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APPRAISING THE U.S. OUTPUT AND PRODUCTIVITY ESTIMATES FOR GOVERNMENT—WHERE DO WE GO FROM HERE?

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Output and productivity estimates for U.S. government organizations are a useful management tool, and are of potential value for improving national income accounts. Real gross government product is currently estimated on the basis of labor input data. However, this imparts a downward bias to real GNP estimates since labor productivity of federal civilian employees has risen, according to Labor Department estimates begun in 1972, at an average annual rate of $1\frac{1}{2}$ percent since 1967. The estimates now cover almost 70 percent of the employees. The chief avenue for further improvement lies in refinement of the output indicators. Coverage of state and local government employees is spotty and needs to be expanded. The author also recommends a major effort to estimate public capital stocks in current and constant prices as a basis for measuring rental values, capital inputs, and productivity.

Index numbers of productivity in government organizations can be a useful management tool, both for monitoring, analyzing, and promoting productivity growth, and for projections and budgeting. Once a sufficient proportion of government employees is covered by output and productivity indexes, they can be incorporated in national income and product accounts (NIPAs), and thus contribute to macro-economic analysis. In this paper the progress made over the past twenty-five years in the United States in measuring productivity, particularly in federal civilian general government, is assessed, and suggestions are made for further improvements.

In this paper the author does not address the question of measuring effectiveness—producing in accordance with the community's wants. Although the students of "public choice" stress that eternal vigilance is needed to prevent government establishments from promoting their own interests at the expense of the general welfare, productivity measurement and analysis do not directly pertain to the question of effectiveness. The measures start with the mission, functions, and outputs of government organizations as given, then the resources used to produce the outputs are estimated. Productivity is increased by the extent to which real costs (inputs) per unit of output are reduced through time. Irrespective of the degree of effectiveness of government operations, it is desirable that their productivity be increased (assuming the associated investments yield more than the interest rate). This is the way that the taxpayer can get more bang for the tax buck—or pay less in taxes for the same level of services.

THE GOVERNMENT ESTIMATES

Federal

Several individual federal agencies had made productivity estimates for their internal use prior to 1960, and BLS (1932) had prepared a time series for the

Post Office, updated by the National Bureau of Economic Research (Kendrick, 1961). The first multi-organizational effort was undertaken in the Bureau of the Budget (now the Office of Management and Budget) in the early 1960s. At the urging of the present writer, who was then a consultant to the Bureau, a pilot study was made of five agencies under the direction of Nestor Terleckyj, and published in 1964 under the title, *Measuring Productivity of Federal Government Organizations* (Government Printing Office, 1964). In 1970, the General Accounting Office took the lead in organizing an interagency task force to develop productivity estimates beginning with fiscal year 1967 for as many organizations as was feasible. When the Bureau of Labor Statistics (BLS) assumed the responsibility in 1972 of continuing the series on an annual basis, there were 187 participating organizations in 45 agencies covering outputs of 60 percent of total civilian years paid for. Since then, coverage has expanded to nearly 400 organizations in approximately 60 agencies covering almost 70 percent of 2.1 million total federal civilian years (see Table I).

TABLE I

SUMMARY COVERAGE TABLE, FISCAL YEARS 1972, 1977, AND 1982–87

Item	Year							
	1972	1977	1982	1983	1984	1985	1986	1987
Number of agencies	45	50	49	54	59	59	60	61
Number of organizations	187	319	405	401	411	391	380	372
Civilian employee years covered (millions)	1.7	1.8	1.8	1.9	2.0	2.1	2.0	2.1
Total civilian employee years (millions)	2.8	2.8	2.8	2.9	2.9	3.0	3.0	3.0
Employee years covered as a percent of total civilian employee years	60%	64%	63%	65%	67%	69%	68%	69%

Source: U.S. Department of Labor, Bureau of Labor Statistics, *Productivity Measures for the Federal Government, 1967–1987*, p. 3, October 1988.

Data on outputs of approximately 3,000 goods and services and on employment are collected by BLS annually, chiefly from agency submissions, but also from agency reports and budgets. The outputs are final from the perspective of the organizational unit and its functional classification, but they are not all final for higher levels of aggregation at which the outputs of one organization may be an input for another. Thus, the overall numbers do not represent Federal productivity in producing final government outputs, but rather are a weighted average of the productivity changes in federal organizations included in the sample.

The output index for each organization is calculated by counting the quantities of each type of output using the base year labor requirements for each as weights. The unit employee year weights are updated every five years, and the output segments are linked to the reference base of 1977.

The organizational units are classified into the 28 functional categories listed on the stub of Table III below. Three or more organizations comprise each function other than the Postal Service. The largest number of organizational units are 64 in the function of Regulation—Compliance and Enforcement. The index

TABLE II

TABLE OF INDEXES OF OUTPUT PER EMPLOYEE YEAR, OUTPUT, EMPLOYEE YEARS, AND OTHER RELATED DATA, FISCAL YEARS 1967–87

Period FY 1977 = 100	Output per Employee Year	Output	Employee Year	Compensation per Employee Year	Unit Labor Cost
Indexes					
1967	86.5	86.4	99.9	43.9	50.7
1968	87.5	89.6	102.5	46.1	52.7
1969	89.6	92.5	103.3	49.5	55.3
1970	90.0	92.8	103.1	55.1	61.3
1971	91.4	94.0	102.8	61.5	67.3
1972	92.0	94.2	102.4	66.0	71.7
1973	94.6	95.7	101.2	69.9	74.0
1974	94.1	95.9	101.9	75.7	80.4
1975	95.5	97.5	102.1	83.0	86.9
1976	97.1	98.3	101.1	91.8	94.5
1977	100.0	100.0	100.0	100.0	100.0
1978	101.7	102.3	100.6	106.8	105.1
1979	102.3	103.1	100.7	113.7	111.2
1980	104.5	106.1	101.5	123.1	117.8
1981	107.0	107.6	100.5	134.8	126.0
1982	108.6	108.9	100.3	143.6	132.3
1983	110.2	111.6	101.3	150.5	136.6
1984	110.2	114.1	103.5	157.5	142.9
1985	110.9	117.0	105.5	165.6	149.3
1986	112.7	119.8	106.2	170.6	151.3
1987	113.0	121.5	107.5	177.1	156.8
		Year-to-year percent change			
1967–68	1.1	3.7	2.6	5.1	4.0
1968–69	2.4	3.2	0.8	7.3	4.8
1969–70	0.5	0.3	−0.2	11.3	10.8
1970–71	1.6	1.3	−0.3	11.6	9.8
1971–72	0.6	0.2	−0.4	7.3	6.6
1972–73	2.8	1.5	−1.2	6.0	3.1
1973–74	−0.5	0.2	0.7	8.2	8.8
1974–75	1.5	1.6	0.1	9.7	8.1
1975–76	1.7	0.8	−0.9	10.6	8.7
1976–77	2.9	1.8	−1.1	8.9	5.8
1977–78	1.7	2.3	0.6	6.8	5.1
1978–79	0.6	0.7	0.1	6.5	5.8
1979–80	2.1	2.9	0.8	8.3	6.0
1980–81	2.4	1.4	−0.9	9.5	6.9
1981–82	1.5	1.2	−0.2	6.5	5.0
1982–83	1.5	2.5	1.0	4.8	3.3
1983–84	0.0	2.2	2.2	4.6	4.6
1984–85	0.7	2.6	1.9	5.2	4.5
1985–86	1.6	2.4	0.7	3.0	1.4
1986–87	0.2	1.4	1.2	3.8	3.6
		Average annual percent change[1]			
1977–87	1.3	2.0	0.7	6.0	4.7
1967–87	1.4	1.6	0.1	7.7	6.1

Source: BLS report, Oct. 1988, p. 8.

[1]Average annual percent change based on linear least squares trend of the logarithms of the index numbers.

TABLE III

TOTAL AND FUNCTIONAL AVERAGE ANNUAL RATES OF CHANGE IN OUTPUT PER EMPLOYEE YEAR AND RELATED DATA FOR THE MEASURED PORTION OF THE FEDERAL CIVILIAN GOVERNMENT, FISCAL YEARS 1967-87

Functional Groupings	Output per Employee Year	Output	Employee Years	Compensation per Employee Year	Unit Labor Cost
Total Measured Portion	1.4	1.6	0.1	7.7	6.1
Audit of Operations	0.7	−0.8	−1.5	7.0	6.3
Buildings and Grounds	3.2	1.3	−1.9	6.7	3.3
Communications[1]	10.4	10.1	−0.3	6.9	−3.2
Education and Training[2]	1.7	0.1	−1.6	7.2	5.4
Electric Power Production & Distr.	−3.4	0.5	4.1	6.8	10.6
Equipment Maintenance[2]	1.1	−0.9	−1.9	7.4	6.3
Finance and Accounting	4.7	2.7	−1.8	7.1	2.4
General Support Services	4.2	6.3	2.0	6.2	1.9
Information Services	1.3	1.3	0.0	6.0	4.7
Legal and Judicial Activities	0.3	4.1	3.8	6.2	5.9
Library Services	4.5	6.2	1.7	7.6	3.0
Loans and Grants	3.1	3.1	0.0	7.1	3.9
Medical Services	0.3	2.0	1.7	7.3	7.0
Military Base Services	0.4	−2.7	−3.1	6.8	6.3
Natural Resources & Environmental Mgmt	1.5	1.4	0.0	6.9	5.3
Personnel Investigation	2.5	5.4	2.8	6.5	3.9
Personnel Management	1.0	3.2	2.3	5.4	4.4
Postal Services	1.2	1.6	0.3	8.5	7.2
Printing and Duplication	0.5	−2.0	−2.5	7.5	6.9
Procurement	2.6	2.4	−0.2	5.4	2.8
Records Management	3.3	0.3	−2.9	6.4	3.0
Regulation-Compliance & Enforc	2.7	4.6	1.8	6.9	4.1
Regulation-Rulemaking & Licensing	3.6	5.8	2.2	6.7	3.0
Social Services and Benefits	2.3	4.1	1.8	7.0	4.6
Specialized Manufacturing	3.3	0.5	−2.7	7.5	4.1
Supply and Inventory Control	1.3	−2.4	−3.7	6.5	5.1
Traffic Management[3]	2.0	−0.3	−2.3	5.4	3.3
Transportation	2.3	2.0	−0.3	7.5	5.1

Source: Bureau of Labor Statistics, U.S. Department of Labor, Oct. 1988, p. 10.

Note: Average annual percent change based on linear least squares of the logarithms of the index numbers.

[1]Fiscal years 1973-87.

[2]Fiscal years 1968-87.

[3]Fiscal years 1972-87.

numbers for the participating units are not published, but are furnished to each organization for its own uses such as analyzing causal factors.

In addition to employee years, compensation data are also assembled. These include supplemental fringe benefits as well as wages and salaries. Indexes of employee compensation are divided by the output indexes to derive indexes of unit labor costs.

The movements of output per employee year of federal civilian workers and the related series over the period 1967-87 are shown in Table II. The trend rate

of increase in productivity of 1.4 percent a year is close to that for the private business economy, although the sub-period patterns of change differ. The annual changes show only one decline (1973-74), with the other changes ranging up to 2.9 percent. In Table III the dispersion in average annual rates of change over all or most of the 20-year period for the 28 functional groupings is shown. Apart from the two extremes—10.4 percent a year for communications and −3.4 percent for electric power production and distribution—the average changes ranged from 0.3 percent for medical services to 4.7 percent for finance and accounting. There was considerable variation across sub-periods as well as annually in most functions. However, it is not our objective here to analyze the results, but merely to convey some of their flavor.

State and Local Governments

Output per employee year estimates are prepared for several state and local services. They are based on concepts and methods similar to those for the federal government, but use published secondary data keyed to the Standard Industrial Classification. The output measures reflect production of final services to the public. The employee year data come mainly from the Census Bureau's annual public employment survey.

Indexes are currently published for state and local government electric power production, state sales (in constant prices) of alcoholic beverages, and unemployment insurance operations. Estimated average annual percentage rates of increase in output per employee year for each of these industries were, respectively: 1.5 percent 1967-86; 1.6 percent 1967-87; and 0.9 percent 1963-87. Productivity declines in all three have been registered since 1982, on average. Note that two of the three industries are composed of government enterprises. Work is underway to develop additional measures for the following areas: state prisons, and later, jails; mass transit; state employment services; and solid waste collection.

Surveys of state and local governments indicate that the majority collect and use productivity measures, although they are often limited to a small number of activities. Larger jurisdictions are more likely to develop and use such measures than smaller ones. Services with tangible outputs, and those subsidized or regulated by the federal government are more likely to have efficiency-type measures, including engineered work standards as well as productivity indexes (Mark, 1983).

Unfortunately, many state and local governments cut back on productivity measurement and improvement programs in the 1980s as a result of several factors: fiscal stringencies; termination in 1978 of the National Center on Productivity and Quality of Working Life, which had encouraged efforts on the state and local level; elimination in 1980 of a program of assistance by the U.S. Office of Personnel Management under the Intergovernmental Personnel Act; and reduced grants from the National Science Foundation and Department of Housing and Urban Development for studies of productivity and related matters.

Appraisal and Recommendations

Since my appraisals of the current status of government productivity measurement condition my recommendations for future work to improve the estimates,

they will be discussed jointly with respect to coverage, and the measurement of outputs and of inputs.

Coverage

Coverage of the outputs of federal civilian employees appears quite good at near 70 percent of total employment, but the percentage has not changed much for several years, and the number of participating organizational units has declined somewhat. Further, when federal government enterprises are excluded, the coverage of general government employees drops to approximately 52 percent of the total. Despite this, in September 1983 the White House Conference on Productivity (1984) recommended that BEA should use the BLS federal government output and productivity estimates as a basis for estimating real product originating in federal general government. Current estimates reflect changes in weighted employment without allowance for productivity changes. The proposal is that the employment index be multiplied by an index of output per employee based on the BLS estimates to translate it into an output index to be used to move the base period estimate of gross product originating in government.

There are both conceptual and statistical problems with this proposal. Is the sample of organizations large and representative enough to validate the imputation to all federal civilian employees? Economists at the National Bureau of Economic Research have considered 60 percent coverage sufficient for such an adjustment. Although the BLS sample of general government civilian employees is smaller than that, the reasonable behavior of the average tells me that the imputation for the total would be much better than the current non-productivity-change assumption. Clearly the coverage of the output and employment data should be expanded further. As a consultant to the Budget Bureau in 1962, the present writer estimated that meaningful data on outputs for at least 75 percent of federal civilian employees could be assembled (Kendrick, 1963). This remains a reasonable objective for BLS. The OMB Executive Orders of 1986 and 1988 and the current circular encouraging further development of productivity data and improvement programs in the large agencies should aid the expansion. Occasional prodding of agency managers by OMB officials could also be useful, since the BLS data collections are voluntary for the participants.

Another issue is whether the imputation should be made from the overall average, or by agency and/or function. The latter would be technically superior if the sub-samples were adequate. Efforts at expanding coverage should be targeted at the areas in which coverage is relatively small and in which output susceptible to measurement is produced.

BEA officials (1980) have contended that for imputational purposes, only outputs final to the government's civilian operations should be counted in the productivity calculations. It might be argued, however, that productivity of the sample organizations producing *both* final and intermediate products could be considered as representative of the government civilian operations as a whole. These and other conceptual and statistical problems (including some discussed below) must be solved by the agencies concerned before real product originating

in federal general government is estimated on an output rather than on a labor input basis.

The coverage of ouputs of government enterprises, both federal and state/local, is reasonably good in the BEA real product estimates as well as in the BLS series. The area requiring the most work, by far, is state and local general governments. The plans of BLS seem reasonable—to expand coverage of services with tangible outputs for which data are readily available. Examples are water supply and sewerage treatment, selected public works, street lighting and repair, and income maintenance programs for which the federal government has responsibility.

Beyond that, progress may require the reestablishment of a federal program of cooperation with states and selected local governments to provide technical guidance in expanding and regularizing productivity measurement. Once the major states and local governments are covered plus a sample of the others, thought can be given to imputing the average measured productivity in major functions to all employees. Conceptual as well as statistical difficulties exist in several important functions, particularly public education (cf. Hatry, 1978).

Output Measurement

It is my assessment that the BLS government output indexes are reasonably good. For each federal agency the Bureau (1988b) has listed the various elements, their missions and the associated output indicators—approximately 3,000 in total. The BLS technicians have tried to specify outputs so that they are relatively homogeneous and not significantly affected by changes in mix. When output qualities change (e.g. use of a new tax form by IRS) the change in weights (labor requirements per unit of output) are adjusted so that the output series is not affected by the quality change as such.

Government reorganizations generally do not create untoward difficulties, since BLS works up from basic organizational elements. The Bureau technicians are also alert to possible changes in the incidence of contracting out by an agency so that the productivity ratios may be adjusted appropriately. When there are production cycles of more than a year, the Bureau tries to estimate the proportion of final output produced in each year.

The chief way BLS could improve the output measures is to specify outputs and collect data in greater detail. Many of its indicators are based on numbers of cases, applications processed, licenses issued or other actions taken. If these could be broken down further, if only by several categories of difficulty, changes in output mix would have less potential effect. The usual expectation is that over a large number of items, average required time at base period technology would not change much from year to year. The greater detail of output data would help ensure this result.

In addition to collecting output data in greater detail, the expansion in coverage of organizational units and employees will also expand the numbers of output indicators in the grand total. Expansion of coverage is not desirable, however, unless output units can be specified and measured as well, on average, as those now included.

Input Measurement

At present only labor input as measured by employee-years comprises the denominator of government productivity ratios. An employee-year reflects regularly scheduled time, overtime, and paid leave time of all full-time, part-time, and intermittent employees. It is equivalent to one person *paid* for 2,087 hours. It is generally agreed that hours *worked* is a better measure of labor input. In the private economy, time paid for but not worked has risen substantially relative to time worked, so time paid for has a significant upward bias as a measure of labor input. It is not known if this is the case with respect to general government employees at all levels. If research indicates that it is, efforts should be made to shift to an hours worked basis.

The other issue is a bit more controversial. BLS considers employee years to be homogeneous and additive. Some academic economists, e.g. Jorgenson, Gallop, and Fraumeni (1987) maintain that employment or hours data should be assembled by occupation and other characteristics relevant to pay and productivity, and weighted by base-period average compensation in each category. In the private economy, weighted labor input has risen faster than unweighted reflecting upgrading of the workforce. The same appears to be true in federal government. BEA moves its base period gross product originating in general governments by numbers of employees in various categories and grades, and the weighted aggregate rises relative to the unweighted. Even if unweighted employee years are used for labor input, the weighted aggregate should be calculated to see how much changes in composition of the workforce have contributed to productivity as measured. One problem of using the weighted aggregate as the input is that its movements depend in part on the degree of detail in which the weighting was done.

Another recommendation is for the development of multifactor input and productivity measures. This points in particular to the estimation of real public capital stocks and inputs. Since most government outputs are services, intermediate product purchases are confined largely to supplies and outside services such as rent and electric power. It would probably not be far from the mark to assume that real product originating in a given agency, function, or government as a whole moved closely with its gross output. However, if data on intermediate purchases could be obtained and adjusted for price changes readily, it would be more accurate to deduct the real intermediate inputs from the real value of gross output to obtain real gross product to relate to the factor inputs alone. Or, gross output could be related to a weighted average of the three major inputs to obtain total productivity ratios. This reveals the net saving in real costs per unit of output, while the three partial productivity ratios are valuable in showing the saving in each input per unit of output, and the substitutions among the inputs.

With regard to capital, the exploratory study, *Measuring Productivity of Federal Government Organizations* demonstrated the feasibility of preparing capital and total factor productivity estimates. When BLS began its regular estimates in 1973, it confined its work to labor productivity due in part to the time it would have taken to develop capital estimates for the many organizations covered. However, it should be feasible to prepare estimates of real capital stocks

owned and used by the federal government in its civilian operations. As a starting point, BEA prepares estimates of the real stocks of structures and equipment, military and civilian, and the stock estimates for structure are available in considerable detail by type. The average yield on federal government bonds could serve as the weighting factor.

It is now time that BEA expand its national income estimates to include imputed rental values of nonbusiness capital stocks. This is being considered for inclusion in the United Nations' revised System of National Accounts, as discussed in my paper "Concept and Measures of Full Income and Product" (see Kendrick, 1989). With this change, the valuation of gross product originating in general government (and in the personal sector) would be consistent and comparable with gross business product by comprising both labor and property compensation.

For the state and local governments, further progress is needed in expanding output and labor productivity estimates before resources are diverted to the preparation of multifactor-input and -productivity estimates. However, the broader and more informative ratios should be kept as a long-term goal.

Conclusion

Much progress has been made in the past 25 years in measuring governmental productivity in the United States. It is important that the progress continue in order to improve further our capabilities in macro-economic analysis, and to provide public administrators better instruments for monitoring and improving government productivity. The latter is particularly important since there is no "bottom line" in public accounts to tell managers how they are doing.

The main avenues for improvement are in expanding coverage, particularly at the state and local general government level; refining the output measures, particularly by development of more detailed output indicators; and by developing multifactor input and productivity measures, beginning with the federal government's general civilian operations as a whole. The improvement of the national income and product accounts is an important feature of the proposed program.

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