access, high-speed design characteristics. (The same change in design appears to be associated with a downwards shift in the risk of traffic fatalities for each vehicle-mile).

3. We have also seen changes in the quality of the environment, both negative and positive. Solid waste disposal standards adopted beginning in 1968 imply that trash and garbage are being subjected to less polluting disposal. On the other hand, increasing use of outdoor recreation facilities has implied increased congestion, queues, and environmental degradation in public parks and recreation areas (CF. U.S. Council of Environmental Quality, 1972.)

Each of these examples points to the fact that a quality dimension is an extremely significant part of the public sector output. More miles of road, days of school children taught, or letters delivered are not valued in the same fashion by the consumer as decreases in road congestion, increases in achievement scores of high school graduates, or reductions in the elapsed time for the delivery of mail.

The implication of changes in the quality of public services is that a study of the cost of living including government must be careful to include measures of the quality of government output as well as the quantity in the measurement of the utility function. (Perhaps the only area where some serious efforts along these lines are being made is in the field of medical care.) Where explicit measurement of quality can not be included in the measurement process, we must be clear that statistics which treat the government services of 1974 equivalent to service of 1948 or 1929 are based on some reasonable evidence.

Fortunately, a number of investigations in a variety of areas offer suggestions on how the quality of public services can be assessed. Continuing studies in the field of transportation have lead to a precise theory concerning the relationship between congestion and the utility of consumption of transport services to the public (Mohring, 1972). Such work can be extended to the public's use of other public facilities. A second type of investigation has investigated the quality of interaction between public agencies and their clientele (Handler and Hollingsworth, 1971). Other studies have made a beginning on the cost of compliance with the law to the individual consumer (Willis, 1969).

Several recent studies have treated the quality of government services as a joint product achieved by distributing a level of government service expenditure over a population (Inman, 1971; Borcherding and Deacon, 1972; and Bergstrom and Goodman, 1973). That is, the following assumptions are made:

(a) Government services are subject to congestion as more persons are served.

(b) Increasing expenditure can offset congestion so that

$$E = qN^{-\alpha}$$

where E denotes expenditures for government services, q is the quality of the service enjoyed and N is the population served.[1] $0 \leq \alpha \leq 1$. ($\alpha = 0$ is the pure

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[1] Alternatively q may be interpreted as a quantity; however, that interpretation implies that *production* of services is less efficient as population served rises. This appears less plausible than the interpretation in the text.

public good; $\alpha = 1$ is the pure private good, distributed in an egalitarian fashion.) This solution to the problem effectively assumes it away, and will be adequate for only a limited number of public services that have substitutes in the private market or can be rationed by some, albeit expensive, price mechanism.

The Production Function for Public Outputs

This last point naturally leads to the question of how public goods are produced. On close examination we find that many public services are in fact intermediate goods that must be combined with inputs from the household before a valued output is created. The road is worthless in the absence of consumer investment in automobiles. In pricing the cost of living including government then, we must be careful to treat intermediate goods as such. We wish to price the cost of living that at one time may include access to work on an interurban (with capital supplied by a regulated monopoly) and at another will include a substantial consumer investment in cars alongside public investment in roadways.

The Price of Public Goods

Having come this far, and having decided that we must measure the units of output of public services received by a consumer, the quality of those services, and the degree to which consumer goods are an intermediate product input into the production of government outputs, we are now in a position to examine the concept of "cost" or "price" to the consumer for public output.

Some services of governments are priced. However, charges collected by government are seldom a user fee that corresponds to the market price for privately produced commodities. The price of services, such as water supply, may reflect the full cost to the municipality of providing the service, but such prices fail to include the subsidy that arises from Federal tax exemption of interest on municipal bonds or the subsidy that the municipal government obtains from exemption from the local property tax. Pricing of roads and bridges, in particular, has been faulted for failing to include the true social cost of congestion. Lastly, few if any government enterprises include a "normal" rate of return on their capital stock.

Explicit prices set by government will not reflect the cost of the majority of public goods received by the consumer. Even for municipalities, who rely on fees and charges for a larger portion of their finances than higher level governments, the ratio of charges to taxes is about one-fifth (Mushkin, 1972, Table 1.5).

Lacking an indication of price in the fees charged by government, we must construct a substitute. Let us call the substitute a cost of output measure. Considerable progress is being made in this area. Cost functions have been derived for a number of local government services (Morris, 1973; Rieuw, 1972; Hirsch, 1973, Hirsch, 1972). Unfortunately, most of the studies to date have dealt with cross-sections that give some perspective on the differences in cost of production in different geographical areas with little control for the differences in quality of services. Geographical differences in cost do not reflect movement along a production function in a particular locality. Moreover it is clear that in some services,

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economies of scale exist over a limited range of provision, so that the niceties of production under constant returns to scale do not generally apply.[2]

Another difficulty compounds the problem of scale economies. The production of government services takes place in a variety of market areas. School districts have one local market area, sewage treatment services another, while some services, such as hospitals may lack a clearly defined market area or clientele. If the production function is, in fact, not homothetic, dealing with aggregates of input costs over several districts, or the smallest commensurable unit, will result in assigning the wrong weights to districts that operate in a range of decreasing costs relative to those that are constant cost. I feel this is a serious problem.

Even after the problems besetting the measurement of cost of government services have been resolved, a measure of the cost of living including government is still not defined. Government services are not equally consumed by all segments of the population, nor are they equally financed by all segments of the population. The problems involved in evaluating the benefits and costs of public service are familiar to each of us who has dabbled in studies of the incidence of government. (A careful review of the issues, and discussion of the problems of valuing redistributional expenditures appears in Neenan, *et al.*, (1974), assessing the net benefit of the fisc.)

Incidence of the Public Fisc and its Relation to the Pricing of Public Services

At this point in time there are two threads to the literature in public finance concerning incidence: the voluntary exchange (Lindahl) theory of fiscal equilibrium and the median voter theory of equilibrium. In the voluntary exchange theory voters (or their representatives) are assumed to bargain in the trading of votes until a Pareto-optimal solution is reached. The solution is characterized by two conditions: (1) tax shares of the cost of government are allocated to individuals in accord with their marginal valuation of government product; and (2) the marginal social benefit of government summed over all individuals is exactly equal to the cost of private goods foregone at the margin (Foley, 1970). This model fails to capture reality for several reasons. Sizeable transactions costs in achieving a bargain have not yet been incorporated into the theory. Impure public goods (subject to congestion) imply that a coalition of voters may achieve an increase in their own utility by threat of withdrawal from the group. When effective, the threat leaves the remaining voters in disequilibrium and the Pareto optimal solution does not lie in core (Ellickson, 1973).

The theory of the median voter is less demanding than the theory of Lindahl equilibrium. It gives us less information and has its own limitations. Certain types of strategic behavior (side-payments and vote trading) can not be admitted. The theory assumes that voter preferences on expenditure issues can be monotonically ranked in relation to income (see Bergstrom and Goodman, 1973).

If we accept the assumptions of the Lindahl equilibrium, then the price of public goods to each citizen voter is the product of his tax share and the marginal

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[2] Providing that the production function is linear and homogeneous, however, a fixed weight index exists that relates the cost of the factor inputs to the cost of the service being rendered. This is the basis on which Bergstrom and Goodman, 1973, obtain their estimates of cost of government services.

cost of production of the public service. Furthermore, the citizen-voter is in equilibrium, so that observations on all individuals can be used to arrive at estimates of a utility function. If we accept the assumptions underlying the theory of the median voter, we admit a broader scope for the public sector but we must accept that only the median voter on a particular issue is in equilibrium. In that case only the commodity bundle consumed by the median voter is relevant for the estimation of a utility function. The price of public services is the tax share of the median voter times the cost of production of the unit of the public good. Henceforth, I use the term *tax price* of public services to refer to this product.

The usefulness of the theory of the median voter will be discussed further in the fourth section of the paper. For the moment, the argument can be summarized by stating that some assumptions can be made that lead to clear conclusions about (i) the tax price of public services to individual consumers and (ii) the suitability of information from consumers as a basis for estimating a utility function.

Jurisdiction

One additional issue must be raised before we can proceed to a discussion of estimating public prices. Public goods and services are delivered by a Federal system that admits substantial variation in the quality and quantity of local public services delivered in any particular geographic location. Heterogeneity of service levels in an area, and indeed heterogeneity of service over the whole country, create a situation in which consumer equilibrium is established jointly by a decision to locate in one of several political jurisdictions and the purchase of a bundle of consumption goods. The nature of this political and economic equilibrium was best described by Ellickson, 1971. It is not clear that an equilibrium can be reached when redistributional functions are mandated to local levels of government (Rothenberg, 1970 and Bradford and Kelegian, 1973).

The implication of these ideas is that a cost of living index must adequately deal with changes in the cost of migration including deadweight loss from the sale of housing in less attractive areas, the unemployment associated with relocation, and the cost of acquiring information about public services in alternative jurisdictions. A COL index for families with fixed places of residence will be inadequate.

Secondly, the existence of variation in service levels across jurisdictions, variation in the cost of producing public services in different jurisdictions, and variations in the tax share of the median voter in different jurisdictions imply that an index of tax prices must either be disaggregated over jurisdictions, or must pool data over jurisdictions that may be regarded as similar with respect to local conditions of the public sector.

This second point parallels the concern expressed by Reid that the national CPI can not relate to a meaningful concept of consumer welfare, when regional variation in the cost of housing and food implies moderate and changing geographical differentials in the price indices for different areas.

Summary

This review of issues lays out the problems that must be solved if measurement of COL including government is to proceed successfully. Units of public output

must be conceptualized and quantities of output must be measured. Quality change must be adequately researched; production functions must be estimated to arrive at meaningful cost functions; the consonance between public choice and consumer equilibrium must be made clear; and the role of jurisdiction in providing heterogeneous prices for heterogeneous bundles of public goods must be clarified.

Before proceeding to discuss the steps that must be taken to implement COL indices, it seems appropriate to demonstrate that the CPI is not an adequate proxy for a cost of living indicator including government services.

3. ADEQUACY OF THE CPI FOR MEASURING THE PRICE OF GOVERNMENT SERVICES

Current Treatment

Though each of us is familiar with the methodology of the CPI, it may be useful to review the treatment of the government sector in that price index, to remind us of the problems that others have long since recognized.[3] First, the CPI makes no explicit provision for the output of government, unless it is sold (as in the case of services of municipal utilities).

Secondly, goods purchased on the market are priced *at market prices* including indirect (sales, customs, and excise) taxes. The portion of taxes inducing market price changes will be reflected in the price index.

Thirdly, the index omits taxes that are levied on individual income, transfers of wealth, and the unshifted portions of the corporate income, payroll, and business property taxes.

This treatment has been discussed and criticized by Kessel and Hansen. Kessel (1961), in his staff paper to the Stigler Commission, pointed out that the principal use of the Consumer Price Index is to measure a level of well-being for the consumer by permitting the computation of real wages. He then went on to indicate that the index is asymmetric in its treatment of taxes. Wages are measured at factor prices; goods are measured at market prices, including indirect taxes. A change in the structure of taxation induces a change in the measure of the real wage. As indirect taxes rise, the CPI measure increases while money wages and government activity may remain constant. The resulting apparent fall in real wages does not reflect a true change in the cost of living (although the shift of direct into indirect taxes may imply marked changes in the distribution of welfare for some individuals in the society).

Hansen (1958) also comments on this peculiarity as he attempts to answer the question: Should the price indicator used for stabilization purposes include or exclude taxes? Apart from the cosmetic problem that the stabilizing taxes are reflected in the index being monitored for stability, Hansen concludes that full inclusion of both direct and indirect taxes is less arbitrary than partial inclusion and perhaps superior to the complete ommission of the government sector from a consumer price index.

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[3] The standard references on CPI methodology are U.S. Department Labor (1971), Stigler (1961), and U.S. Bureau of the Census (1968).

The merit of Hansen and Kessel's observations is clear when one examines the recent history of the government sector in the U.S. Six relevant points may be made:

1. The share of government in the national product has increased markedly. (Expenditures for goods and services rose from 13.0 percent of NNP in 1948 to 24.2 percent in 1972).
2. The share of the state and local governments in exhaustive spending by government has also increased, from 47.7 percent in 1948 to 59.0 percent in 1972.
3. Transfer payments by the government also increased markedly.
4. The social insurance component of those transfers was financed by large increases in payroll taxes that reduce the share of income taxes. Payroll taxes increased from 10.4 percent of Federal budgetary receipts in 1948 to 27.6 percent in 1972.
5. At the State and Local level, adoptions of income taxes have sharply increased the reliance of those governments on direct tax sources. In 1948 4.1 percent of State and Local revenues were derived from individual income taxes; in 1971 12.5 percent came from that source.
6. Lastly, Federal government transfers to State and Local levels of government have increased rapidly, so that a smaller fraction of State and Local government product is financed by locally raised revenue.[4] In 1948 such grants were 11.3 percent of receipts; in 1971 grants-in-aid were 26.5 percent.

What do these changes imply for the utility of the CPI calculation?

1. Increasing the relative scope of government implies that the proportion of goods and services consumed by the household explicitly treated by the CPI has fallen. Pricing is directly germane to a smaller and smaller proportion of the consumer's real goods and services consumed. We need to ask if this is a desirable situation.

2. The increase in the State and Local share of expenditures for government product implies that the heterogeneity of service levels and qualities becomes a more serious question for index number construction.

3. The increase in transfer payments to individuals raises the interesting question— should a real benefit of transfers be ascribed to the high-income voters who altruistically yield factor income to alleviate poverty (Hochman and Rodgers, 1970, Smolensky, *et al*. 1974).

4. The increased role of payroll taxes in the Federal government sector increases the degree to which market pricing reflects the cost of that sector to the extent that such taxes are shifted forward to the consumer. That effect is offset by expansion of the Federal sector and associated income taxes so that conclusions concerning impact on real wage measurement depend on empirical values and cannot be determined *a priori*.

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[4] The corollary is that the local cost of expanding State and local Government output has fallen, because of matching grants. At the same time the tax price to the citizen-voter is less as the proportion of taxpayers itemizing property tax deductions has increased.

5. The increased reliance by state and local governments on income taxation unambiguously reduces the extent to which cost of that government product is reflected in the CPI.

6. The increase in Federal aid to state and local governments implies an unambiguous decrease in the extent to which local government services are priced in connection with the CPI, although the effect for the aggregate of all government services will depend, as is suggested by point 4 above, on the change in the proportion of the Federal sector that is priced in connection with CPI.

Table 1 reflects the combined effects on these various trends on the degree to which the market price assumptions of the CPI implicitly reflect changes in the cost of government.

TABLE 1

INCLUSION OF THE GOVERNMENT SECTOR IN THE CPI

Sector and Year	Ratio of Excise, Customs, Social Insurance Contributions and Corporate Tax Accruals to Total Receipts	Ratio of Excise and Customs to Total Receipts	Ratio of Excise and Customs to Purchases of Goods and Services
Federal Government			
1929	0.660	0.306	0.922
1934	0.821	0.605	0.718
1939	0.794	0.323	0.425
1944	0.405	0.137	0.063
1949	0.583	0.204	0.395
1954	0.544	0.151	0.203
1959	0.554	0.139	0.232
1964	0.574	0.136	0.241
1969	0.516	0.092	0.184
1972	0.524	0.083	0.182

	Ratio of Receipts Less Personal Income and Estate Taxes to Total Receipts	Ratio of Receipts Less Personal and Corporate Income Taxes and Estate Taxes to Total Receipts
State and Local Governments		
1929	0.959	0.939
1934	0.973	0.958
1939	0.962	0.943
1944	0.950	0.903
1949	0.945	0.908
1954	0.943	0.911
1959	0.931	0.897
1964	0.914	0.880
1969	0.880	0.843
1972	0.853	0.815

As there is probably no consensus on the best way to estimate implicit coverage of government by the CPI, several comparisons are included in the Table. Price effects of government finance are most completely represented in the CPI

if all corporate income tax levies and employment taxes are shifted forward to consumers. Thus indirect taxes, payroll taxes and corporate income levies must be added to measure the proportion of tax receipts represented in the CPI for both Federal and State and Local levels of government. The second column of the table illustrates the proportion of the government sector that is included in the CPI when no payroll or corporate tax shifting is assumed.

The post-war decline in the fraction of Federal revenues represented in the CPI immediately raises the question "Is total receipts a proper magnitude to compare with included revenues?" The historical growth in Federal transfer payments to individuals suggests that total receipts is perhaps an excessively large measure to use for a divisor.[5]

The third column of the table relates Federal excise and customs revenues to Federal purchases of goods and services. That comparison provides a measure of the extent to which expenditures on the national product are reflected in the CPI. This measure also indicates that taxes included in the CPI decline in relation to direct expenditures of the Federal Government.[6] The lower rank of Table 1 shows calculations comparable to those for the Federal government sector for the State and local government sector. By any of the measures in Table 1 the CPI implicitly reflects a decreasing proportion of the total cost of government desired by the citizen voter over the period 1929–1972. Direct taxes clearly finance a larger fraction of Federal expenditures so that the market price convention mirrors a smaller portion of Federal government activity than State and local activity. In both cases, the market price serves as an indicator of government cost only to the extent that full forward shifting of indirect taxes, payroll taxes, and property taxes occurs.

Using the CPI as a proxy for a COL index including government suffers from another difficulty: namely, so long as public output is not measured one cannot determine whether increasing expenditures for public goods represent rising costs for fixed levels of service, constant costs for increasing levels of service, or increased costs associated with quality change in the goods being delivered.

The importance of this latter point is made clear in the indices of government performance recently released by the Inter-agency Task Force on Measuring Federal Government Productivity (1973). The Task Force has made detailed analyses of the resources required to produce a variety of intermediate outputs within the Federal government. (Vouchers processed, number of checks issued, and similar measures of work activity were taken as the measures of intermediate government product.) The index of wage expenditure rose rapidly. This is the expenditure magnitude implicitly included in the CPI. Over the six-year period of measurement wage expenditures rose to 158 percent of their base period value. However, output also rose, to 113 percent of its base period value. Hence the

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[5] Recent theoretical speculation on the optimal level of redistribution contests such a view. Hochman and Rodgers (1970) argue that the level of Federal transfer payments is a component of the vector of public goods and services that ought to be concluded in the utility function.

[6] A comparable computation for state and local governments is not shown, as inter-governmental transfers financed by direct Federal taxes must show that the proportion of tax burden measured by the CPI has declined even more rapidly in relation to outlays of lesser governments.

appropriate index of cost of output rose to only 140 percent of the base period value.[7] See Table 2.

TABLE 2

EXPENDITURE VERSUS COST OF OUTPUT—FEDERAL GOVERNMENT PRODUCTIVITY SAMPLE

Fiscal Year	Wage Expenditure	Wage/ Man-Year	Output	Current Dollar Unit Labor Cost
1967	100.0	100.0	100.0	100.0
1968	108.3	104.3	105.1	103.1
1969	118.1	111.9	107.9	109.5
1970	132.0	125.2	110.9	119.0
1971	147.1	140.1	112.3	130.9
1972	157.9	152.1	112.8	140.0

Source Inter-Agency Task Force (1973), 65

4. MEASURING THE COST OF LIVING, INCLUSIVE OF PUBLIC GOODS AND SERVICES

The steps that must be taken to produce a COL index that includes public goods and services are outlined in this section. The likelihood of success in such an undertaking is evaluated. A strategy for research emerges from the discussion.

The principal problem in constructing a COL index is to estimate the parameters of the consumer's utility function. According to the theory of revealed preference such estimates can be derived from observations on consumers who are in equilibrium. Unfortunately most citizen-voters are in disequilibrium with respect to the quantity of public goods provided, unless the voting mechanism approximates the voluntary exchange mechanism of Lindahl. If not, it is only the median voter who is in equilibrium with respect to both public and private consumption.

Consider the community of citizens with private consumption c and government consumption x. The utility to the median voter of any combination is $U(c, x)$. In the theory of the median voter, the citizen who casts the swing vote on a quantitative issue of budget determination is in a position to determine the level of x and the tax price t_m that he pays for public services. Bargaining among voters assures that the ratio of private good price to the tax price on the median voter equals his marginal rate of substitution. The median voter can be regarded as a maximizing consumer who is in equilibrium in all markets. (Ellickson, 1970).

As a consequence of his role in determining the size of the government sector, the median voter is also free to vary the structure of taxation in any way that he wishes. However, the voting power of the community implies that he cannot reduce his share of taxation without also reducing the size of the government sector and conversely. Therefore it is appropriate to write the budget constraint of the median voter as:

$$Y_m = p_f c + t_m x$$

[7] These calculations assume a labor theory of value in which the capital cost of output moves in proportion to direct labor costs.

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where the prices of consumer goods are measured at factor costs p_f. Y_m is the sum of income and net dissaving of the median voter; t_m is the "tax price" of public consumption.

To estimate the utility function we require data on t_m, p_f, and the share of the budget of the median voter that is expended on each public and private commodity. That is, we require $p_f c / Y_m$ and $t_m x / Y_m$. Over time the same individual is not necessarily the median voter, but this causes no problems if the utility function is identical for all citizen-voters in the community. At any instant of time only one citizen-voter is the median voter with respect to Federal decisions. To identify the parameters of a utility function that includes the Federal sector, time series data are obviously required. The budget shares cannot be derived from aggregates, as we are interested in the expenditures shares of the median individual. (While it may be possible to approximate the truth by assuming that the median voter is the consumer with median income, skewness in the distribution of expenditures makes it impossible to assume that the median equals the mean in expenditures.)

I conclude that for the immediate future research effort on the Federal sector had best be directed towards measures of the cost of government, p_x, in a framework that is not linked to cost of living indicators.

For the State and local sector a much brighter picture emerges. Cross-section data, such as the Survey of Consumer Expenditures (CES), give budget share information for a number of median voters in different jurisdictions.[8] (Such data are observations on particular households living in particular jurisdictions.) At the municipal level there are a sufficient number of independent choices of the level of government output, that we can estimate the utility function from a single cross section. For state governments several cross-sections can be pooled to give the requisite data. The micro-data in the CES will give information on private budget shares, while regularly collected Census of Government information gives local public expenditure information. The missing data are the tax shares t_m / p_x, and p_x the cost of producing government output. The former must be evaluated by incidence analysis; the latter, by studies of government cost functions.

Incidence analysis requires both the measurement of direct and indirect taxes paid and an estimate of the effect of shifting of business taxes and payroll taxes on the median voter. While the former are already partly included in the data bases collected for obtaining the quantity weights of the CPI, the estimates of shifting are not directly measurable, and are not derivable from a set of assumptions that will be easily agreed upon by the economics profession. Nonetheless, a number of efforts to measure incidence of tax burdens indicates that some ad hoc principles can be used to solve the problem (Tax Foundation, 1966; Musgrave, 1951; Pechman and Okner, 1974; and Reynolds and Smolensky, 1974).

The measure of public output is clearly a far more difficult problem. However, there appear to be numerous areas where proxies for output can be generated. The value of time and its relation to the value of transport services has been well explored (Mohring, 1972 and Walters, 1968). The valuation of user-days at

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[8] The median voter can be identified directly by studying attitudes towards expenditure and tax measures (Mueller, 1963). However the assumption that the median voter is the individual with median income (Bergstrom and Goodman, 1973) is probably not too far from the truth.

recreational sites has been repeatedly attempted (Clawson and Knetsch, 1966; see also Cicchetti, 1971 for a "pure" application of this technique).

In other cases one may argue that the public output is not directly measurable, but that externalities are inverse functions of the level of public provision. Thus the accident and death rates per vehicle mile travelled constitute an inverse measure of the output of public services from highway transport. The expected value of fire damage and theft constitute measures of the inverse of the value of public emergency services.

It would appear that a moderate research effort could reveal the utility function for local government services. Bergstrom and Goodman (1973) have already done some work on the tax shares, but have not set their estimates of demand functions in a framework in which elasticities of substitution between public and private goods can be estimated (Christensen, Jorgenson, and Lau, 1973). This is vital for the purpose that we have in mind.

A second conceptual problem is created by the fact that we have ignored the quality of public outputs. I feel that failure to recognize quality explicitly in the utility function and in the measurement of costs of production will be extremely misleading. What is required is to estimate a production surface in which quality and intensity of public output are jointly related to the inputs of labor and capital.[9] If, as most students of the public sector assume, government activity is a superior good, then it is clear that an incentive exists to substitute additional quality for quantity as income rises. Recent work on the estimation of production functions with joint outputs, by Hasenkamp (1973) gives us methodology to handle the problem. What is lacking in general are the data.

To summarize, some immediate progress on the estimation of utility functions appears possible for the lesser governments in our Federal system. The first priority for research is definition of units of output and systematic work on government cost functions. A second priority is to determine the tax shares of median voters. Maintenance of a cost of living index will require annual updating of these variables and measurement of the private expenditure shares of the median voters through a vehicle such as the present Consumer Expenditure Survey.

I am less sanguine about progress at the Federal level, or progress on the estimation of joint quality-quantity production functions, as we have so little data in these areas. An alternative approach to measuring the welfare impact of the public sector will be discussed in the remainder of the paper.

5. A Direct Measure of Cost of Living Including Government

Construction of Measures of Cost of Living From Surveys

An alternative to pricing the public sector in the manner described above, is to develop a direct measure of satisfaction with government and deduce changes in the cost of a fixed level of living from that index.

In principle we are interested in measuring the change in the money value of the budget constraint of individuals who (a) are in equilibrium at two points in

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[9] Bergstrom–Goodman and Borcherding–Deacon finesse the problem by (a) assuming a fixed coefficients production function relating quality to public output and (b) deleting quantity variables from the utility function.

time and who (b) report no change in the satisfaction derived from their level of living. I would like to explore how this idea can be applied to measure welfare associated with the public sector.

In his quarterly surveys Katona has used several simple questions to define changes in personal financial situations. Similar questions can be used to determine whether a given household is generally better or worse off than a year ago. Those who report no change satisfy (b) above. This group can then be asked to scale their opinions on the government sector. Using questions similar to those developed by Mueller (1963) it is possible to rank individuals according to their willingness to pay additional taxes to support additional services.[10] Conversely it is possible to determine the strength of desires to reduce services in order to cut taxes. The individuals who rank themselves as unwilling to extend or reduce the government sector are in equilibrium with respect to government; they satisfy condition (a) above. The target group, who are in equilibrium in personal economic dimensions and in equilibrium with respect to the scope of government, is displayed in Figure 1.
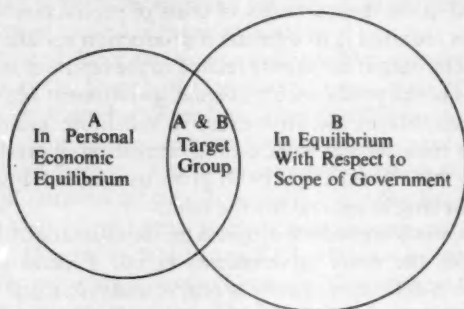

Figure 1

In the target group income can be measured for the current year and the prior year. I will define the *direct cost of living* as the median ratio of income in the current and prior years for the target group. (If it is preferred, savings can be excluded from the ratio, by measuring consumption and taxes paid, but the measurement or those quantities is more difficult and less reliable than income.)

The direct cost of living can be measured annually. The ratios obtained over a period of time can be linked to a fixed base to give an index of the cost of living including government.

Feasibility

Is a direct measure of cost of living feasible? I believe it is. The problems that will develop fall into four categories: sampling, development of scales, extraction of an equilibrium group, and measurement of the consumer budget constraint (i.e., income). The first and last problems are thoroughly discussed in the literature on

[10] A more recent measurement, unfortunately, neglected to test opinions on spending against willingness to raise taxes. See Katona et al. (1970). The most recent findings (Curtin and Cowan, 1975) include 1973 data comparable to the 1961 Mueller data.

household survey data and need not occupy us here (Bureau of Census, 1968 and Lansing and Morgan, 1971).

Development of a scale for defining personal economic equilibrium does not appear to be a major obstacle. It is true that the development of a scale entails measuring an attitude, a state of mind of consumers, in a replicable and reliable fashion. A quarter of a century of experience in this area gives us some idea of the feasibility of attitude measurement, in a variety of dimensions that relate to the problem before us today. The most pertinent measurements are included in the *Index of Consumer Sentiment*, that has regularly been measured by the University of Michigan Survey Research into a component that pertains to personal financial dimensions, that are of interest to us here, and more general perceptions of business conditions.

The Gallup organization reports another type of attitudinal measurement that bears on the cost of living problem. Since 1946 samples of U.S. adults have been asked "What is the smallest amount of money a family of four needs (weekly) to get along in this community?" Table 3 indicates the mean of those reports, historically and by community size. The reports have face validity, reflecting both an increase in perceptions of need greater than the corresponding changes in the CPI and a differentiation between the costs for urban dwellers and more rural areas (Rainwater, 1973).

TABLE 3

GALLUP "GET ALONG" WEEKLY AVERAGES BY COMMUNITY SIZE

	Farm and Rural	Up to 49,999[1]	50,000 to 499,999[2]	500,000 to 999,999[3]	1,000,000 and above[4]	CPI
	$	$	$	$	$	
January 1946	35.27	42.13	45.34	52.61		58.5
August–December 1947	36.66	45.88	48.83	53.74		66.9
June 1948	43.29	50.84	54.83	61.31		72.1
May 1949	38.65	49.24	52.81	59.32		71.4
February 1950	40.42	52.51	52.58	52.01		72.1
April–December 1951	44.01	57.84	62.58	64.38		77.8
October 1952	51.12	62.59	66.06	74.98		79.5
March 1953	48.48	62.55	66.67	59.79		80.1
April 1954	54.44	62.88	65.34	63.70		80.5
November 1957	62.07	69.45	83.39	90.10	75.18	80.2
May 1958	55.00	69.39	74.45	84.10	70.42	86.6
August 1959	66.97	76.42	81.73	97.21	95.50	87.3
August 1960	63.77	79.50	87.25	96.82	82.32	88.7
January 1961	68.72	80.30	88.50	91.99	100.75	89.6
January 1962	71.43	72.99	87.02	92.24	101.28	90.6
April 1963	69.26	78.56	87.77	89.19	99.83	91.7
November 1964	74.08	81.60	86.26	93.56	99.42	92.9
December 1967	92.81	101	115.50	115.83	127.73	100.0
February–October 1969	103.32	109.65	121.80	139.73	142.66	109.8

[1] Up to 100,000 in 1946–51; 2,500 to 49,999 in 1951–54.

[2] 100,000 to 499,999 in 1946–51.

[3] 5000,000 and over in 1946–54.

[4] Not available until 1957.

Source: Rainwater (1973), 234.

Other measurements of attitudes clearly demonstrate the ability to document important changes in the public perception of its economic and political institutions. Cantril developed a technique for documenting perception of personal well-being that has documented the consumer's sense of progress, a technique that can be used to establish the equilibrium group of Figure 1 (Watts and Free, 1973, 22–26). Gallup questions on the effectiveness of institutions has received great publicity in recent months due to the fall in the esteem accorded Congress and the Presidency. The same type of perceptions are documented in the Center for Political Studies' index of *Trust in government* which reflected the serious deterioration in public confidence in government accompanying the credibility crisis associated with the Vietnam War.

These various attitudinal indices are mentioned to indicate that attitude measurement is no will o' the wisp and can be linked to important structural changes in political economy. Indeed, recent work by Struempel (1973, 1974) suggests models for the interrelationships between measures of financial satisfaction and the real economic condition of the family. The considerable research in this area indicates that households can make year-to-year comparisons of their personal economic situation.

The more difficult question is whether a measurement technique can be devised that accurately reflects the equilibrium or disequilibrium of an individual with respect to the scope of government activity. Mueller (1963) concludes that many people do not have a well-defined concept of government activity, and will give responses that must be viewed as contradictory when one evaluates their implications for the government budget constraint. These conclusions imply that a battery of questions is required to discriminate individuals with active consensus to government activity from others whose responses reflect noise. On the more optimistic side numerous investigators have demonstrated that it is possible to obtain measures of satisfaction with the activities of Federal, State and local governments and that these measures record important shifts in priorities for government activity (Cf. Watts and Free, 1973; Nation's Cities, 1971).

The development of a measure of the equilibrium of the individual with respect to government thus requires careful conceptual groundwork. This should not discourage such measurements. We have not arrived at a measure of unemployment rates without arbitrary definitions of the survey week, and part-time workers. Analogously, definition of an equilibrium group for the direct measure of cost of living will require a decision on how to differentiate among the activities of different levels of government, how to elicit the margin between the individual's preferred role for government and its current role, and in what way to confront the individual with the trade-offs required among programs or between public and private activity.

The job of framing questions and scales is feasible, but it is not trivial.

The extraction of an equilibrium group can be tackled at a variety of levels of sophistication. The most primitive would be to define the dimensions of Figure 1 in terms of responses to a nested group of questions. Such a procedure runs the danger that persons with inconsistent responses or poorly defined preferences are misclassified. An errors-in-variables model suggests that it may be useful to model the data with a factor analysis (Hauser and Goldberger, 1971 and Goldberger and

Joreskog, 1972.) The resultant scaling of the underlying measures could then be used to identify the equilibrium set.

Desirability

A direct measure of the cost of living appears to have a high priority in the arsenal of policy-related measures of the economy. Perhaps the most convincing argument in its favor is to consider the alternatives. Earlier in this paper I argued that a cost of living measure was unlikely to be implemented to include the Federal government. Lack of measures of output quantity and quality forestall a comprehensive approach to the tax price of that sector. The Inter-Agency Task Force on Productivity has shown us that some progress on measuring the cost of intermediate government products can be made, but for less than half of the employment in the Federal sector. This does not seem like a promising way to relate cost of government to the consuming public. Continued dependence on the deflator for government goods and services appears an equally unreasonable approach, given the known changes in the quality of government services that we have experienced and can continue to expect (U.S.-OBE (1955)).

Another class of arguments in favor of a direct measure of the cost of living lies in the externalities provided by a continuing series of measurements on the consumer's satisfaction with government activity and taxation. Continuing measurements by the Inter-University Consortium for Political Research have demonstrated that it is possible to quantify a secular decline in the public trust in government and their confidence that government is acting in the interest of the average citizen. The lack of comparable data on the willingness of the public to support government activities with additional tax dollars, and satisfaction with the tax structure has made it possible for a variety of special interest groups to conduct polls of public opinion with respect to government activity. Lacking standards of comparison it has been impossible to validate or disprove the finding of such polls.

A particularly offensive instance of this type of data collection was undertaken by the Advisory Commission of Inter-Governmental Relations (1973). The study failed to distinguish random response from strongly held opinion and confused policy issues at several levels of government. Its use of fixed responses strongly suggests an intention to lead response in particular directions.

I cite the ACIR study because it appears to me that a continuing data collection effort directed at direct measures of cost of living would create a vehicle to which policy questions on the scope of government and method of financing government might easily be added. Lack of continuing measurements of public preferences relating to the government sector creates a perilous gap in policy-relevant knowledge. Time series measurements are mandatory, as the connotation of questions in this area cannot be defined as precisely as questions about income. We will learn to improve our measurements only by doing, and criticizing the results of past efforts.

6. CONCLUSIONS

Three conclusions can be drawn from this analysis. First, a pressing need exists to invest in the creation of welfare indicators that reflect government activity

fully and explicitly. The post-war erosion of the degree to which government is reflected in the CPI casts real doubts on the advisability of using that index as a proxy for a cost of living index. Yet we are being pushed in that direction by chronic inflation, measured without correction for improvements in the quantity or quality of government.

A second conclusion is that we are unlikely to make a rapid breakthrough in explicitly representing the Federal sector in a cost of living index as output measures do not exist and a time series approach will be required to measure the preference function of the median voter. As an alternative, a direct measure of the cost of living can be obtained from regular surveys of consumer satisfaction with the public sector. Enough experience has been assembled on this problem, so that a pilot program of measurement can be undertaken. The science of attitudinal measurement has advanced to a point where results of value for policy-making can be assumed. A commitment to undertake direct measurement of cost of living through attitudinal measures for a-five-year period seems to me to be the most likely means for advancing our understanding of cost of living and its relationship to costs of government.

The last conclusion that may be drawn from the discussion is that cost of living measures including the State and local government sector can be devised with data at hand. The biggest stumbling blocks are quantification of output, up-to-date measures of cost functions, and techniques for integrating quantity and quality in a single production constraint. While further progress in this direction is feasible, it is less significant than work on the Federal sector. Relative to State and local government a much smaller proportion of Federal government revenue is now implicitly represented in the CPI. In absolute terms barely half of Federal receipts are reflected in the prices measured by the CPI, even when full forward shifting is assumed. For this reason I again conclude that a direct, attitudinal measure of changes in satisfaction with government linked to changes in money income is more likely to produce needed information concerning the consumer's level of living than research using more traditional data.

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REFERENCES

[1] Aaron, H. and McGuire (1970), "Public Goods and Income Distribution," *Econometrica* 38, p. 909.
[2] Advisory Commission on Inter-governmental Relations (1973), *Financing Schools and Property Tax Relief—A State Responsibility* (Washington, D.C.: GPO), Appendix B.
[3] Behrens, E. and Smolensky, E. (1974), "Alternative Definitions of Income Redistribution," *Public Finances* (forthcoming).
[4] Bergstrom, T. and R. Goodman (1973), "Private Demands for Public Goods," *American Economic Review* 63, 280–96.
[5] Borcherding, T. and R. Deacon (1972), "The Demand for Services of Non-Federal Government," *American Economic Review* 62, 891–901.
[6] Bradford, D. and H. Kelegian (1973), "An Econometric Model of Flight to the Suburbs," *Journal of Political Economy* 81, 566–89.
[7] Christensen, L., D. Jorgenson, and L. Lau (1973), "Transcendental Logarithmic Utility Functions," Social Systems Research Discussion Paper 7311 (Madison, Wisconsin: University of Wisconsin).

[8] Christensen, L. and M. Manser (1973), "Cost of Living Indices and Price Indices for U.S. Meat and Produce, 1947–71," *Conference on Income and Wealth* (New York: National Bureau for Economic Research).

[9] Cicchetti, C. *et al.* (1971), "On the Economics of Mass Demonstrations: A Case Study of the November 1969 March on Washington," *American Economic Review* 61, 719–724.

[10] Clawson, M. and J. Knetsch (1966), *Economics of Outdoor Recreation*, Baltimore: Hopkins University Press, Ch. 5.

[11] Curtin, R. (1973), "Index Construction: An Appraisal of the Index of Consumer Sentiment," in Mandel, L. *et al. Surveys of Consumers 1971–1972* (Ann Arbor, Mi: Institute for Social Research) 253–62.

[12] Curtin, R. and Cowan, C. (1975, forthcoming) "Public Attitudes Toward Fiscal Programs" *Surveys of Consumers*, 1973–1974 (Ann Arbor, Mi: Institute for Social Research).

[13] Ellickson, B. (1971), "Jurisdictional Fragmentation and Residential Choice," *American Economic Review* 61, 334–339.

[14] Ellickson, B. (1970), "Metropolitan Residential Location and the Local Public Sector," (unpublished Ph.D. dissertation: Cambridge: MIT).

[15] Ellickson, B. (1973), "A Generalization of the Pure Theory of Public Goods," *American Economic Review* 63, 417–32.

[16] Foley, D. (1970), "Lindahl's Solution and the Core of an Economy with Public Goods," *Econometrica* 38, 66–72.

[17] Goldberger, A. and Joreskog, K. (1973) "Maximum Likelyhood Estimation of Structural Systems with Errors in the Variables" (Madison, WI: Social Systems Research Institute Reprint).

[18] Griliches, Z. (1971), *Price Indexes and Quality Change*, Cambridge: Harvard University Press.

[19] Handler, J. and E. Hollingsworth (1971), *The Deserving Poor: A Study of Welfare Administration* (Chicago: Rand McNally–Markham series in Public Policy).

[20] Hansen, B. (1958), *The Economic Theory of Fiscal Policy*, (Cambridge: Harvard University Press), 215–224.

[21] Hasenkamp, G. (1973), *Specification and Estimation of Multiple Output Production Functions* (unpublished Ph.D. dissertation: University of Wisconsin-Madison).

[22] Hauser, R. and Goldberger, A. (1971), "The Treatment of Unobservable Variables in Path Analysis. In H. L. Costner (Ed.) *Social Methodology 1971* Ch. 4 (San Fransico: Josey-Bass) 81–117.

[23] Hirsch, W. (1972), *Economics of State and Local Government* 6 (New York: McGraw-Hill).

[24] Hirsch, W. (1973), *Urban Economic Analysis*, (New York: McGraw-Hill), p. 330.

[25] Hochman, H. and Rodgers (1970), "Pareto Optimal Redistribution: Reply" *American Economic Review* 60, 997–1002.

[26] Inman, R. (1971), *Four Essays on Fiscal Federalism* (unpublished Ph.D. dissertation, Cambridge: Harvard University).

[27] Inman, R. (1972). "Towards an Econometric Model of Local Government," *Proceedings of the National Tax Association: Kansas City* 64, 699–719.

[28] Inter-Agency Task Force on Measuring Productivity (1973), *The Permanent Measurement System*, Vol. 1 (Washington, D.C.: GPO, December, 1973).

[29] Katona, G., L. Mandell and J. Schmeideskamp (1970), *1969 Survey of Consumer Finances* (Ann Arbor: Institute for Social Research) Tables 15–9, 15–10.

[30] Kessel, R. (1961), "The Measurement and Economic Implications of Inclusion of Indirect Taxes in the Consumer's Price Index" in Stigler (1961).

[31] Lansing, J. and Morgan, J. (1971) *Economic Survey Methods* (Ann Arbor, MI: Institute for Social Research).

[32] Maital, S. (1973), "Public Goods and Income Distribution: Some Results," *Econometrica* 41, 561–568.

[33] Mohring, H. (1973), "Optimization in Urban Bus Transportation," *American Economic Review* 62, 591–604.

[34] Morris, D. (1973), "Economies of City Size: Per Capita Costs of Providing Community Services," (unpublished Ph.D. dissertation: Oklahoma State University).

[35] Mueller, E. (1963), "Public Attitudes Towards Fiscal Programs," *Quarterly Journal of Economics*, 367, 215.

[36] Musgrave, R., et al. (1951), *National Tax Journal*.

[37] Mushkin, Selma, ed. (1972), *Public Prices for Public Products* (Washington, D.C.: Urban Institute).

[38] *Nation's Cities* (1971), "City Taxes and Services: Citizens Speak Out."

[39] Neenan, W., C. Scott, and K. Green (1974), *Fiscal Interactions in a Metropolitan Area* (Washington, D.C.: Urban Institute).

[40] Pechman, J. and Okner, B. (1974), *Who Bears the Tax Burden?* (Washington, D.C.: Brookings Institution.

[41] Rainwater, L. (1973), in Joint Economic Committee *Studies in Public Welfare (No. 12): The Family, Poverty, and Welfare Programs, Part II Household Patterns and Government Policies* (December 3, 1973).

[42] Reynolds, M. and Smolensky, E. (1974), "The Post-Fisc Distribution: 1961 and 1970 Compared," Institute for Research on Poverty (Discussion Paper 191-74). *National Tax Journal (forthcoming)*.

[43] Rieuw, J. (1972), "Scale Economies in Public Schools," *Review of Economics and Statistics* 54, p. 100.

[44] Rothenberg, J. (1970), "Local Decentralization and the Theory of Optimal Government" in Margolis, J. ed., *Analysis of Public Output*, (New York: National Bureau for Economic Research, 31-68).

[45] Shapiro, H. (1972), "The Index of Consumer Sentiment and Economic Forecasting—A Reappraisal", 373-398 in Strumpel, B. *et al. Human Behavior in Economic Affairs* (Amsterdam: Elsevier).

[46] Smolensky, E., Steifel, L., Plotnick, R., and Schmundt, M. (1974), "Adding In-Kind Transfers to the Personal Income and Outlay Account: Implications for the Size Distribution of Income." Institute for Poverty Research Discussion Paper, also Conference on Income and Wealth, Ann Arbor, MI.

[47] Stigler, G. (1961), *The Price Statistics of the Federal Government* (New York: National Bureau for Economic Research).

[48] STRUMPEL, B. (1973), "Economic Life Styles, Values and Subjective Welfare—An Empirical Approach" in E. Sheldon *Family Economic Behavior: Problems and Prospects* (Philadelphia: J. B. Lippincott) 69-129.

[49] Strumpel, B. (1974 forthcoming), Economic Deprivation and Social Discontent in *Economic Well-Being and In a System of Social Indicators* (Ann Arbor: Institute for Social Research).

[50] U.S. Bureau of the Census (1968), Technical Paper No. 27, *Methodology of Consumer Expenditures Surveys* 10-12.

[51] U.S. Council on Environmental Quality (1972), *Environmental Quality*, Chapter 1, (Washington: GPO).

[52] U.S. Department of Labor (1971), *BLS Handbook of Methods*, Bulletin 1711 (Washington: GPO) 75-95.

[53] U.S. Office of Business Economics, *U.S. Income and Output-1954*, (Washington: GPO), 157.

[54] Walters, A. (1968), *Economics of Road User Changes*, World Bank Staff Occasional Papers No. 5; Baltimore: John's Hopkins University Press.

[55] Watts, W. and L. Free (1973), *State of the Nation*, New York: Universe Books.

[56] Willis, Arthur ed. (1969), *Studies in Substantive Tax Reform* (Chicago: American Bar Foundation), Chapter 9.