NBER WORKING PAPER SERIES

GOVERNMENT SAVING, CAPITAL FORMATION AND WEALTH IN THE UNITED STATES, 1947-1985

Michael J. Boskin

Marc S. Robinson

Alan M. Huber

Working Paper No. 2352

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
August 1987

We are indebted to the Center for Economic Policy Research at Stanford University for support of this research. We are deeply indebted to John Musgrave for generously providing unpublished data and to Paul Pieper for providing data on inventories and par-to-market indices for financial assets and liabilities. This paper was originally presented at the NBER Conference on Research in Income and Wealth, held in Baltimore, Maryland, March 27-28, 1987. We have greatly benefited from the comments of the conference participants, especially Robert Lipsey and Helen Stone Tice, and numerous valuable suggestions made by our discussants, Robert Eisner. The research reported here is part of the NBER's research program in Taxation. Any opinions expressed are those of the authors and not those of the National Bureau of Economic Research.

NBER Working Paper #2352
August 1987

Government Saving, Capital Formation and Wealth in the United States, 1947-1985

ABSTRACT

This paper presents new updated and improved estimates of various components of governments' contribution to national wealth and its growth in the post-war period. The primary conclusions drawn are:

1. The federal government's assets, tangible and financial, are substantial; they grew more rapidly than the national debt in the 1970s. By 1980, federal tangible assets amounted to $1.7 trillion and financial assets $940 billion, compared to liabilities of $1.5 trillion (in 1985 dollars);

2. Since 1980, conventional liabilities have grown much faster than assets, causing about a $727 billion decline in federal "net worth";

3. The state-local government sector contributes importantly to government and national wealth. State-local fixed reproducible capital is twice the federal amount, about $1.9 trillion in 1985. The difference between assets and liabilities is both larger and more stable for state-local governments than for the federal government. The estimated "net worth" of state-local governments is $2.5 trillion in both 1980 and 1985;

4. Total government reproducible capital was about 55% of the corresponding private non-residential capital stock in 1985;

5. Government net investment has often been sufficient to turn the government sector into a net saver despite large budget deficits;

6. Extending the traditional National Income Accounts to include imputed returns to government capital and consumer durables while treating government net investment and durables purchases as saving indicate that the share of national output devoted to consumption has risen substantially, while that devoted to net saving has fallen sharply in the period 1951-85. The private consumption rate has risen from 63% to 69% over this period while the government consumption rate has fallen slightly;

7. The inclusion of consumer durables and government tangible investment raises the national saving rate substantially. In 1985, the gross and net saving rates rise from a traditionally measured 13.8% and 3.2% to 24.5% and 8.8%, respectively (about one and a half percentage points of this increase is due to our different depreciation methodology).

Thus, the data presented in this paper reveal much about the post-war fiscal history of the United States. In addition to their importance in understanding trends in national wealth, they may also prove important inputs into future studies of the long-term growth of the economy and to the short-run effects of fiscal policy.

Michael J. Boskin
NBER
204 Junipero Serra Blvd.
Stanford, CA 94305

Marc S. Robinson
GM Research Labs
Operating Science Div.
30500 Mound Road
Warren, MI 48090

Alan M. Huber
Department of Economics
Stanford University
Stanford, CA 94305

1. Introduction

In all countries, the public sector owns substantial amounts of capital. Governments also invest as well as consume and make transfer payments. Government capital, like private capital, also depreciates. Most advanced countries attempt to incorporate this information, however imperfectly, in their formal budget documents, by generating separate capital and current accounts. The United States federal government is the most conspicuous exception.

Government capital formation raises a number of issues important to national economic well-being. For example, net capital formation may be a major component of net national saving or dissaving. It may be more appropriate to finance government capital formation than government consumption by borrowing rather than taxing. Some types of government capital formation are complementary to private activity and enhance productivity, but government investments do not have to meet the same kind of market test as private investment.[1] We do not have an analogue to the stock market to value it. Thus, measures of government capital and investment may be particularly useful information which cannot be inferred from other data.

Measuring government capital raises difficult conceptual issues (see, for example, Eisner and Nebhut (1982)). Among these are the definition of

---

1. The theory of local public goods suggests there may be at least a partial market test for site-specific investments.

what is government versus private product, and what is capital.[2] Another set of questions concerns whether to include and how to measure, government human capital investment.[3]

---

2. Various government sponsored enterprises which are, at least nominally, private, also maintain a specific line of credit at the Treasury. Still more subtle is the treatment of mandated private activity. While the economic "rules of the game", establishing property rights and the like, are made by the government, in advanced economies, governments have increasingly required the private sector to engage in various activities and provide various types of benefits. For example, when pollution and safety control equipment are mandated by law for automobiles, regardless of whether the activity mandated passes social cost-benefit tests, the expenditures are counted as part of gross private auto sales, although they are close substitutes for the government levying a tax and paying the automobile companies to install them. Various recent proposals would require employers to pay for health insurance coverage for all employees. Quite aside from the impacts this might have on wages and/or employment, it would be considered as private compensation of employees in the data, not government taxes and spending.

A related issue is what to do about uncompensated or below market compensation services "purchased" by the government. For example, a military draft presumably enables the government to hire military personnel at below market wage rates (see Eisner and Nebhut (1982) for estimates of these uncompensated services in the 25 years after World War II). This issue is not confined to the government but extends to the private sector as well. For example, substantial uncompensated volunteer time is given by millions of Americans every year to various charitable causes. This often enables the free or below market price dispensation of various services, and hence, the size of this product is underestimated in the National Income Accounts. We do not propose magic answers to these problems, but only raise difficult questions and applaud those who have sought to assign plausible orders of magnitude to them.

Another important distinction is between consumption and investment expenditures. Again, accounting rules and various conventions in the private sector make even the traditional private sector data somewhat suspect. In the booming microelectronics and software industries, much of what an economist might think of as investment -- a purchase made to enhance future earnings -- becomes totally obsolete before the three year period elapses which distinguishes investment from consumption expenditures.

3. The government spends substantial amounts on education and health -- as does the private sector -- and other forms of spending which may include a substantial human capital component. How much of this is investment versus consumption? Various recent studies have attempted to ascertain this human capital component for both the private and government sector (see Kendrick (1976) and Eisner and Nebhut (1982)). Certainly the expenditures are quite

Still, separating out capital and current expenditures, and generating sensible measures of depreciation and net investment can be important inputs into various kinds of economic analyses. It would enable us to provide a more accurate picture of how government is using the funds that it raises. It could help develop better measures of productivity and capital. It can improve our understanding of fiscal history and highlight emerging fiscal issues, such as the alleged deterioration of the infrastructure. It may be useful in explaining private consumption and saving (Boskin (1986a)). Most important from the standpoint of this paper, it is a necessary input into comprehensive measures of net national saving and national wealth and into government balance sheets.

One purpose of this paper is to provide estimates of various types of government investment, depreciation, and capital. Our major innovations lie in the estimates of depreciation of fixed reproducible capital, the value of government land, and the value of government mineral rights.

We then use these series, and corresponding ones for the private sector, to obtain values for government consumption and net worth and to adjust GNP, NNP, and national saving and investment figures from the National Income and Product Accounts (NIPA). Thus, we seek to complement previous studies attempting to extend measures of national income and

---

large, and if all such expenditures are included, gross investment in human capital is about as large as gross investment in tangible capital. But not all of the expenditures is investment; and of course, the stock of such capital depreciates and obsolesces.

product to a more comprehensive treatment of the government sector (such as Eisner and Nebhut (1982), Goldsmith (1962, 1982), Martin, Landefeld and Peskin (1982), Kendrick (1976), Eisner and Pieper (1984), and Eisner (1986)).

We focus on a particular subset of improvements to the NIPAs and previous studies while ignoring others. For example, we do not examine mandated private activity or uncompensated or undercompensated services; nor do we examine human capital expenditures. This is not because we consider these issues unimportant; it is to allow us to focus on others. Even with this deliberately narrow focus, our estimates of gross and net national product extended to include the return to government capital substantially exceed the traditional numbers. Our estimates of the combined state-local and federal government capital stock are a large fraction of the analogously computed private capital stock. Government net saving, defined as revenues less consumption rather than by the traditional budget surplus or deficit figures (in accord with the OECD and United Nations system of national accounts for other countries) and government net capital formation are substantial. They also vary over time and can be important components of net national saving and net national investment.

The paper is organized as follows. The next section discusses fixed reproducible capital -- the methodology, concerns with the traditional estimates of the Bureau of Economic Analysis, and various estimates and trends of fixed reproducible capital of the federal and state-local governments in the United States. Importantly, it provides estimates based on depreciation assumptions which are consistent with empirical estimates for the private sector. The depreciation estimates generate internally consistent capital stock and imputed rent series. It also presents consistent real net revaluation estimates.

Section 3 discusses government inventories, presents data on inventory values including military and non-military as well as a breakdown by level of government, and compares inventory investment with fixed reproducible investment. It also discusses real revaluations for inventories.

In Section 4, we provide comparisons of these estimates of government investment and capital stocks to estimates of net investment and capital stocks in the private sector. We update through 1985 and expand to consumer durables and residential capital the estimates of Hulten and Wykoff (1981). We also compare government and private capital stocks using consistent depreciation assumptions, although they may be controversial ones.

Section 5 presents revised saving, investment and consumption as well as adjusted GNP and NNP estimates. In addition to imputing the rental flow from government capital as current consumption, developing improved estimates of depreciation to estimate net investment and the accrued capital stock, we also make corresponding adjustments for consumer durables purchases. These are substantial in the United States and substantially exceed the depreciation of the durables and hence contribute an important component to national capital formation (see Boskin and Roberts (1986) for an elaboration of the importance such adjustments can make in international comparisons (e.g., with Japan)). The data reveal interesting patterns of government consumption, saving and net investment. The government sector, federal and even more importantly state and local, are major contributors to national capital formation, and their patterns of capital formation have differed substantially over time and relative to the private sector.

Financial assets and conventional liabilities are discussed in Section 6. It presents the real market values of federal and state and local financial assets and liabilities. It updates and makes minor changes to

the work of Eisner and Pieper (1984) and Eisner (1986), which draw on the work of Seater (1981) and Cox and Hirschorn (1983). In addition to the tangible assets, government units also have substantial financial assets, as well as the traditional liabilities which have drawn so much recent attention.

Section 7 updates and corrects estimates of the value of federal mineral rights developed by Boskin, Robinson, O'Reilly and Kumar (1985) and extends the analysis -- albeit based on scanty data -- to state and local mineral rights. The value of these rights is quite large and fluctuates substantially as one might suppose given the substantial flucuation in the prices of minerals. In some years the change in the value of mineral rights exceeds the conventionally measured budget deficit.

Section 8 discusses the value of federal and state-local ownership of land. Again, this extends the analysis in Boskin, Robinson, O'Reilly and Kumar (1985) to the last several years and to the state and local sector. Various methodological issues are discussed. Governments own a substantial fraction of the total acreage of land in the United States, and a modest fraction of the total value of land.

Section 9 is concerned with contingent liabilities such as loan guarantees, deposit insurance and government pension liabilities. We do not provide systematic time series on the value of these contingent liabilities, but discuss the conceptual issues in valuing them, and some data on the outstanding value of loans, guarantees and insured deposits. The economic consequences of subsidized loans or loan guarantees depend heavily upon one's view of credit markets, especially the supply of funds to them (see Gale (1987)). Various issues are discussed in defining a sensible estimate of the expected present value of the contingent liabilities flowing from new commitments of subsidized loans and guarantees and deposit insurance.

Section 10 discusses the most important set of potential government liabilities, the unfunded liabilities in social security and government pension plans. We refer the reader to other sources for time series on these data, but discuss a variety of issues surrounding these unfunded liabilities, their sensitivity to various economic and demographic assumptions, as well as to political decisions, and highlight some key recent events in the system.

In Section 11, we present a preliminary attempt to develop a balance sheet for the government sector of the U.S. economy. After discussing the advantages and numerous limitations of our estimates, and government net worth calculations in general, we present balance sheets for federal and state-local governments for selected years. The trends, particularly in federal "net worth", are sometimes dramatic. Looking at tangible and financial assets and conventional liabilities, the federal government had a net worth (in 1985 dollars) of over $1.0 trillion in 1980, substantially higher than in 1970, but had lost two-thirds of it by 1985.

A brief conclusion summarizes the results and emphasizes the large number of caveats we have had to invoke along the way. It also suggests various avenues for future research.

2. Fixed Reproducible Capital

Goldsmith (1962) and Kendrick (1976) both estimated the government capital stock as part of their pioneering studies of national wealth. The most recent and comprehensive estimates of fixed reproducible government

capital stocks have been made by the Bureau of Economic Analysis.[4] All three studies use the perpetual inventory method to calculate net capital stocks: gross investment is cumulated and estimated accumulated depreciation is subtracted. Our estimates use the BEA's gross investment series and most of their service life assumptions, but we adopt a different depreciation method.

The BEA assumes straight-line depreciation over the estimated economic service life of each asset.[5] However, within each category of structure or equipment, the BEA allows for a distribution in service lives around the mean, reflecting a retirement distribution.[6] Since the assets with the shortest assumed lives are retired first, the depreciation rate for any category of investment slows down once retirements start to occur. The resulting overall depreciation pattern resembles a geometric decay.

The straight-line assumption made by the BEA is basically arbitrary. A more satisfactory approach to estimating economic depreciation makes use of the observed sales prices of used assets. For the private sector, Hulten and Wykoff (1981) collected data on used asset price from several sources, weighted these price by estimated survival probabilities to account for discarded assets, and estimated the form and rate of economic depreciation. They used a functional form which included all the common

---

4. Musgrave (1980,1986) and Bureau of Economic Analysis (1982).

5. See BEA (1982) and Musgrave (1980) for more details on the BEA methodologies.

6. A bell-shaped Winfrey S-3 retirement distribution is used to assign service lives ranging from 45% to 155% of the mean service life for each category.

assumptions -- geometric, linear, or one-hoss-shay -- as special cases. Although none of the common forms was accepted statistically, the estimated price-age profiles were found to be close to geometric for the classes of assets considered.[7] The authors then estimated the constant depreciation rate which provided the best fit.

These results were used to derive depreciation rates for the types of producers' durables and nonresidential structures defined in the NIPAs. There was sufficient data to estimate some types directly. The declining-balance rates, R, found for these categories were used to infer depreciation rates, δ, for the remainder from the definition $\delta = R/T$, where T equals the BEA estimated service life. The average R value for four equipment categories was 1.65, so depreciation rates for other equipment classes were calculated as $\delta = 1.65/T$. The average R value for two types of structures was 0.91, so depreciation rates assigned to other types of structures were $\delta = 0.91/T$.

The Hulten-Wykoff depreciation rates are consistent with the observations of Young and Musgrave (1980) and Hulten and Wykoff (1981) summarizing earlier studies: equipment depreciates faster than straight-line in the early years, while structures depreciate more slowly. These depreciation rates are certainly significant topics for future research, but we feel that the Hulten Wykoff depreciation estimates are the best

---

7. Hulten and Wykoff (1981) state that "the age-price profiles estimated using the Box-Cox model were very close, on average, to being geometric in form." (p.93) The eight NIPA asset categories for which depreciation rates were calculated directly as averages of rates for the assets they study were tractors, contruction machinery, metalworking machinery, general industrial equipment, trucks, autos, industrial buildings and commercial buildings.

available.[8]

In addition to fitting the used asset price data more closely, the geometric depreciation assumption has important theoretical advantages.[9] The depreciation methods and measures used in the national income accounts, the BEA capital stock series, the important work of Denison (1957, 1962, 1967, 1972, 1974, 1979 and 1985), Kendrick (1973) and studies using the NIPA and/or BEA capital stock data are internally inconsistent. The measures of capital must employ the same pattern of relative differences of capital goods of different vintages for both capital stocks and rental prices. As pointed out originally by Jorgenson and Griliches (1972), the depreciation patterns assumed in these studies cannot be used both to impute the rental prices and measure the capital stocks against which the rental prices are applied to measure imputed rent, gross or net.[10] The principal disadvantage of geometric depreciation is that retirement never occurs. Of course, all simple depreciation formulae assume that depreciation is constant over time and across assets within a category.

Given the empirical evidence and theoretical advantages, we assume that fixed government capital depreciates geometrically. Lacking evidence

---

8. See Hulten and Wykoff (1981), DeLeeuw (1981), Taubman (1981) and Boskin, Robinson, and Roberts (1986), for further discussion of the strengths and weakness of the estimates and the used-asset-price approach.

9. See Boskin, Robinson, and Huber (1987) for additional discussion of the theoretical issues.

10. See Jorgenson (1986) for further discussion of this point.

on prices for used government assets,[11] we use the market evidence on used private assets gathered by Hulten and Wykoff; that is, the depreciation rate for government equipment is 1.65/(service life) and that for each type of structure is 0.91/(service life). With one exception, the BEA estimated service lives for the various types of government capital are used to infer depreciation rates.[12]

Our estimates of the net investment and net stock of government fixed reproducible capital in 1985 dollars are shown in Table 1. We give our separate estimates for federal and state and local governments in Table 2. Both tables give the corresponding estimates for the BEA, updated by us to 1985 dollars.[13]

---

11. For some categories, such as military equipment, there are no private analogs and little or no secondary market. Even for government assets comparable to private categories, depreciation may be systematically different, due, for example, to differences in maintenance. Any adjustments to depreciation rate would be quite arbitrary, however, without more information.

12. Based on several studies (Jack Faucett Associates Inc. (1974), Kendrick (1976)) which estimate or assume a shorter service life than the BEA, we assume a 40 year service life for highways and streets, instead of the BEA's 60 year life.

13. The BEA 1982 dollar estimates were updated by the price indices used by the BEA to derive its current and constant dollar estimates. These price indices are implicit in the BEA current and constant cost net capital stock, investment and depreciation data, as found in the 1986 BEA wealth data tape. Separate indices are used for each asset type and values differ slightly for stocks (end of year) and flows (yearly average).

Thus, we converted the constant cost net capital stock estimates from 1982 to 1985 dollars for each BEA asset category by multiplying the 1982 dollar net capital stock series by the ratio of the 1985 BEA current cost net capital stock to the BEA constant cost (1982$) net capital stock. Similarly, we multiplied the corresponding investment and depreciation flows by the ratio of 1985 current cost depreciation to 1985 constant cost depreciation (1982$). This reflects the BEA's use of an end of the year price index for stocks and a yearly average price index for investment and depreciation flows.

Table 1

TOTAL GOVERNMENT FIXED REPRODUCIBLE CAPITAL
(BILLIONS OF 1985 DOLLARS)

YEAR	NET STOCK		NET INVESTMENT	
	BEA	BRH	BEA	BRH
1927	343.4	369.4	13.8	15.3
1928	358.5	386.1	14.7	16.3
1929	373.7	403.1	14.9	16.6
1930	393.6	424.8	19.4	21.3
1931	414.4	447.5	20.3	22.2
1932	429.9	465.2	15.2	17.3
1933	438.1	475.6	8.0	10.3
1934	451.4	491.3	13.1	15.4
1935	465.1	507.4	13.6	16.0
1936	490.0	534.8	24.5	27.0
1937	508.4	555.9	18.1	20.8
1938	531.4	581.6	22.5	25.2
1939	559.9	612.8	28.0	30.7
1940	583.7	639.3	23.5	26.1
1941	657.4	702.5	72.9	62.6
1942	859.6	854.7	199.8	150.8
1943	1114.1	1028.4	250.2	171.1
1944	1292.1	1189.2	174.5	157.6
1945	1341.3	1241.2	48.0	50.8
1946	1154.3	1121.8	-183.5	-117.1
1947	1021.7	1047.6	-129.7	-72.8
1948	935.1	1004.3	-84.6	-42.5
1949	896.0	988.2	-38.3	-15.8
1950	886.1	986.4	-9.7	-1.7
1951	904.3	1008.6	17.9	22.0
1952	956.9	1062.5	51.9	53.1
1953	1007.8	1114.6	50.1	51.3
1954	1053.2	1162.5	43.8	47.0
1955	1088.0	1203.1	35.1	40.0
1956	1119.3	1241.5	30.7	37.7
1957	1146.7	1277.4	27.0	35.2
1958	1180.4	1319.9	33.0	41.8
1959	1218.9	1367.6	37.9	46.8
1960	1259.9	1417.6	40.3	49.2
1961	1309.5	1475.8	48.9	57.2
1962	1358.4	1533.1	48.1	56.2
1963	1412.9	1595.6	53.6	61.4
1964	1467.8	1658.7	54.1	61.9
1965	1523.7	1723.2	54.9	63.3
1966	1584.8	1793.2	60.3	68.7
1967	1644.3	1862.3	58.8	67.9
1968	1704.8	1932.9	59.7	69.3
1969	1756.8	1995.6	51.2	61.6
1970	1799.6	2049.6	43.3	53.0
1971	1841.1	2102.8	39.8	52.2
1972	1883.1	2156.1	41.5	52.3
1973	1918.0	2202.5	34.4	45.6
1974	1950.6	2246.8	32.1	43.6
1975	1981.7	2289.8	30.5	42.2
1976	2009.0	2329.3	26.7	38.7
1977	2030.0	2362.8	20.6	33.0
1978	2063.2	2408.3	32.5	44.7
1979	2092.4	2449.6	28.6	40.5
1980	2121.5	2490.9	28.5	40.6
1981	2144.3	2525.8	22.3	34.3
1982	2175.0	2567.6	30.0	41.0
1983	2202.2	2605.8	26.6	37.5
1984	2236.9	2650.8	33.9	44.1
1985	2285.5	2708.7	47.4	56.8

Table 2

FEDERAL AND STATE-LOCAL FIXED REPRODUCIBLE CAPITAL
(BILLIONS OF 1985$)

YEAR	FEDERAL				STATE-LOCAL			
	NET STOCK		NET INVESTMENT		NET STOCK		NET INVESTMENT	
	BEA	BRH	BEA	BRH	BEA	BRH	BEA	BRH
1927	75.1	80.1	-1.9	-1.3	268.3	289.3	15.7	16.5
1928	73.4	79.1	-1.7	-1.0	285.1	307.0	16.4	17.3
1929	72.3	78.8	-1.1	-0.3	301.4	324.3	16.0	17.0
1930	72.1	79.3	-0.2	0.6	321.6	345.5	19.7	20.7
1931	73.0	81.1	0.9	1.7	341.4	366.4	19.4	20.5
1932	75.3	84.2	2.3	3.1	354.7	381.0	12.9	14.2
1933	79.2	88.9	3.9	4.7	358.9	386.7	4.1	5.6
1934	85.0	95.5	5.8	6.5	366.4	395.8	7.3	8.9
1935	92.8	103.9	7.7	8.4	372.4	403.5	5.8	7.6
1936	99.4	111.4	6.6	7.4	390.6	423.4	17.8	19.5
1937	105.2	118.0	5.7	6.6	403.3	438.0	12.4	14.2
1938	111.1	124.7	5.9	6.7	420.3	456.9	16.6	18.5
1939	118.0	132.3	6.9	7.6	441.9	480.5	21.1	23.1
1940	128.2	143.0	10.2	10.6	455.5	496.4	13.3	15.5
1941	195.7	197.5	66.8	54.1	461.7	505.0	6.1	8.5
1942	400.1	349.2	201.9	150.4	459.6	505.5	-2.1	0.5
1943	662.5	528.1	258.0	176.1	451.6	500.3	-7.8	-5.1
1944	849.3	694.9	183.1	163.4	442.7	494.4	-8.7	-5.8
1945	906.5	751.8	55.8	55.7	434.7	489.4	-7.9	-4.9
1946	721.2	630.9	-181.9	-118.5	433.1	490.9	-1.5	1.4
1947	581.2	546.4	-137.4	-82.9	440.4	501.2	7.7	10.1
1948	484.2	489.6	-95.4	-55.7	450.9	514.7	10.8	13.2
1949	431.2	456.5	-52.1	-32.4	464.9	531.7	13.8	16.6
1950	404.2	434.7	-26.4	-21.3	481.9	551.6	16.7	19.6
1951	404.9	436.3	0.6	1.7	499.4	572.3	17.3	20.3
1952	439.6	469.3	34.3	32.6	517.3	593.3	17.6	20.6
1953	470.5	498.3	30.5	28.7	537.2	616.4	19.6	22.7
1954	488.5	515.5	17.7	17.1	564.7	646.9	26.1	29.9
1955	494.8	524.5	6.3	8.9	593.2	678.6	28.7	31.0
1956	496.5	530.1	1.7	5.6	622.8	711.4	29.0	32.2
1957	492.2	530.9	-4.1	0.9	654.5	746.5	31.1	34.3
1958	491.7	535.6	-0.5	4.8	688.7	784.3	33.5	37.0
1959	495.4	544.7	3.7	9.0	723.5	822.9	34.1	37.7
1960	501.8	556.3	6.4	11.5	758.1	861.4	33.9	37.7
1961	513.4	572.3	11.4	15.9	796.2	903.5	37.5	41.3
1962	523.2	586.3	9.7	13.9	835.2	946.8	38.3	42.3
1963	534.6	601.5	11.2	15.1	878.3	994.2	42.4	46.4
1964	543.3	614.0	8.6	12.4	924.5	1044.7	45.5	49.5
1965	549.9	624.6	6.5	10.6	973.9	1098.6	48.4	52.7
1966	557.4	636.4	7.4	11.8	1027.5	1156.7	52.9	57.0
1967	558.2	642.3	0.8	5.9	1086.2	1220.0	58.0	62.0
1968	557.4	647.0	-0.8	4.7	1147.4	1285.8	60.5	64.6
1969	554.4	649.9	-2.9	2.8	1202.4	1345.7	54.2	58.7
1970	550.2	651.7	-4.2	1.8	1249.4	1397.8	47.5	51.2
1971	546.4	654.2	-3.7	2.5	1294.7	1448.5	43.5	49.7
1972	548.6	662.1	2.1	7.8	1334.5	1493.9	39.4	44.5
1973	547.7	666.6	-0.9	4.5	1370.3	1535.8	35.3	41.1
1974	544.1	668.2	-3.6	1.6	1406.6	1578.6	35.7	42.0
1975	544.8	673.8	0.7	5.6	1436.9	1616.0	29.9	36.7
1976	547.3	681.0	2.5	7.1	1461.7	1648.2	24.2	31.6
1977	551.0	689.1	3.6	8.1	1479.0	1673.7	17.0	24.9
1978	563.2	705.1	12.0	15.8	1500.0	1703.2	20.5	28.9
1979	574.8	719.8	11.3	14.4	1517.7	1729.8	17.3	26.1
1980	586.3	734.2	11.3	14.2	1535.2	1756.7	17.2	26.4
1981	598.3	748.5	11.7	14.1	1546.0	1777.2	10.6	20.1
1982	621.6	772.9	22.8	23.9	1553.4	1794.7	7.2	17.1
1983	641.9	793.9	19.9	20.6	1560.3	1811.9	6.8	16.9
1984	665.9	817.8	23.5	23.5	1571.0	1833.0	10.4	20.6
1985	698.7	849.4	31.3	31.1	1586.8	1859.3	16.1	25.7

We estimate that the net government fixed reproducible capital stock exceeds $2.7 trillion dollars, having more than doubled in real terms since World War II. As can be seen in Figure 1, the broad trends of our estimates are consistent with those of the BEA, which is not surprising since we use their gross investment data and most of their service lives. Nevertheless, there are important differences between the two series regarding both the level and postwar growth of the government capital stock. Our 1985 estimate is 19% higher than that of the BEA, while at the end of World War II our value was 8% lower.[14] The BEA's estimate of the postwar growth in net government capital is more than 40% below ours.

With the exception of World War II, state and local government capital stocks have been larger than those of the federal government, as shown in Figure 2. Currently, state and local governments own 69% of total government fixed reproducible capital. Except during military buildups, state and local governments provide an even larger fraction of total government investment, as can be seen in Figure 3. The surges in federal investment roughly coincide with World War II, the Korean and Vietnam Wars and the Reagan defense buildup.

We attempted to reproduce the BEA estimates from the gross investment and service life data. We exactly succeeded for several categories, but were slightly off on others. We believe the differences result from our incomplete data on BEA adjustments for intersectoral transfers. To correct for this and other possible statistical discrepancies, we subtracted the excess of our straight-line estimates over the BEA's from our BRH estimates.

14. The different trend is due to the smaller share of equipment in government investment in the postwar years. See Boskin, Robinson, and Roberts (1986) and Boskin, Robinson, and Huber (1987) for further discussion and detailed estimates.

Figure 1.

BRH AND BEA TOTAL GOVERNMENT FIXED REPRODUCIBLE NET CAPITAL, AND BRH ESTIMATES INCLUDING REAL NET REVALUATIONS

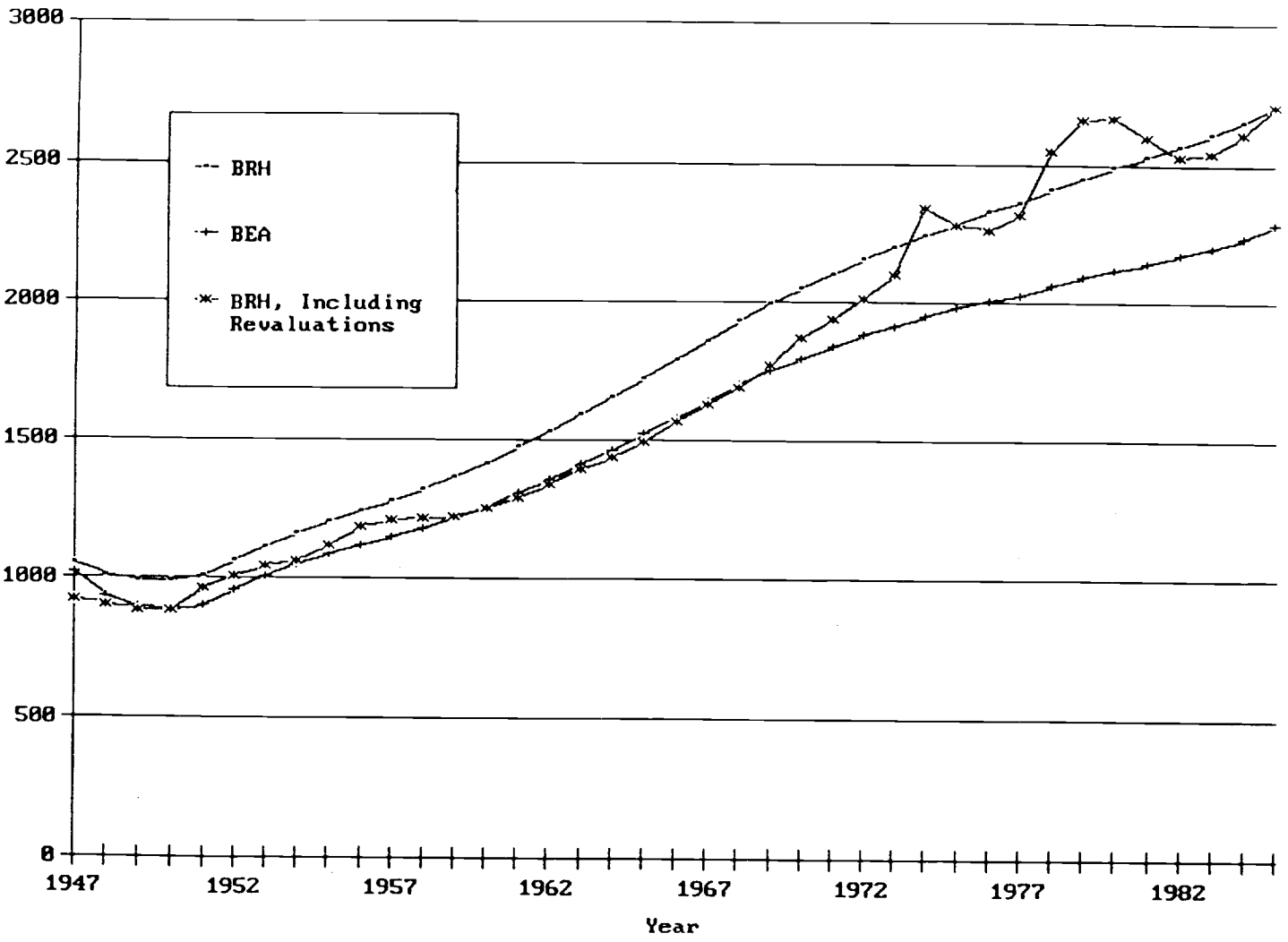


Figure 2.

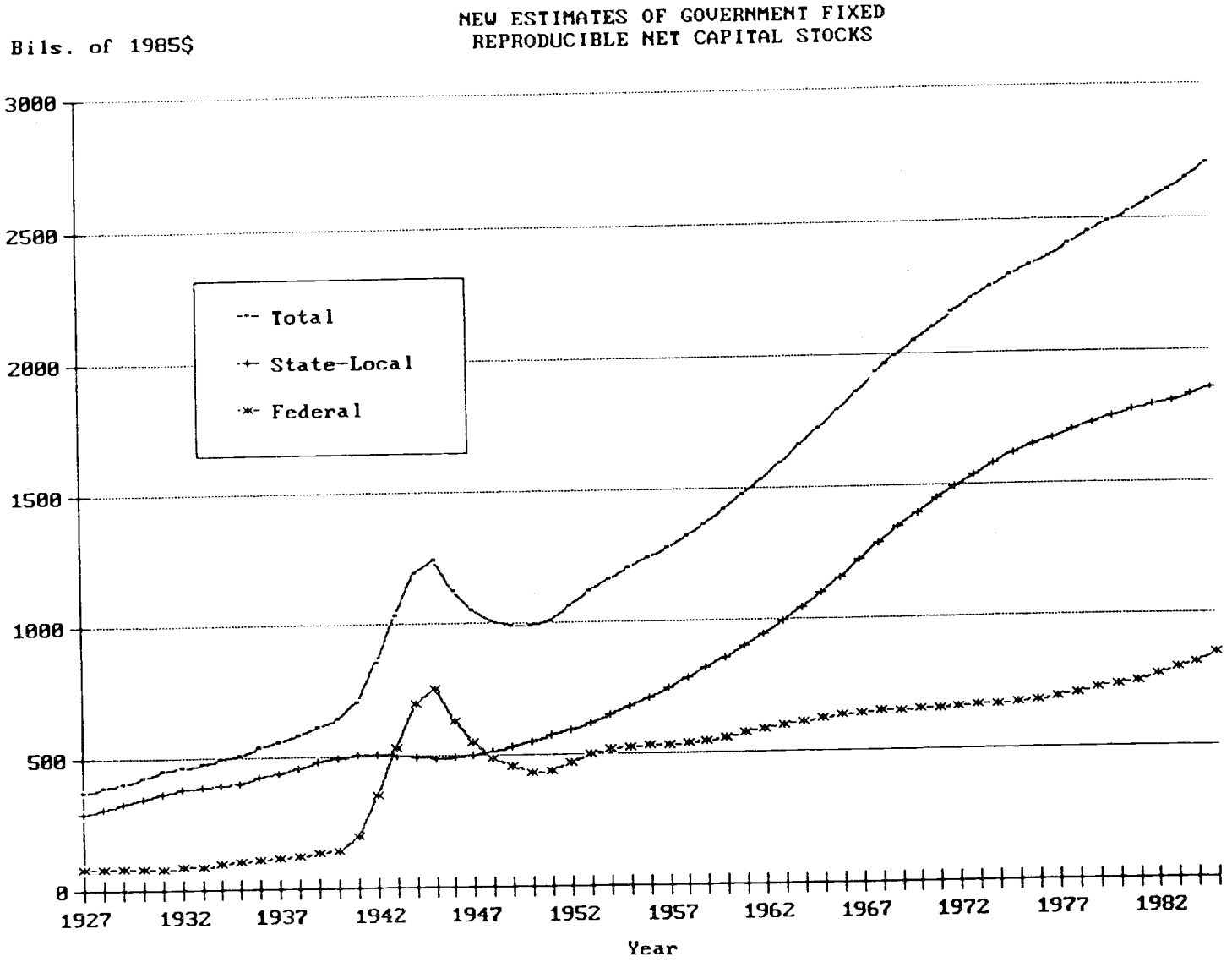
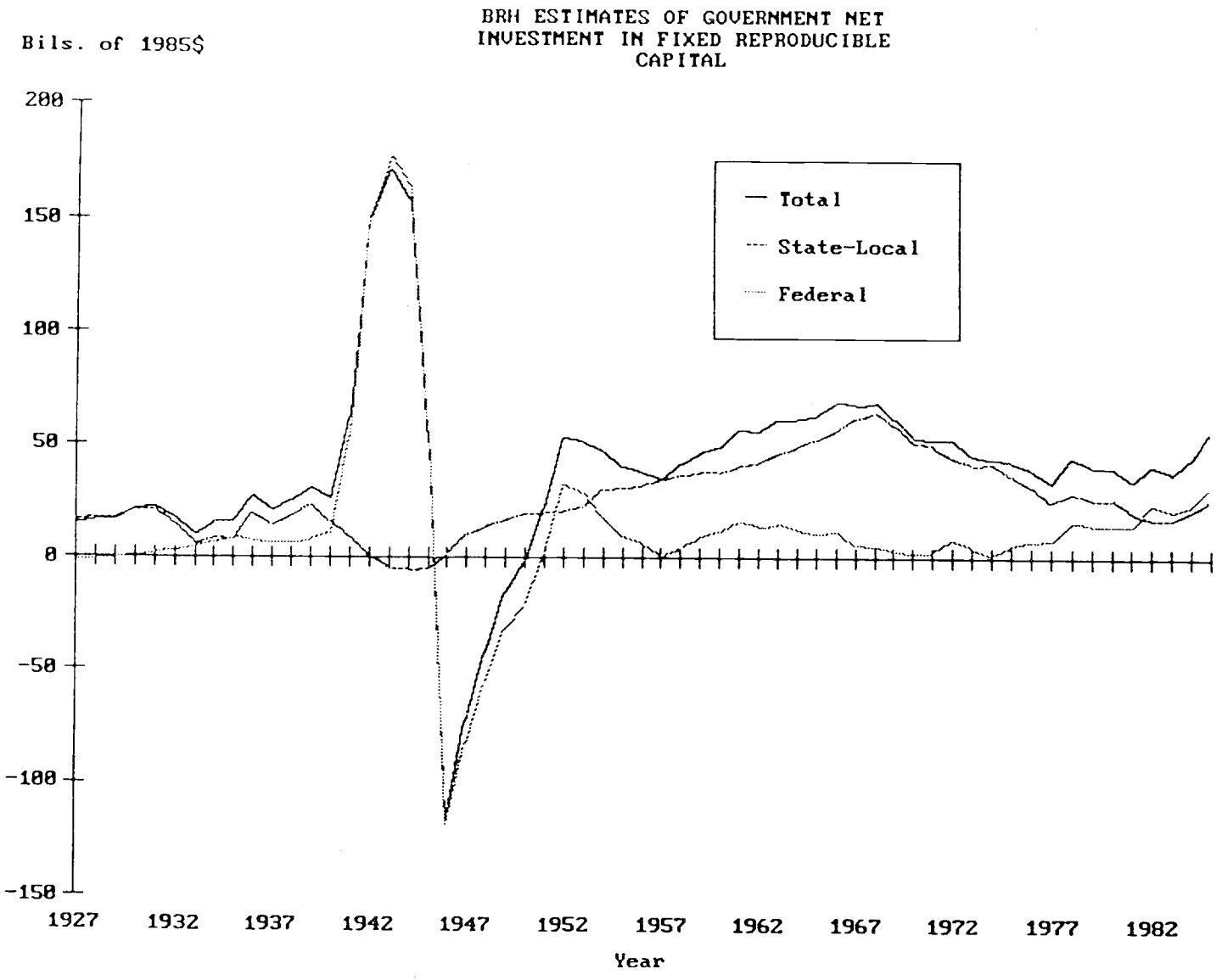

NEW ESTIMATES OF GOVERNMENT FIXED
REPRODUCIBLE NET CAPITAL STOCKS
Bils. of 1985$
3000
2500
2000
1500
1000
500
0
Total
State-Local
Federal
1927
1932
1937
1942
1947
1952
1957
1962
1967
1972
1977
1982
Year

Figure 3.


BRH ESTIMATES OF GOVERNMENT NET INVESTMENT IN FIXED REPRODUCIBLE CAPITAL
Bils. of 1985$
200
150
100
50
0
-50
-100
-150
1927
1932
1937
1942
1947
1952
1957
1962
1967
1972
1977
1982
Year
Total
State-Local
Federal

The behavior of the various components of federal and state and local investment and capital sheds light on several policy debates, though we can only touch on them in this paper. Figure 4 pictures the division of aggregate federal net investment between military and non-military. For a twenty-five year period beginning in 1954, the military and non-military series track fairly closely, with non-military investment usually slightly larger. Starting in 1979, however, the two series diverge, as military net investment has reached record postwar levels while civilian investment has dropped.

In Figure 5, we divide net state and local investment into three major categories: educational buildings, highways, and other. The "other" category is primarily other types of structures; equipment is less than 5% of the net state and local stock. The three components have a similar pattern: after disinvestment during World War II, all three reach peaks in the late 1960s and drop to troughs in the recent recession. The observed pattern of aggregate net investment, therefore cannot be attributed solely to the baby boom or the construction of the interstate highway system. The substantial levels of net investment in the highway and other categories, even in recessions, casts doubt on reports of a deteriorating infrastructure.[15]

---

15. Much of the worry about the infrastructure, however, concerns deferred maintenance. As Hulten and Peterson (1984) point out, maintenance is not counted as investment. If governments spend less on maintenance than the private sector, our depreciation estimates may be too low. Of course, we are also considering the entire state and local sector. The infrastructure may well be deteriorating in some areas while substantial investment goes on elsewhere.

Figure 4.

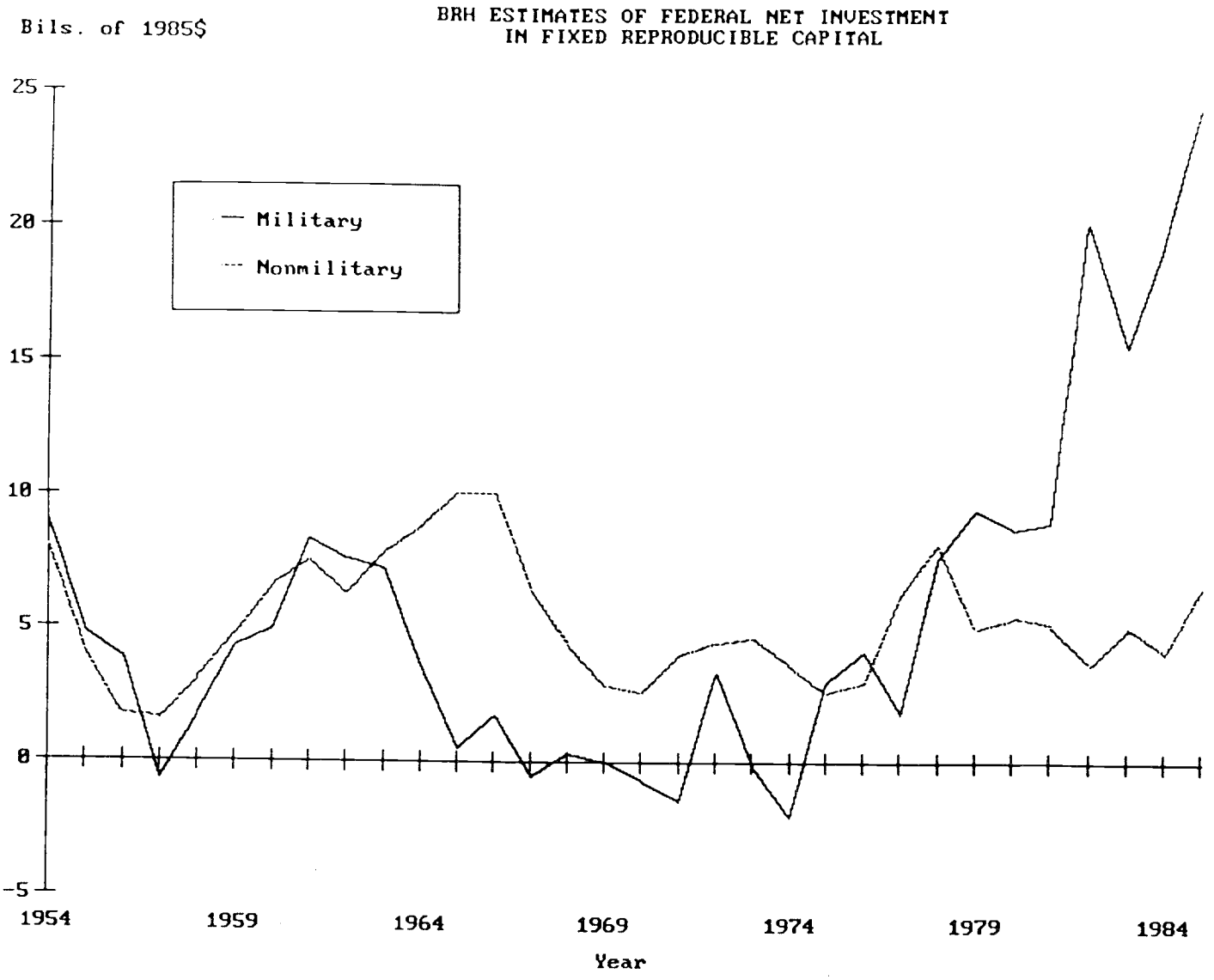
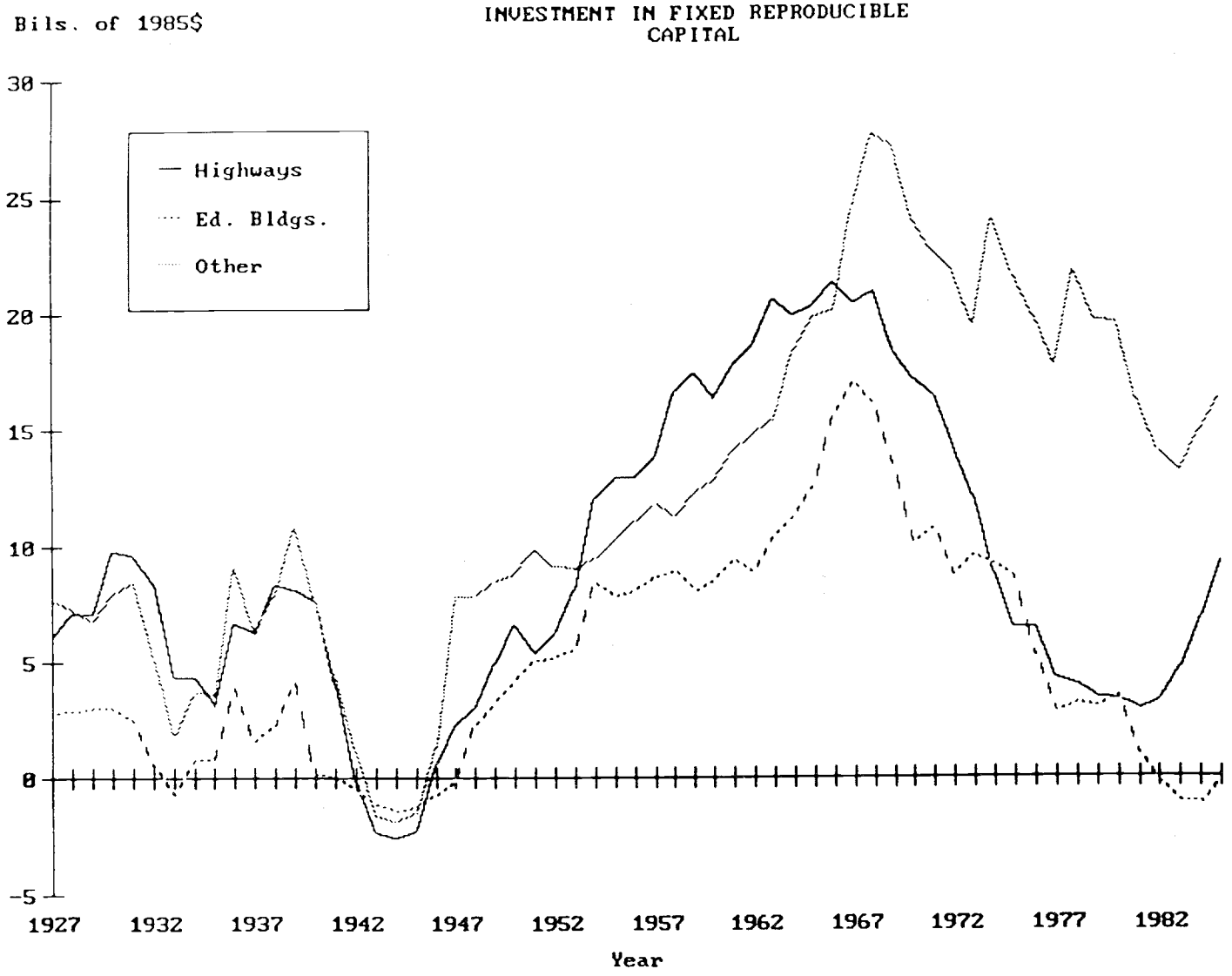

BRH ESTIMATES OF FEDERAL NET INVESTMENT
IN FIXED REPRODUCIBLE CAPITAL
Bils. of 1985$
25
20
15
10
5
0
-5
Military
Nonmilitary
1954
1959
1964
1969
1974
1979
1984
Year

Figure 5.

BRH ESTIMATES OF STATE-LOCAL NET INVESTMENT IN FIXED REPRODUCIBLE CAPITAL



Real Revaluations of Tangible Fixed Reproducible Capital

The data discussed above and presented in Tables 1 and 2 do not include net revaluations for tangible reproducible capital due to changes in capital goods prices relative to the general price level. They deflate current dollar figures by the BEA implicit deflators for each type of capital. Because real revaluations can be substantial (see Eisner (1980)), we present data on real revaluations (in constant 1985 dollars) of federal and state-local tangible fixed reproducible capital in Table 3. Real net revaluations are defined as the change in the value of capital minus real net investment and minus the change in the value of capital which would just compensate for changes in the general price level. Thus, real net investment (calculated from the specific implicit price deflators for investment goods) plus real net revaluations plus the real capital stock in period t-1 equals the real capital stock in period t (where the real capital stocks are just the current cost series as deflated by the repective end-of-year GNP deflator).[16]

As Table 3 reveals, both the federal and state-local sector have experienced substantial real capital gains and losses on their corresponding fixed capital stocks. The net revaluations were generally negative in the 1950s and 1960s, positive in the 1970s, and negative in the 1980s. While real revaluations are substantial in absolute dollars and relative to net

---

16. We have scaled the GNP deflator to equal 1.0 at the end of 1985. Eisner's (1980) definition of real net revaluations seems to be identical to ours. However, he deflates slightly differently. We believe our method coresponds more closely to the definition.

Table 3

Real Net Revaluations of Government Fixed Reproducible Capital
(Billions of 1985 dollars)

Year	State/Local	Federal	Total
1948	6.7	21.2	27.9
1949	-10.3	8.2	-2.1
1950	-3.0	2.0	-1.0
1951	33.9	22.8	56.7
1952	07.2	0.5	-6.7
1953	-22.7	6.5	-16.2
1954	-16.4	-8.1	-24.7
1955	6.8	8.3	15.1
1956	13.0	14.7	27.7
1957	-9.2	-2.4	-11.6
1958	-22.0	-11.1	-33.0
1959	-30.3	-13.5	-43.8
1960	-13.5	-4.2	-17.7
1961	-13.3	-2.5	-15.8
1962	-4.6	-3.6	-8.3
1963	-3.6	-0.1	-3.7
1964	-15.6	-3.0	-18.6
1965	-4.6	-3.7	-8.3
1966	4.3	-1.9	2.4
1967	-5.5	1.5	-4.0
1968	-4.2	-2.0	-6.2
1969	12.5	1.7	14.2
1970	39.8	9.7	49.4
1971	12.2	0.2	12.4
1972	17.6	7.1	24.6
1973	33.9	4.7	38.7
1974	169.6	31.8	201.4
1975	-88.8	-17.0	-105.8
1976	-59.3	4.1	-55.3
1977	22.9	-2.6	20.3
1978	167.2	13.8	181.0
1979	53.6	18.8	72.4
1980	-40.6	7.5	-33.1
1981	-96.3	-6.3	-102.6
1982	-96.1	-13.6	-109.7
1983	-16.7	-5.4	-22.1
1984	27.6	-3.6	24.0
1985	47.8	-6.6	41.2

investment, they are modest relative to the capital stock. For example, the $170 billion and $32 billion real revaluations of state-local and federal capital stocks for 1974 amount to about 10% and 5% of the corresponding stocks, but were much larger than net investment. These large real capital gains were offset the following year by real losses approximately one-half as large. Indeed, cumulating the combined state-local and federal net revaluations from 1948-85 yields a total of about $160 billion, or 6% of the estimated 1985 real net stock excluding revaluations. Thus, while the year-to-year fluctuations are important, the overall cumulative real wealth effect of revaluations has been quite modest, as is evident from Figure 1. In principle, one would add real net revaluations to real net investment to obtain total net capital formation for each year. Since we often wish to compare gross or net investment spending with borrowing, we adopt the procedure here of separate presentations of real revaluations, but do include the values adjusted for revaluations in the balance sheets in Section 11.

3. Government Inventories

The focus of the previous section was on government equipment and structures, but inventories are an important part of government reproducible capital, at least at the federal level. Table 4 presents estimates of inventory stocks and investment for both the federal government and the government sector. These are unpublished BEA series

Table 4

FEDERAL AND TOTAL GOVERNMENT INVENTORY STOCKS AND INVESTMENT
(BILLIONS OF 1985 DOLLARS)

	FEDERAL STOCK	FEDERAL INVST.	TOTAL STOCK	TOTAL INVST.	TOTAL REAL REVALUATIONS
1926	3.0	0.0	3.2	0.0	
1927	3.1	0.1	3.3	0.1	
1928	3.1	0.1	3.4	0.1	
1929	3.2	0.1	3.4	0.0	
1930	3.3	0.1	3.6	0.1	
1931	3.4	0.1	3.7	0.2	
1932	3.5	0.1	3.9	0.1	
1933	3.6	0.1	4.0	0.1	
1934	4.7	1.1	5.1	1.2	
1935	4.8	0.2	5.3	0.1	
1936	4.2	-0.7	4.6	-0.7	
1937	4.7	0.5	5.1	0.5	
1938	7.0	2.3	7.4	2.3	
1939	9.4	2.4	9.8	2.5	
1940	13.7	4.3	14.2	4.3	
1941	28.5	14.8	28.9	14.8	
1942	62.2	33.7	62.6	33.7	
1943	113.9	51.7	114.3	51.7	
1944	173.8	59.9	174.2	59.9	
1945	208.4	34.6	208.8	34.6	
1946	173.5	-34.9	173.9	-35.0	
1947	139.4	-34.1	139.8	-34.1	
1948	107.5	-31.9	107.9	-31.9	-21.1
1949	91.2	-16.3	91.7	-16.2	-4.5
1950	80.6	-10.6	81.1	-10.6	-9.3
1951	88.2	7.6	88.6	7.6	-3.5
1952	112.4	24.2	112.9	24.2	-6.0
1953	145.8	33.3	146.2	33.3	16.7
1954	162.2	16.5	162.7	16.5	30.2
1955	161.2	-1.0	161.8	-0.9	10.1
1956	160.1	-1.2	160.6	-1.2	-7.9
1957	159.1	-0.9	159.6	-0.9	-11.8
1958	160.2	1.1	160.8	1.2	-4.9
1959	155.5	-4.7	156.3	-4.5	-4.6
1960	150.8	-4.7	151.6	-4.7	-4.9
1961	144.5	-6.3	145.3	-6.3	-4.0
1962	146.5	2.0	147.3	2.0	-6.8
1963	150.7	4.2	151.6	4.3	-3.0
1964	147.2	-3.5	148.2	-3.4	-1.2
1965	139.0	-8.2	140.1	-8.1	-3.3
1966	135.3	-3.6	136.5	-3.5	-8.0
1967	141.9	6.5	143.2	6.6	-4.2
1968	144.6	2.8	146.1	2.9	-4.9
1969	158.8	14.2	160.4	14.4	-5.5
1970	152.5	-6.3	154.4	-6.1	-5.4
1971	147.2	-5.4	149.2	-5.2	-4.7
1972	135.8	-11.4	137.9	-11.3	0.2
1973	127.6	-8.2	129.8	-8.1	1.3
1974	132.1	4.5	134.4	4.6	5.7
1975	128.8	-3.3	131.3	-3.0	1.2
1976	127.9	-0.9	130.6	-0.7	3.1
1977	131.5	3.6	134.5	3.9	3.3
1978	137.1	5.6	140.2	5.7	0.8
1979	132.7	-4.5	135.6	-4.6	18.7
1980	132.3	-0.4	135.2	-0.4	6.6
1981	138.0	5.7	140.8	5.6	-2.6
1982	156.6	18.6	159.5	18.7	-1.5

updated by us to 1985 dollars.[17]

Government inventories are substantial, exceeding $200 billion dollars in 1985, finally surpassing the World War II peak. Almost all the inventories are held by the federal government; for most years, state and local governments had less than 1% of the total. Figure 6 illustrates that most of these federal inventories are military, such as munitions. Not surprisingly, military inventories are quite volatile.

Non-military inventories have grown, however, from 5% of the stock in 1945 to almost 40% in 1985. A further breakdown of non-military inventories reveals that, in 1982, more than half were strategic stockpiles of minerals, nuclear materials, helium and oil (the Strategic Petroleum Reserve).[18] More than two-thirds of the remaining non-military inventories were surplus crops.

Real inventory stocks declined steadily from 1954 through 1980. Since then, inventory investment has taken off, reaching $33 billion in 1985. Inventory changes have a large effect on the level of net federal investment in reproducible capital, as shown in Figure 7. Net federal investment in structures and equipment has been positive every year since 1950, according to our estimates. When inventories are added in, however,

---

17. The data were kindly provided to us by John Musgrave. We are also grateful to Paul Pieper for his assistance. The BEA 1982 constant dollar estimates of federal government military and nonmilitary, and state and local government, inventories were each updated to constant 1985 dollars by multiplying by the ratio of the 1985 BEA current dollar stock to the 1985 constant (1982) dollar stock for each type. Inventory investment was then calculated as the change in net stock from the previous year.

18. This breakdown was provided to us by Paul Pieper, based on BEA data.

Figure 6.

FEDERAL INVENTORY STOCKS

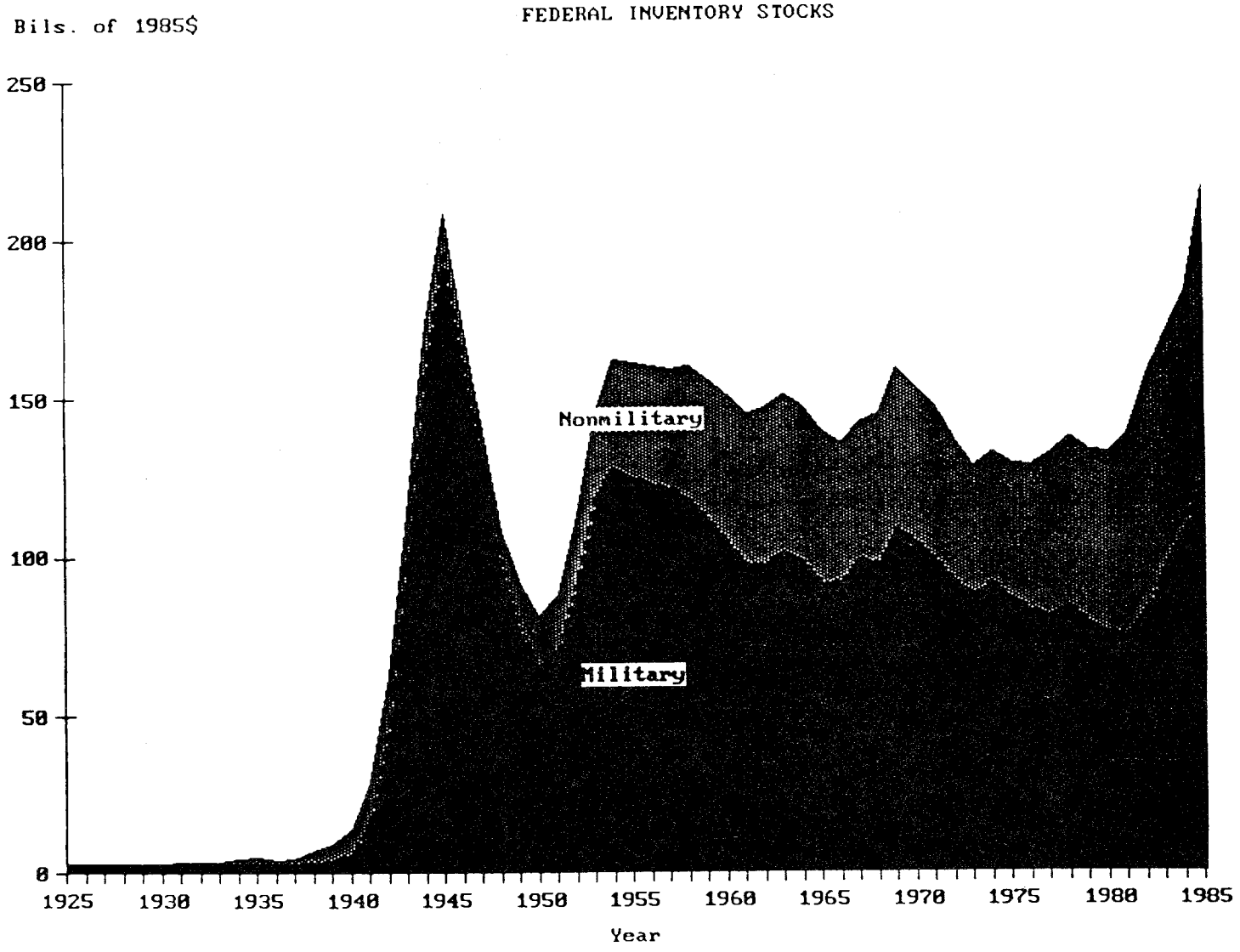
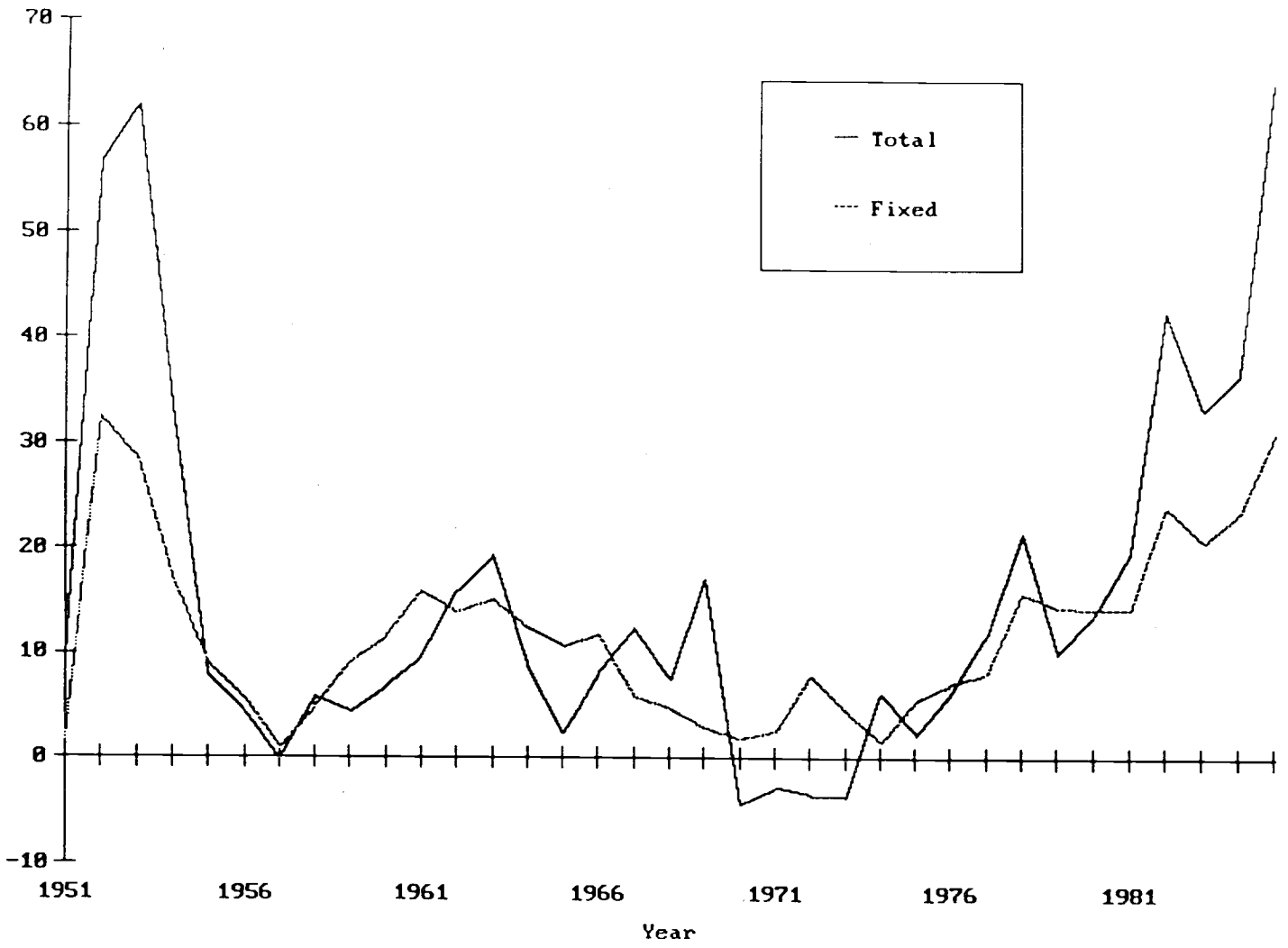


Figure 7.

FEDERAL GOVERNMENT NET INVESTMENT IN REPRODUCIBLE CAPITAL: TOTAL AND EXCLUDING INVENTORIES (FIXED)



net federal investment becomes negative in 5 of the last 35 years. When inventories increase, as in the '80s, the impact is also large: more than half of our estimated $64 billion in net federal investment in 1985 is inventory investment.

Real Inventory Revaluations

As with fixed reproducible capital, real net revaluations may occur for government inventories. Table 4 includes a column on estimated real inventory revaluations defined analogously to that for the fixed reproducible capital stock. These data reveal that capital losses on inventories occurred in every year except 1953-55 and 1972-80. Cumulatively, the total real capital loss was approximately $70 billion, about one-third quarter of the value of the net stock excluding revaluations.

4. Comparisons with Private Capital

One of the purposes of this paper is to present more comprehensive measures of national product and investment. While we concentrate on government capital, consistency requires adjustments to private capital measures as well. These adjustments also allow a more accurate comparison between private capital and investment and our estimates for the government sector.

Our measures differ from the NIPAs in the treatment of consumer

durables and in our depreciation assumptions. As many have noted,[19] expenditures on consumer durables should be treated as investment, while an imputed service flow from these assets should be added to consumption. Accordingly, we add expenditures on consumer durables to gross private domestic investment.

In order to determine private capital stock and net investment, depreciation assumptions must be made. For the various classes of structures and equipment, we generally use the constant depreciation rates which were estimated and imputed by Hulten and Wykoff (1981).[20] For those categories whose service lives, as estimated by the BEA, changed, we imputed depreciation rates using the formulas described in section 2. For residential structures, we assumed a depreciation rate of 0.91/(service life) for the various components, as with most other categories of structures. For consumer durables other than vehicles, we followed Christensen and Jorgenson (1973) in assuming double-declining balance depreciation and we used the BEA's estimated service lives for the various components.[21] For vehicles, we took the depreciation rates for the corresponding business categories estimated by Hulten and Wykoff.

---

19. See Katz (1983) for a review of the literature on valuing the services of consumer durables.

20. Hulten and Wykoff only applied their rates through 1974. Recent work by Hulten, Robertson, and Wykoff (1986) suggests that depreciation did not shift substantially after the oil shocks. Hulten and Wykoff did not attempt to find a depreciation rate for residential capital, either.

21. The BEA methodology is described in Musgrave (1979). Kendrick (1976) also used double-declining balance for non-vehicle consumer durables. See Katz (1983) for a discussion of alternative depreciation assumptions for consumer durables.

Our estimates of the various components of the private capital stock are presented for selected years in 1985 dollars in Table 5. Our value for the total private capital stock in 1985 is $11.0 trillion, which is 16% above that of the BEA.[22]

Regardless of whether one takes our estimates or those of the BEA, the government sector clearly owns a large fraction of our national capital stock. As shown in Figure 8 and Table 5, total government tangible capital is 27% of the size of the private capital stock and is 55% as large as the stock of private nonresidential structures, equipment, and inventories. A comparison of government and private net investment is made in Figure 9. Government investment is much less cyclical than private investment and actually exceeded total private nonresidential investment in 1982.

5. New Estimates of Adjusted GNP, NNP, Government Consumption, Saving and Investment

The discussion above highlights the size of the government capital stock and investment. Governments create a large share of the national capital formation, and the failure to include the imputed return on government capital seriously distorts measures of total consumption and income. The inappropriate treatment of consumer durables also distorts our understanding of investment, income, and consumption. These issues are

---

22. Our depreciation estimates for residential and nonresidential structures are significantly lower than the BEA's, while our estimates of the depreciation of consumer durables are much higher.

Figure 8.

NEW ESTIMATES OF NET STOCKS OF PRIVATE AND GOVERNMENT REPRODUCIBLE CAPITAL

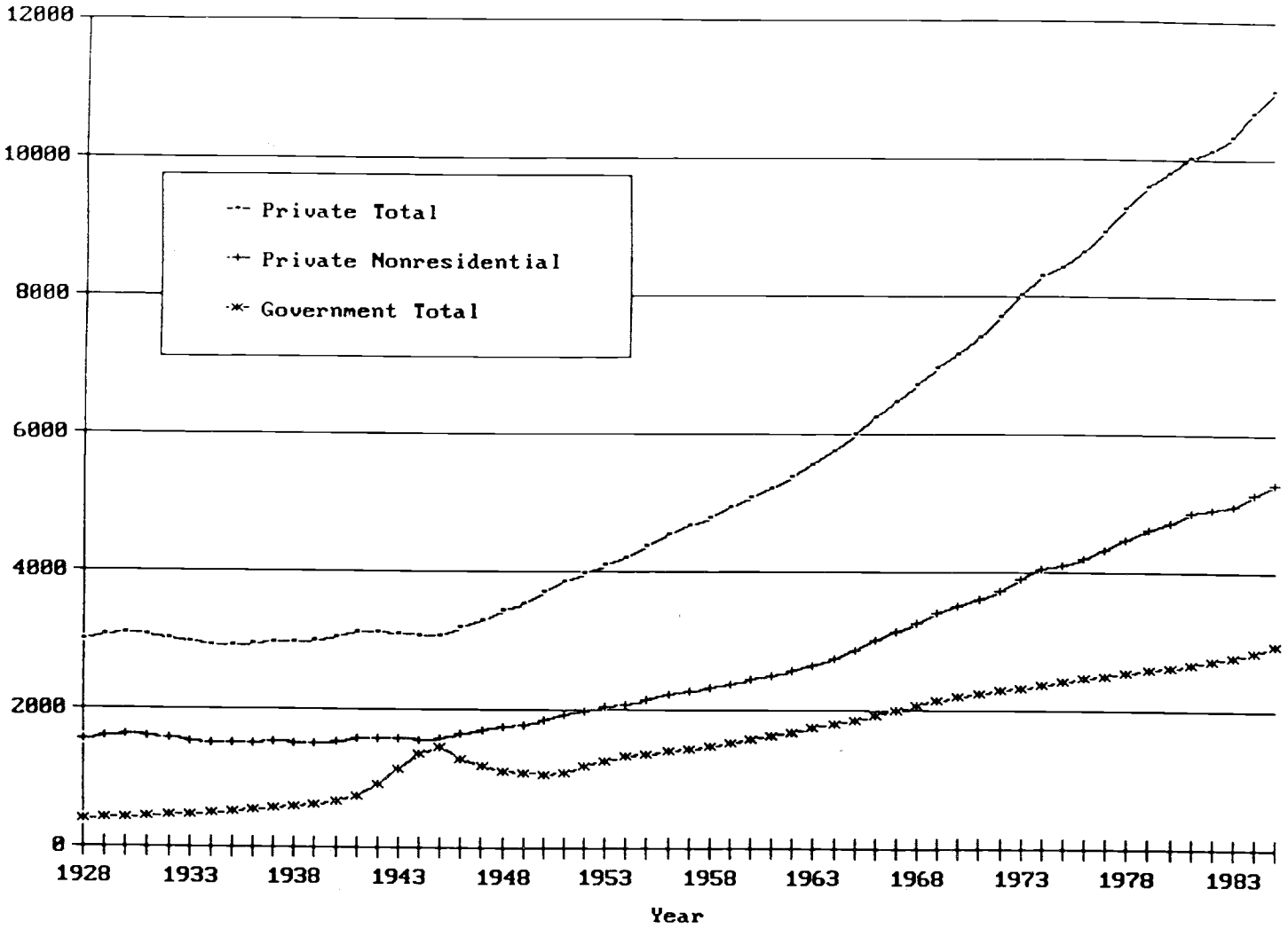


Table 5

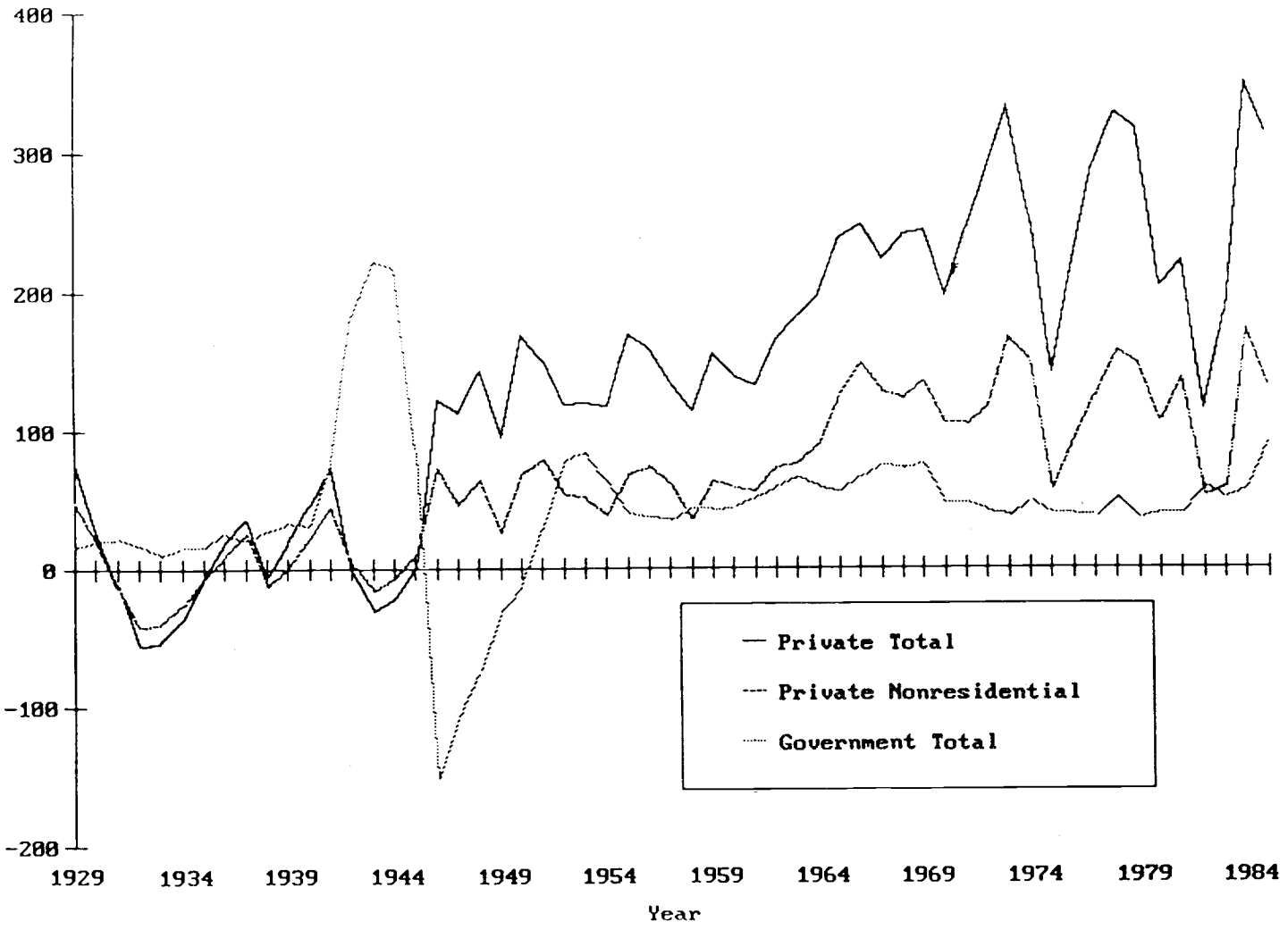
New Estimates of Net Stocks of Private and Government Reproducible Capital[a]
(billions of 1985 dollars)

	(1) Private Nonresi-tial	(2) Private Residen-tial	(3) Consumer Durables	(4) Total Private = (1)+ (2)+(3)	(5) State-Local	(6) Federal	(7) (5)+(6) as a % of (1)	(8) (5)+(6) as a % of (4)
1928	1,552.0	1,324.1	105.0	2,981.1	307.3	82.2	25.1	13.1
1935	1,495.2	1,336.3	88.8	2,920.3	403.9	108.8	34.3	17.6
1945	1,576.0	1,382.5	96.8	3,055.3	489.8	960.2	92.0	47.5
1955	2,146.9	2,008.2	227.1	4,382.2	679.1	685.8	63.6	31.1
1965	2,861.5	2,816.5	333.4	6,011.4	1,099.7	763.5	65.1	31.0
1975	4,102.1	3,754.0	581.7	8,437.8	1,618.5	802.6	59.0	28.7
1985	5,281.7	4,817.3	899.2	10,998.2	1,863.2	1,064.9	55.4	26.6

[a]Excludes revaluations.

Figure 9.

NEW ESTIMATES OF NET INVESTMENT IN PRIVATE AND GOVERNMENT REPRODUCIBLE CAPITAL



well-known (see, for example, David and Scadding (1974), Eisner and Nebhut (1982), Kendrick (1976), and Holloway (1987)). In this section, we present estimates of GNP and NNP including imputed rent to durables and government capital, and adjusted estimates of government and private consumption, saving and investment rates. The advantages of the work reported here, relative to earlier studies, include the following:

(1) The estimates of government and private depreciation are consistent with the best available empirical evidence.

(2) The depreciation assumptions are internally consistent, i.e., the estimates of rental prices of capital services are consistent with the corresponding estimates of capital stock. Unfortunately, the depreciation estimates of the BEA capital stock series and those used in the national income accounts are based on an internally inconsistent set of estimates of depreciation, stemming from an important paper presented at a previous NBER Conference on Income and Wealth by Denison (1957). Jorgenson and Griliches (1972) pointed out long ago that the Denison/NIPA approach to estimating depreciation is consistent with the basic economic concept of depreciation only if the relative efficiencies of capital of different ages decline geometrically.

(3) We impute a constant 3% real rate of return net of depreciation and maintenance to government capital and consumer durables. Given the illiquidity of most government capital and consumer durables, it is unlikely that the service flow from these assets fluctuates with any short-term variation in the real interest rate. A sensitivity analysis showed only

very minor changes to variations in the assumed real interest rate.[23]

(4) We include an imputed return for government land.

Table 6 presents a reconciliation for 1985 of GNP, NNP, private consumption, saving and investment, and government consumption, saving and investment based on the adjustments we have made. While real net revaluations might be included in net saving and investment, we do not do so here. First, these estimates are more readily comparable to the traditional figures. Second, we may wish to compare direct investment spending with various variables, not presuming revaluations were being forecast and used in decision-making. Further, they are more important for year-to-year variation than cumulatively. Finally, we often compare saving or investment to government borrowing. In the sections which follow we develop more comprehensive measures of changes in real assets and liabilities. One might

---

23. Martin, Landefeld and Peskin (1982) consider several methods for calculating the value of services of government capital net of depreciation. The current-cost framework values all vintages of capital at current prices and interest rates. This method would be appropriate if we were using a market value of government capital as set, for example, in a stock market, since the market would demand the same rate of return on all capital of similar risk. With our cost-base capital estimates, such a measure would overstate fluctuations as interest rates change.

A second method used by Martin, Landefeld and Peskin is a vintage framework, where investment in any year is assumed to meet a cost-beneift test with an interest rate appropriate to the year. They use a five-year average of nominal interest rates as their proxy for the discount rate used at the time of investment. It seems unlikely, however, that investment decisions vary with fluctuations in interest rates, particularly nominal rates. When inflation rates change, using nominal rates means that the real value of services would vary for the existing capital.

We prefer their third method of assuming a constant real rate of return. Martin, Landefeld, and Peskin use a 7% real rate, but we believe that is probably above the rate of return actually achieved on government capital. Hence, we use a 3% real rate. The calculations, particularly of saving rates, are quite insensitive to the constant real rate chosen.

Table 6

Comparison of Adjusted and Traditional
National Income and Product Accounts for 1985
(billions of 1985 dollars)

I. Gross National Product and Net National Product

	Adjusted	Traditional
Gross National Product	3,998.1	3,998.1
plus Rent on Govt. Reproducible Capital[1]	152.0	--
plus Rent on Govt. Land	25.5	--
plus Rent on Consumer Durables	317.1	--
equals adjusted GNP	4,492.7	--
less Depreciation of Private Capital[2]	380.1	437.2
less Deprec. of Govt. Reproducible Capital	97.1	--
less Depreciation of Consumer Durables	291.0	--
equals Net National Product	3,724.6	3,560.9

II. Government and Private Consumption

Total Government Purchases	815.4	815.4
plus Rent on Reproducible Capital & Land	177.5	--
less Government Gross Investment[3]	199.2	--
equals Adjusted Government Consumption	793.7	--
Personal Consumption Expenditures	2,600.5	2,600.5
plus Rent on Consumer Durables	317.1	--
less Gross Investment in Consumer Durables	347.0	--
equals Adjusted Private Consumption	2,570.7	--

III. Saving

	Adjusted	Traditional
Gross National Product	4,492.7	3,998.1
less Private Consumption	2,570.7	2,600.5
less Government Consumption	793.7	815.4
less Adjustments for net transfers & interest paid by govt. to foreigners & statistical discrepancy	30.8	30.8
equals Gross Saving	1,097.6	551.5
less Depreciation of Tradtn'l Private Capital	380.1	437.2
less Depreciation of Govt. Reproducible Capital	97.1	--
less Depreciation of Consumer Durables	291.0	--
equals Net Saving	329.4	114.3

IV. Investment

Gross Private Investment[3]	639.9	661.1
plus Govt. Gross Invest.in Reproducible Captl	187.1	
plus Gross Investment in Consumer Durables	347.0	
equals Gross Domestic Investment	1,174.0	661.1
less Depreciation of Private Capital	380.1	437.2
less Depreciation of Govt. Capital	97.1	
less Depreciation of Consumer Durables	291.0	
equals Net Domestic Investment	405.8	223.9

Notes:

[1]Rent equals opportunity cost plus depreciation. We assume a constant real interest rate of 3% in calculating opportunity cost for government capital and consumer durables. We apply this discount rate to midyear stocks for year t obtained by averaging the end of year stocks for years t and t-1. Because the return on government enterprise capital is, at least in theory, already included in GNP, we do not include imputed rent on government enterprise capital in our expanded measures of government consumption and GNP. See Martin, Landefeld, and Peskin (1982) for further discussion. All depreciation estimates used in the adjusted calculations are the authors', as described in Sections 2 and 4.

[2]This entry includes private equipment and nonresidential and residential structures. Consumer durables are listed separately. Inventories are assumed not to depreciate. The adjusted estimate is from the authors' calculations while the "traditional" entry is the NIPA capital consumption allowance.

[3]In the adjusted calculations gross investment data for fixed reproducible capital and consumer durables is from the 1986 BEA Wealth Data Tape, with our conversion to 1985 dollars based on BEA price indices. These series differ slightly from the NIPA series from which they are derived, because of adjustments for intersectoral transfers, for instance. Most of the difference between the gross private investment series presented here is in equipment. Government inventory investment is measured as the change in year-end stocks, based on BEA data converted to 1985 dollars. Government gross investment in land is based on estimates of yearly net acquisitions (see Section 8 for a discussion of our land estimates) and does not include revaluations.

well wish to compare, for example, government investment with the change in real net debt (the changes in the real value of financial liabilities in excess of financial assets) or even with an estimate of real "net worth". Again, we adopt the more conventional comparisons in this section, leaving the discussion of these other adjustments to subsequent sections. As can be seen, including the gross rent on government capital and consumer durables increases GNP by more than 10%, while including net rent and using our estimates of depreciation increases NNP by about 4%.

Government consumption likewise is slightly different from government purchases of goods and services as the rent on government capital was about $20 billion smaller than government gross investment. Private consumption, however, is quite close to NIPA personal consumption expenditures, as the estimated rental flow of services from the stock of consumer durables in 1985 (but not in general) is close to gross investment in durables. To total gross investment, we add approximately $190 billion of government investment and almost $350 billion of consumer durable investment. Thus, total gross investment is almost 80% larger than gross private investment as traditionally reported in the NIPA. Using our depreciation estimates, both for traditional private investment and for government capital and consumer durables, yields adjusted net national investment of $406 billion, also 80% larger than the NIPA figures.

Turning to saving, gross saving substantially exceeds NIPA gross private saving, about $1.1 trillion compared to $551 billion. NIPA net saving of $114 billion is only about one-third of our adjusted net saving.

Corresponding differences would be found in saving, investment, and consumption rates, although recall that NNP and GNP are slightly larger than the NIPA figures, so the proportionate increases would be slightly less. Table 7 presents estimates of U.S. saving and investment from

Table 7

Adjusted U.S. Saving and Investment, 1951-85
(as a % of expanded GNP, and taken from current dollar calculations)

	1951-60	1961-70	1971-80	1981	1982	1983	1984	1985
Total Net Saving	11.5	11.4	9.9	8.0	5.2	5.1	7.7	7.2
Net Private Saving	8.9	9.6	9.3	7.6	6.6	7.5	8.8	8.3
Net Govt. Saving	2.6	1.7	0.7	0.4	-1.4	-2.4	-1.2	-1.1
Fed. Govt. Saving	1.3	-0.0	-1.1	-1.1	-2.8	-4.0	-3.3	-3.0
Fed. Govt. Net Invst.	1.4	0.4	0.5	0.7	1.3	0.6	0.8	1.4
Fed. Govt. Surplus	-0.1	-0.4	-1.6	-1.9	-4.1	-4.6	-4.0	-4.4
State/Local Govt. Saving	1.3	1.7	1.8	1.5	1.4	1.7	2.1	1.9
S/L Govt. Net Invst.	1.4	1.7	1.0	0.5	0.4	0.4	0.5	0.6
S/L Govt. Surplus	-0.2	0.0	0.8	1.0	1.0	1.2	1.6	1.4
Total Net Invst.	11.6	11.3	9.9	8.1	5.2	5.3	7.6	7.1
Net Foreign Invst.	0.4	0.9	-1.1	-0.1	0.1	-1.0	-2.0	-1.9
Natl. Domestic Invst.	11.2	10.4	11.0	8.2	5.1	6.2	9.6	9.0
Private Dom. Net Invst.	8.3	8.3	9.5	6.9	3.4	5.2	8.3	7.1
Govt. Net Invst.	2.9	2.1	1.5	1.3	1.7	1.0	1.2	1.9
Fed. Govt. Net Invst.	1.4	0.4	0.5	0.7	1.3	0.6	0.8	1.4
S/L Govt. Net Invst.	1.4	1.7	1.0	0.5	0.4	0.4	0.5	0.6
Memo: Gross Natl. Saving	27.6	26.5	26.2	25.4	23.3	22.6	24.6	24.4
Gross Private Saving	22.1	22.6	23.5	22.9	22.6	22.8	23.7	23.3
Gross Govt. Saving	5.5	4.0	2.7	2.5	0.8	-0.2	0.9	1.1
Total Capital Consumption	16.1	15.2	16.3	17.4	18.1	17.5	16.9	17.2
Private Capital Consumption	13.2	12.9	14.2	15.4	15.9	15.4	14.8	15.0
Govt. Capital Consumption	3.0	2.3	2.1	2.1	2.2	2.2	2.1	2.2
Fed. Govt. Captl. Consmp.	2.2	1.4	1.0	1.0	1.1	1.1	1.1	1.2
S/L Govt. Captl. Consmp.	0.8	0.9	1.1	1.1	1.1	1.0	1.0	1.0

1951 to 1985, using our adjusted accounts, as percentages of adjusted gross national product. For the three decades from 1951 to 1980, we present simple averages of annual figures for the decade.[24]

The data reveal some interesting trends in total net saving and total net investment in the United States. Total net saving, while substantially higher than the traditional NIPA figures, has declined substantially relative to the 1950s and 1960s. It declined about 15% between the 1950s and 1960s on the one hand, and the 1970s on the other, and has deteriorated markedly in the 1980s. By 1985, the third year of an expansion, the total net saving rate, expanded to include government saving and saving in the form of consumer durables, was almost 40% below the average for the 1950s and 1960s. Net private saving (also substantially larger than the corresponding NIPA figures because of the inclusion of net saving in consumer durables) was only slightly below historical levels in 1984-5. Net government saving, however, which averages a substantial fraction of GNP in the 1950s and 1960s, and a modest fraction in the 1970s, turned negative from 1982 to 1985.

Federal government net saving turned sharply negative, and more than offset state-local government saving. Note here that saving is defined to adjust the traditional surplus or deficit figures for net investment. It is interesting to note, for example, that while the federal government borrowed 4.4% of adjusted GNP in 1985, federal government net investment was

---

24. While we have alternative estimates based on different combinations of deflators of the various components, the estimates reported here for comparability with the traditional national income accounts are presented as current dollar estimates for the corresponding period. The corresponding constant dollar figures are similar, but show a smaller rise in private consumption and fall in government consumption.

estimated as 1.4% of GNP, about one-third of the deficit figure. Whether the value of these assets the federal government was accumulating is properly measured by purchase price and should be thought of as representing a substantial available set of public assets to offset the growing public liabilities represented by the deficits is a question we do not address here.

The state-local government sector has always been a large net saver. In the period 1951-80, this was primarily because of net investment, for example, in educational buildings. In the 1980s, the pattern has changed. Net investment by state-local governments has fallen to one-third of its earlier historical level, perhaps desirably so in view of changing demographics. Counteracting this has been the swing to a very substantial state-local surplus, although the latter is heavily concentrated in pension plans, whose simultaneously accruing liabilities are not accounted for in these data.

Net investment in the United States has been more stable than national saving. Domestic investment was actually a higher fraction of national product in the '70s than in the '60s. The net domestic investment rate in 1984-85 was only 14% below its level from 1951-80, compared with a 32% drop in net saving rates. Making up for much of the savings decline of course, has been the substantial decline in net foreign investment (due both to a decrease in U.S. investment abroad and an increase in foreign investment in the U.S.), the other side of the trade deficit. Over 20% of domestic investment was financed from abroad in 1984-85.

Government net investment in 1985 was about at the same ratio of national income as over the previous three decades, although state-local government net investment had fallen substantially. Federal government net

investment heavily reflects the military buildup; in 1985, federal investment was at a level not attained since the 1950s.

It is worth mentioning that gross saving and investment rates were in the low to mid twenty percent range with the expanded definitions, with total capital consumption having risen from fifteen to sixteen percent in the 1951-80 period to seventeen to eighteen percent in the 1980s. Two-thirds of the difference between the net saving rates in the '60s and '80s is attributable to an increased rate of capital consumption. A similar rise is reported in NIPA, but the gross saving, gross investment, and depreciation figures are all substantially higher under the expanded definitions.

We present, in Table 8, estimates of gross and net saving rates on various adjusted bases. We start with the traditional NIPA basis, show the rates on an OECD basis (including government non-military investment, but neither government military investment nor consumer durables), and move to broader definitions. While the trends in these rates are important, perhaps at least as important is the fact that traditional comparisons between the United States and other countries are marred by numerous comparability problems, among the most important of which is the differential role played by government relative to private capital formation and net investment, especially military investment, on the one hand, and consumer durable purchases on the other. These comparisons are particularly misleading with respect to Japan (see Boskin and Roberts (1986)).

As the data in Table 9 and Figure 10 reveal, private consumption as a share of NNP has risen from 62.9% in 1950 and 63.7% in 1960 to 69.0% in 1985. This six percentage point rise -- about a 10% increase -- is close to the volume of traditional net private saving. Had private consumption remained at its 1950-60 ratio, and the government sector been unchanged, net private saving would have been almost doubled in 1985.

Table 8

Gross Saving Rates (Gross National Saving/GNP),[1]
Selected Years

	Exclude Govt Nonmilitary Investment (NIPA Basis)	Include Govt Nonmilitary Invstmt in Fixed Reproducible Capital (OECD Basis)	Include Govt Nonmilitary Invstmt in Fixed Reproducible Capital & Consumer Durables	All Govt. Invstmt & Consumer Durables
1950	17.8	20.3	24.7	23.9
1960	15.0	18.3	21.9	22.9
1970	13.8	16.8	21.3	21.8
1980	16.4	18.1	23.2	24.0
1985	13.8	15.5	22.2	24.3

Net Saving Rates (Net National Saving/NNP), Selected Years

1950	11.7	13.2	14.6	11.8
1960	8.2	10.6	10.9	11.1
1970	6.2	8.2	8.8	8.7
1980	7.7	8.5	8.7	9.2
1985	4.7	5.5	7.0	8.8

[1]These estimates are derived from 1985 dollar calculations. Denominators (GNP or NNP) in each column have been adjusted to include the relevant service value. Depreciation for each category is based on authors' calculations (see text).

Table 9

Private, Government and National Consumption
as % Expanded NNP, Selected Years

	Private Consumption/ NNP	Govt. Consumption/NNP			Natl Consumption/ NNP
		Total	Fedl	State-Local	
1950	62.9	23.5	13.8	9.7	86.4
1960	63.7	25.1	14.4	10.7	88.8
1970	65.4	25.6	12.7	12.9	91.0
1980	67.9	22.0	8.6	13.4	89.8
1985	69.0	21.3	8.7	12.6	90.3

Government consumption, as shown in Figure 11, remains about 25% of NNP throughout the '50s and '60s, but has since declined to only 21.3% by 1985. This aggregate marks a ten percentage point decline in federal government consumption since the Korean War (despite the growth of the government capital stock) and a four percentage point rise in state-local government consumption. The former heavily reflects the growth of federal transfer payments (which by the mid 1970s exceeded purchases of goods and services) and the latter the demographic pressure of the baby boom on government spending on education.

The share of NNP devoted to national consumption has risen from about 86% in 1950 to over 90% by 1985. Though the consumption ratio has fluctuated substantially, partly for cyclical reasons, the continued upward trend is marked.

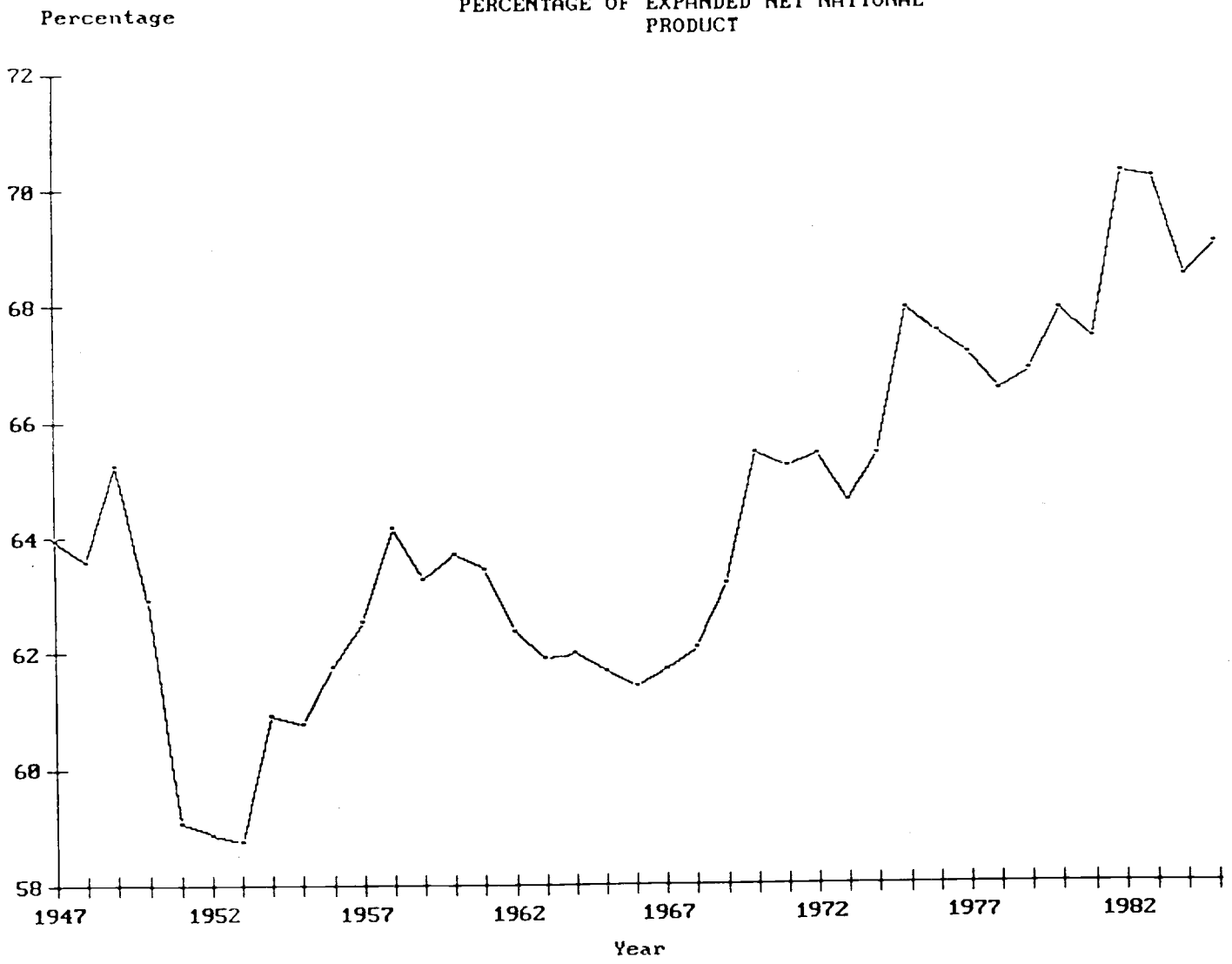
While the share of national product devoted to consumption has risen, the government's role in the trend is complex. While direct government consumption has fallen, part of the increase in the private consumption rate undoubtedly reflects the incentives created by growing government transfer payment programs and by tax policies. Thus, the decline in the national saving rate alluded to earlier reflects both the growth of the private consumption ratio -- partly resulting from government transfer payment growth -- and the decline in the net saving rate of the government sector -- indeed, its shift to net dissaver -- resulting both from historically large federal deficits and from the decline in state-local government net investment.

6. Government Financial Assets and Liabilities

The federal debt receives enormous attention from the press and

Figure 10.

ADJUSTED PRIVATE CONSUMPTION AS A PERCENTAGE OF EXPANDED NET NATIONAL PRODUCT



public. Little noticed is that governments also hold substantial financial assets, as well as off-budget liabilities. Though, as Boskin (1982) argues, the appropriate definition of deficits depends on the question being asked, the conventional measures of debt and deficits are not accurate answers to almost any of them.

The Federal Reserve's Flow of Funds presents balance sheets with financial assets and liabilities for both the federal and the state and local governments. As Eisner and Pieper (1984) point out, the Flow of Funds figures should be adjusted to reflect their market, rather than the par, value. They make a series of careful adjustments to the various components on the balance sheet.[25] Eisner (1986) updates the par-to-market conversions and extends them to state and local governments. The conversion factors are particularly large during periods of increasing inflation and interest rates, like 1980.[26]

Financial assets and liabilities in 1985 are presented for both levels of government in Table 10. We have made only Eisner and Pieper's par-to-market corrections to the Flow of Funds accounts.[27] The federal government had more than $1 trillion in financial assets. More than half of these were loans, but there was also more than $140 billion in cash, time deposits and gold. Conventional debt also understates liabilities,

---

25. The methodology is described in an appendix to Eisner (1986). Eisner and Pieper build on work by Seater (1981) and Cox and Hirschhorn (1983).

26. The large interest subsidies received by state and municipal bondholders and some borrowers from federal agencies might suggest further refinements of these adjustments if one were willing to contemplate sales of portfolios to the private sector which continued to carry tax advantages.

27. We are grateful to Paul Pieper for providing us with 1985 par-to-market indicies.

Figure 11

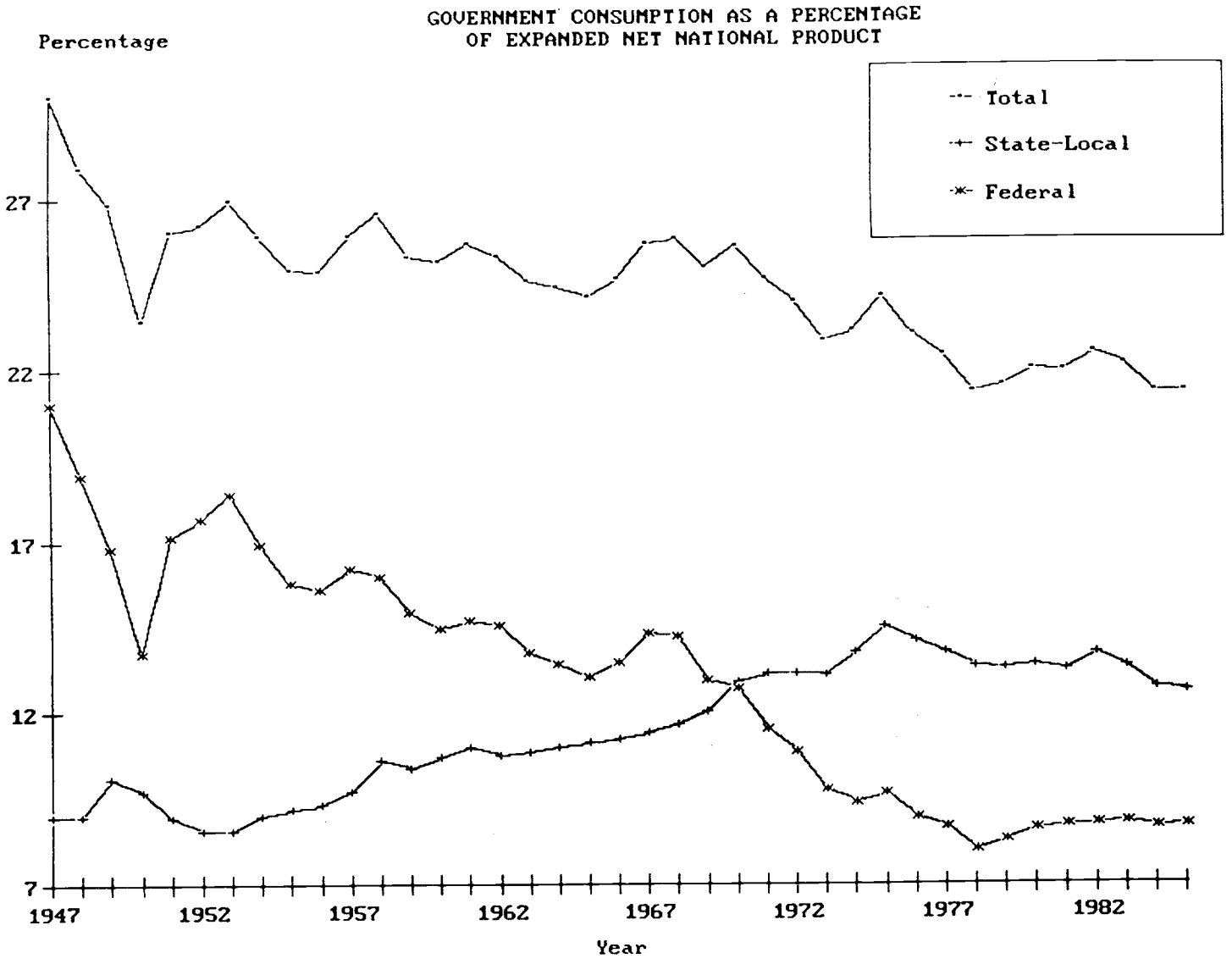

GOVERNMENT CONSUMPTION AS A PERCENTAGE
OF EXPANDED NET NATIONAL PRODUCT
Percentage
Total
State-Local
Federal
27
22
17
12
7
1947
1952
1957
1962
1967
1972
1977
1982
Year

Table 10
Federal Government Financial Assets and Liabilities, 1985
(Billions of 1985 dollars)[1]

Financial Assets	
Currency, demand & time deposits	53.4
Gold	86.4
Foreign Exchange & SDRs	32.1
U.S. Government Securities	205.8
Treasury Issues	194.3
Agency Issues	11.5
Mortgages	224.9
Other loans	317.7
Taxes receivable	10.6
Miscellaneous assets	100.2
Total Financial Assets	1,031.1
Financial Liabilities	
Treasury currency & SDR ctfs.	18.0
Demand deposits & currency	182.4
Bank reserves & vault cash	54.1
Credit market instruments	1,954.2
Treasury issues	1,590.1
Agency issues	279.4
Savings bonds	84.7
Insurance, retirement reserves	159.0
Misc. liabilities	92.3
Total Financial liabilities	2,460.0
Net Debt	1,428.9

State and Local Government Financial Assets and Liabilities, 1985
(Billions of 1985 dollars)

Financial Assets	
Currency, demand & time deposits	78.0
Security RPs	48.8
U.S. Government Securities	231.8
Treasury issues	166.3
Agency issues	65.5
State and local obligations	8.3
Mortgages	78.3
Taxes receivable	21.1
Total Financial Assets	466.3
Financial Liabilities	
State and local obligations	482.6
Short-term	18.5
Other	26.8
U.S. government loans	26.8
Trade Debt	23.0
Total Financial Liabilities	532.4
Net Debt	66.1

[1]Source: see text.

which include more than $250 billion in agency debt. State and local government financial assets exceeded $450 billion and were within $100 billion of their financial liabilities. Nearly half of state and local financial assets were federal government liabilities.

Figures 12 and 13 show the trends in financial assets and liabilities for the two sectors in 1985 dollars. Federal financial liabilities fell rapidly after the war, then changed relatively little in real terms through 1981. At the same time, federal financial assets were gradually rising in real terms. The difference, called by Eisner the net debt, was less than $600 billion in 1980, only slightly above its postwar low. In the last few years, of course, federal liabilities have exploded, and in 1985 they exceeded the 1945 peak for the first time. Since financial assets grew by only 10%, the net debt, as shown in Table 11, grew by 145%.

State and local government financial liabilities grew more rapidly than financial assets through 1971. Liabilities fell sharply in real terms in the late '70s, while financial assets continued their steady growth, so that net debt in 1985 was $66 billion, less than one-third its peak.

7. Government Oil and Gas Mineral Rights

Governments own a large fraction of the mineral rights in the United States. Federal and state governments own all mineral rights on offshore and tidal lands. In addition, all levels own the mineral rights under government land. For consistent accounting, the value of these assets should be counted as wealth and revenues from government-owned lands should be charged as sales of the assets.

Oil and gas rights are by far the most valuable to the government sector, though other minerals, particularly coal, may be more valuable in

Figure 12.

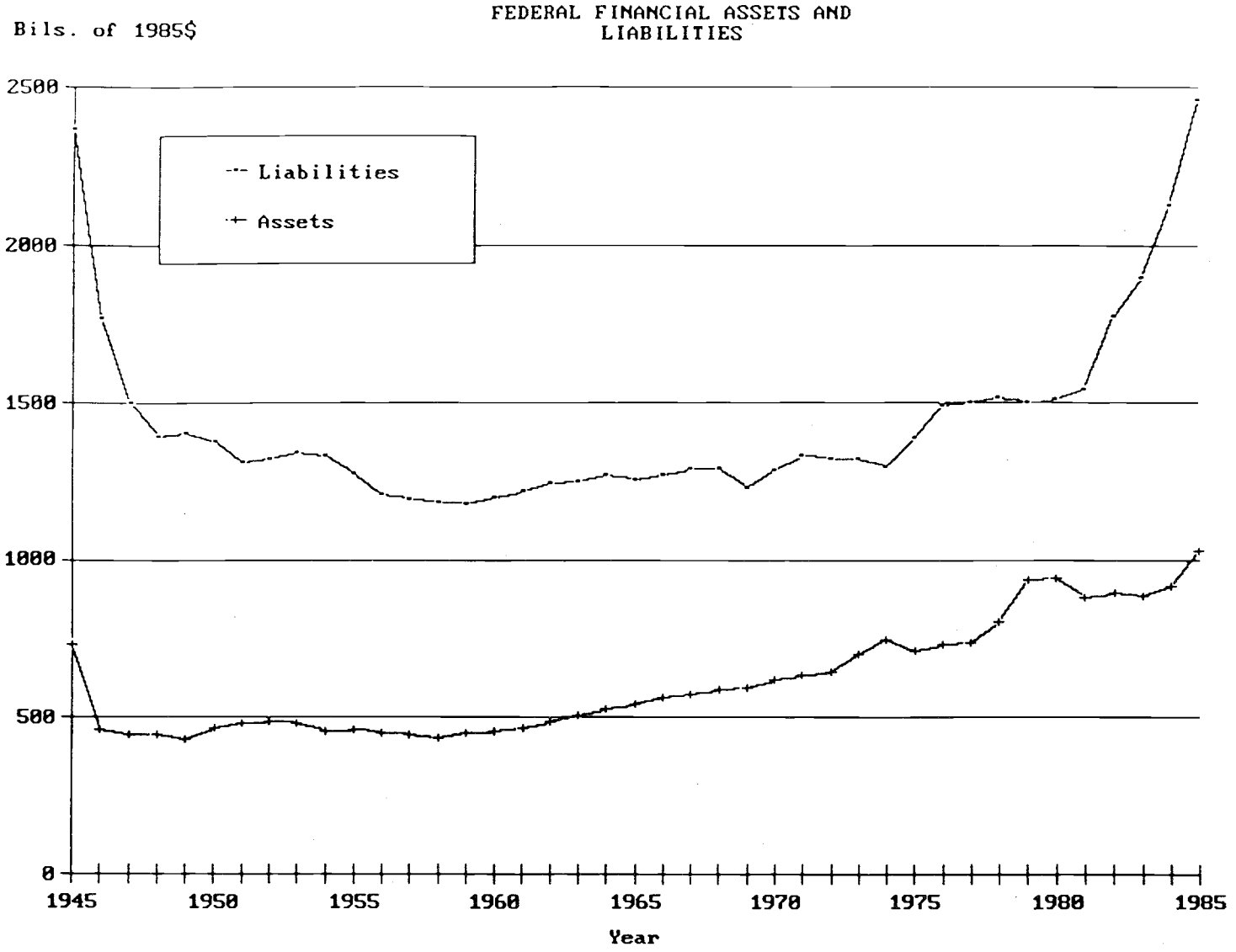

FEDERAL FINANCIAL ASSETS AND LIABILITIES
Bils. of 1985$
Liabilities
Assets
2500
2000
1500
1000
500
0
1945
1950
1955
1960
1965
1970
1975
1980
1985
Year

Figure 13.

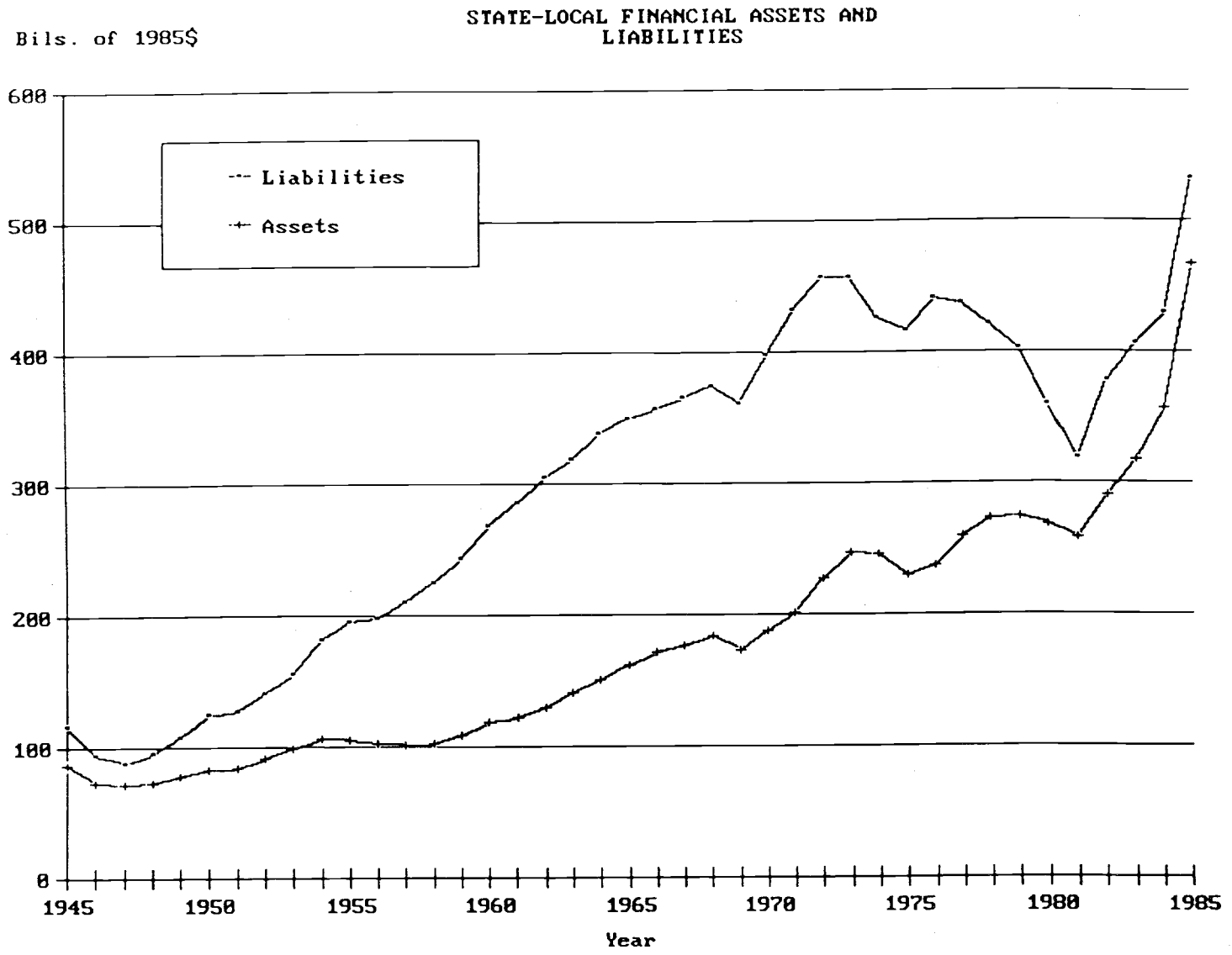

STATE-LOCAL FINANCIAL ASSETS AND LIABILITIES
Bils. of 1985$
600
500
400
300
200
100
0
Liabilities
Assets
1945
1950
1955
1960
1965
1970
1975
1980
1985
Year

Table 11

Net Debt and Change in Net Debt For
Federal, State and Local Governments
(billions of 1985 dollars)

	Federal Net Debt	Change in Federal Net Debt	State-Local Net Debt	Change in State-Local Net Debt
1946	1309.3	-325.6	20.7	-9.2
1947	1059.9	-249.4	16.7	-4.0
1948	950.4	-109.5	21.8	5.1
1949	980.6	30.2	29.9	8.2
1950	917.9	-62.7	41.6	11.7
1951	833.5	-84.4	43.2	1.6
1952	842.3	8.8	50.4	7.2
1953	865.6	23.2	57.4	7.0
1954	877.5	11.9	75.2	17.8
1955	817.6	-59.8	89.5	14.4
1956	758.8	-58.8	94.6	5.1
1957	749.3	-9.6	108.2	13.6
1958	753.3	4.0	123.4	15.1
1959	731.9	-21.4	134.1	10.8
1960	749.0	17.1	148.9	14.8
1961	753.3	4.3	163.6	14.7
1962	760.9	7.6	175.4	11.8
1963	744.3	-16.6	177.9	2.5
1964	746.3	1.9	187.4	9.5
1965	719.4	-26.8	187.4	-0.0
1966	710.4	-9.0	185.4	-2.0
1967	720.3	9.9	188.6	3.1
1968	704.3	-16.0	191.1	2.6
1969	633.7	-70.6	188.0	-3.1
1970	668.6	34.9	209.8	21.8
1971	697.1	28.5	231.7	21.9
1972	684.4	-12.7	229.9	-1.8
1973	621.5	-62.9	210.8	-19.1
1974	550.6	-70.8	181.0	-29.8
1975	675.1	124.5	187.0	6.1
1976	762.3	87.2	203.2	16.2
1977	764.6	2.4	178.3	-25.0
1978	715.5	-49.1	148.2	-30.0
1979	570.6	-145.0	128.5	-19.7
1980	574.5	4.0	91.2	-37.2
1981	664.0	89.5	59.4	-31.8
1982	882.1	218.1	87.3	27.9
1983	1015.1	133.0	88.9	1.5
1984	1215.3	200.2	73.0	-15.9
1985	1428.9	213.6	66.1	-6.9

some states. For the federal government, we correct, update, and convert to 1985 dollars the estimates of the value of oil and gas rights made by Boskin, Robinson, O'Reilly, and Kumar (1985).[28]

When a government leases the mineral rights in a particular area -- rights essentially to as yet undiscovered resources -- it has reduced its mineral wealth by transferring claims to part of it to the private sector. In return the government receives some payment immediately in the form of a bonus, with the rest of the payments deferred as royalties or rental payments. Bonuses are cash payments that are not conditional on the existence or size of the resource, and are typically the variable subject to bidding. Royalty payments are fractions, usually fixed in advance, of the gross revenue of the produced output, if any. By the time reserves are 'proven', their only value to the government is the present value of royalties they represent.[29]

The method used by BROK takes advantage of several institutional and theoretical characteristics of oil and gas production to value federal oil and gas rights with the limited information available.[30] The base-year

---

28. While revising and updating the data, we discovered a programming error underlying Table 1 of Boskin, Robinson, O'Reilly, and Kumar (BROK). We correct the series in Table 12. Fortunately, the qualitative conclusions of BROK are unaffected by the error, but the revised estimates are about one-third lower than in BROK.

29. We shall argue below, however, that severance taxes on the production should also be counted as royalties.

30. See BROK for a more complete description and discussion of the method. The following persons provided unpublished data or other assistance with this section: L. Cordova of the Minerals Management Service, D. Everitts and H. Gonzalez of the California State Lands Commission, S. Sharlot of the Texas General Land Office, B. Van Dyke of the Alaska Division of Oil and Gas, and C. Logsdon of the Alaska Department of Revenue.

value of oil and gas rights to the government is the sum of three components: future royalties on proven reserves; future royalties on estimated undiscovered reserves; and future bonuses on unleased land. Fortunately, royalties are historically fixed percentages of the gross revenues. Since the percentage is known, forecasting royalties requires forecasting production and prices. By definition, expected future production, with current prices and technology, is the sum of proven and estimated undiscovered reserves. Since oil and gas are exhaustible resources, there are theoretical, as well as empirical, reasons to expect increasing real prices. BROK assume that real prices will grow at the real rate of interest, since this is both convenient and roughly consistent with historical evidence and theory.[31] Bonuses on unleased land are assumed to be proportional to royalties on undiscovered resources.

BROK obtain the value of federal oil and gas rights in other years by making two additional assumptions. First, the quantity of oil and gas reserves changes only with production.[32] Second, the expected future price path at any date is proportional to actual prices at that

---

31. Without this assumption, one needs to know the rates of leasing, discovery, and production of the resources. See BROK for a justification. We consider alternative assumptions, as did BROK, below.

32. Since the government only receives royalty revenue on oil actually produced, it seems appropriate for a wealth calculation to use the best estimate of oil reserves, rather than have reserves fluctuate with changing geologic predictions. Reserve estimates should change, though, as prices and technology change. Given the assumption of rising real prices, however, oil which is not profitable to produce at current prices will probably become profitable in the future. Even using a reserve estimate made with high real prices (BROK use 1981 figures) will probably understate ultimate recovery of oil and gas.

date.[33] With these assumptions, capital gains or losses are proportional to price changes and the change in value from year to year is the capital gain less bonuses and royalties received.

The corrected values of federal oil and gas rights, converted to 1985 dollars using the GNP deflator, are given in Table 12. The magnitudes are enormous, particularly after the second oil shock. The 1980 value is the largest of any single asset on the federal balance sheet, substantially higher than structures, gold, mortgages, or inventories. It is almost as large as the net federal debt in that year. Even after the dramatic drop in world oil prices, we estimate the value of federal oil and gas rights exceeded one-third of a trillion dollars in 1986. As Figure 14 shows, changes in the value of federal rights can also be large, occasionally exceeding the conventionally measured budget deficit. Some volatility is appropriate since the method is designed to give a contemporaneous estimate of the value of mineral rights.

Before turning to state and local mineral rights, let us add some caveats. Our calculations are sensitive to estimates of undiscovered, economically recoverable reserves. As shown in BROK, the value of oil and gas rights could be up to 39% higher or 29% lower if one took the 5% or 95% bounds calculated by the U.S. Geological Survey (1981). The estimates are

---

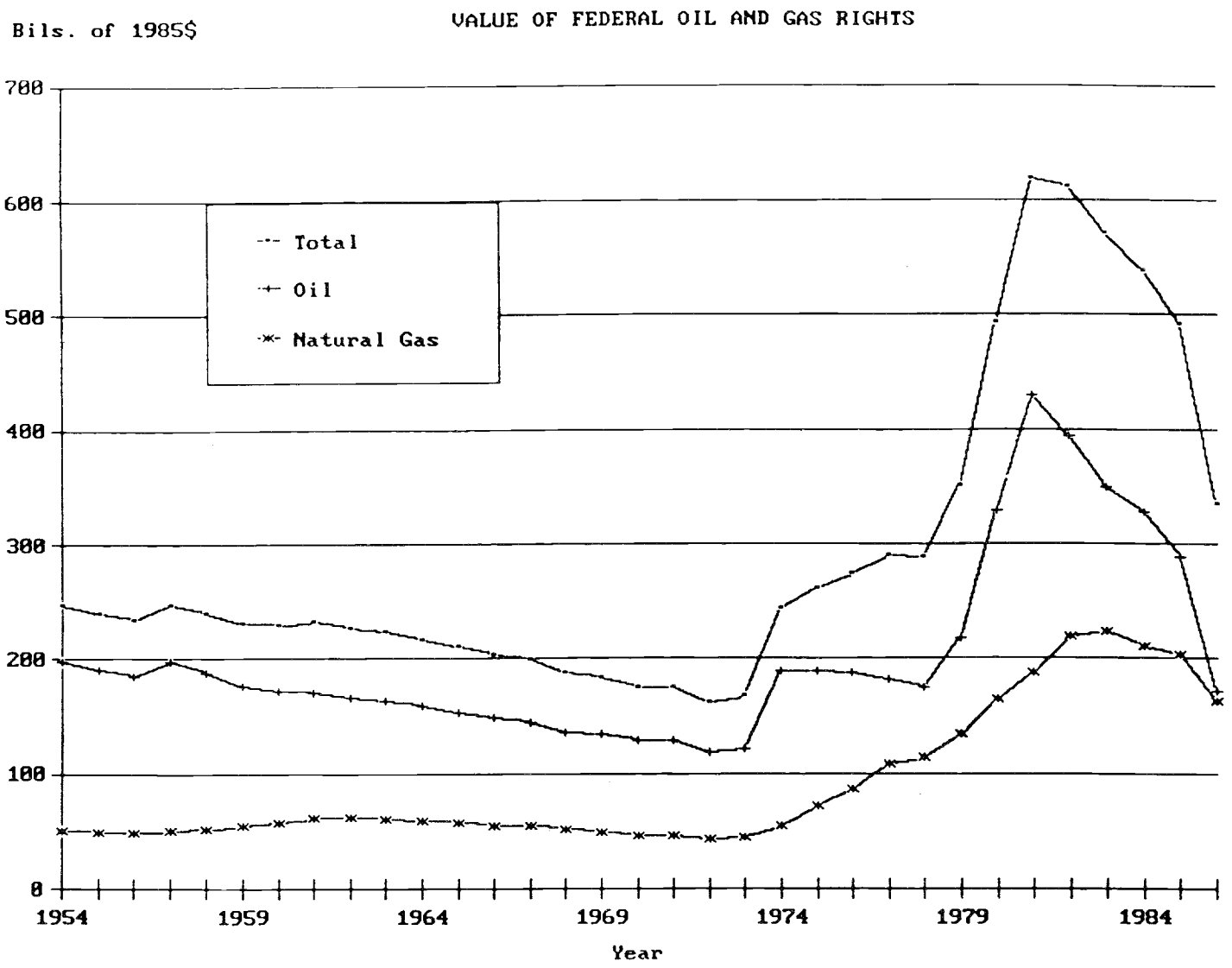
33. Implicitly, this assumes that oil and gas markets are in equilibrium each year.

Table 12

Value of Federal Oil & Gas Mineral Rights
(Billions of 1985$)

Year	Total	Oil	Gas	Change in Value
1954	247.2	197.1	50.0	
1955	239.0	189.8	49.2	-8.2
1956	234.1	184.5	49.6	-4.9
1957	247.1	196.9	50.2	13.0
1958	239.9	188.1	51.8	-7.2
1959	230.7	176.4	54.3	-9.2
1960	229.5	171.8	57.7	-1.2
1961	231.9	170.5	61.5	2.4
1962	226.8	165.7	61.2	-5.1
1963	223.3	162.4	60.9	-3.5
1964	216.9	158.6	58.3	-6.4
1965	209.8	152.7	57.1	-7.1
1966	202.9	147.8	55.1	-6.9
1967	198.8	144.7	54.0	-4.2
1968	186.6	135.2	51.5	-12.2
1969	182.9	133.6	49.3	-3.7
1970	174.7	128.0	46.7	-8.3
1971	175.0	128.3	46.7	0.4
1972	161.6	118.0	43.6	-13.4
1973	166.7	121.6	45.1	5.1
1974	243.0	188.5	54.5	76.3
1975	261.0	189.3	71.6	18.0
1976	273.7	187.7	86.1	12.7
1977	289.3	180.9	108.4	15.6
1978	287.9	173.7	114.1	-1.4
1979	350.7	217.3	133.3	62.8
1980	492.7	328.5	164.2	142.0
1981	618.2	430.3	187.9	125.5
1982	612.2	393.7	218.5	-6.0
1983	571.6	348.7	222.9	-40.7
1984	537.7	327.2	210.5	-33.9
1985	491.5	288.9	202.6	-46.2
1986	334.8	172.2	162.6	-156.7

Figure 14.


VALUE OF FEDERAL OIL AND GAS RIGHTS
Bils. of 1985$
700
600
500
400
300
200
100
0
Total
Oil
Natural Gas
1954
1959
1964
1969
1974
1979
1984
Year

also sensitive to the assumptions on price growth.[34]

Since state and local governments do not appear, for the most part, to keep records on either production or reserves on state-owned lands, it is difficult to make estimates of the value of oil and gas rights for them. We have obtained information from three states which account for more than 60% of U.S. oil production and a higher fraction of the value of state-owned oil and gas rights: Alaska, Texas, and California.[35]

By far the most valuable oil and gas rights are owned by the state of Alaska. More than 99% of Alaska's production is on state-owned land; this compares to an estimated 6.5% for Texas and 1.8% for California.[36] Since essentially all of Alaska's production is on state-owned land, it is artificial to treat taxes on petroleum differently than royalties. If the severance tax rate were lower, for example, royalty rates could be raised by the same amount without changing production or state revenues. Even the corporate tax on oil companies should be viewed as payment for oil rights; oil companies pay more than 90% of corporate income taxes and the formula

---

34. If prices grow more slowly than the interest rate by 1% or 2%, and we assume that 10% of proven reserves are produced and 3% of undiscovered reserves are proven each year, the value in 1981 would fall to $494 billion or $383 billion, respectively.

35. Production figures are from U.S. Dept. of Energy (1986a), Petroleum Supply Outlook, 1985. Except for Alaska, most oil and gas on state land is underwater. Louisiana is the only significant omission.

36. The figure for Alaska is based on a phone conversation with the state Department of Revenue (the quoted figure was 99.75%). The California and Texas percentages are based on mimeo sheets on "tide and submerged lands" with the Texas figure inferred from royalties, royalty rates, and an assumed price. No information was available on other state-owned land in either state.

for calculating the base was changed to maximize the take from the oil producers.[37] Accordingly, we include all petroleum taxes and royalties as part of the value of rights.

In 1985, Alaska's revenues from petroleum were $3.1 billion or $4.64 per barrel produced. Alaska had 7.1 billion barrels of proven oil reserves, so under the price growth assumption of BROK, these alone were worth at least $32.9 billion in 1985.[38] Alaska was estimated to have 6.9 billion barrels of undiscovered, economically recoverable oil onshore. If this was all on state land, the value of oil rights would have been $65 billion in 1985. Finally, the state was estimated to have 71 trillion cubic feet of natural gas either proven or undiscovered. If the value to the state of 10,000 cubic feet of gas were the same as a barrel of oil, this would make the total value of Alaskan oil and gas rights $98 billion in 1985.[39]

By comparison to Alaska, even Texas looks small. The average royalty rate on state-owned land was 12% and the severance tax rates were 4.6% for

---

37. Alaska changed from using a formula based on fraction of investment and employment in the state to one based on sales when the oil pipeline was completed. Percentage is calculated using figure is State of Alaska (1986).

38. Actually the figure is even greater, since Alaskan revenue increases more than proportionally with the world oil price and BROK assume rising oil prices. In part, this is due to the high transportation cost of Alaskan oil. The state is currently forecasting revenues of $1.70 per barrel for fiscal 1987, a drop of 63% from the 1985 figure with only a 44% drop in the world oil price. This makes calculating the value of oil and gas rights over time even more difficult.

39. Without a gas pipeline, the value of Alaska's gas is problematical.

oil and 7.5% for gas.[40] If the reserve-to production ratio is the same on private and state-owned land, the value of proven reserves of oil and gas on state land in 1985 was $2.2 billion and $1.6 billion respectively.[41] If state land contains the same fraction of undiscovered reserves as of production, the total value of Texas's oil and gas rights was roughly $12 billion in 1985.[42]

Since California has much smaller proven and estimated undiscovered reserves, and since the state owns a much smaller fraction of those reserves, the value of California's rights is lower by an order of magnitude. The state collects an average royalty of 16.5%. Under the BROK assumptions, the value of California's oil and gas rights were $0.8 billion in 1985, if the ratio of both undiscovered and proven reserves to production was the same on private and state land.

Our estimates of the total value of oil and gas rights in 1985 owned by the three states for which we have data is $110.8 billion. Using the method described by BROK, we adjust for royalty and bonus payments and price changes to create current dollar estimates for earlier years. Converting the estimate to 1985 dollars using the GNP deflator, we obtain an estimate

---

40. Royalty rates are based on the average of royalty rates on Relinquishment Act lands and State Fee lands weighted by the acreage in each category under lease. Severance tax rates were provided by the U.S. Advisory Commission on Intergovernmental Relations.

41. Reserve figures are from U.S. Dept. of Energy (1986b). Production on state land calculated using royalties, royalty rates, and a $26 per barrel price for oil and $2.60 per mcf price for gas.

42. Undiscovered reserve estimates were taken, as usual, from U.S. Geological Survey (1981). Texas figures are approximate, since the regions the U.S.G.S. used were not contiguous with state boundaries.

for state oil and gas rights in 1980 of $125 billion. We wish to stress, however, that data limitations forced several assumptions about the quantity and value of oil and gas reserves, both proven and undiscovered, on state land. In addition, we are limited to three states -- the most important omission being Louisiana -- and, due to a lack of royalty data, to the 1980s. Our 1980 estimate of the value of state oil and gas rights exceeds our figures for the value of any single category of financial asset on the state and local balance sheet or the value of state and local residential structures, equipment and inventories combined.

8. Government Land

Governmental units own substantial amounts of land in the United States, with the federal government alone holding nearly one-third of the nation's land area. In this section, we present annual estimates of the value of federal and state-local land from 1946 to 1985.[43] The estimates for 1946-51 are taken from Goldsmith (1962) and those for 1952-68 are from Milgram (1973). Our contribution is to update these series from 1969 forward. In doing this we follow Milgram's basic methodology with some modifications.

---

43. For a discussion of previous estimates of government land values and another version of estimates for the federal government, see Boskin, Robinson, O'Reilly, and Kumar (1985).

The following persons provided unpublished data or other assistance with this section: Z. Addison of the Federal Housing Administration, R. Gary of the National Forest Service, B. Daniels of the General Services Administration, J. Jones of the USDA, and W. Sischel.

Unfortunately, the data available on acreage and market values of government land are incomplete, especially for state and local governments, and not entirely reliable. Like Goldsmith and Milgram, we use these data to update estimates made for 1946 by Reeve, et al (1950), and more current and more rigorously-derived benchmark estimates are desirable. These limitations restrict the degree of confidence that can be placed in any estimate of government land values.

The General Services Administration publishes estimates of rural and urban acreage owned by the federal government and its original acquistion cost in its annual Summary Report of Real Property Owned by the United States Throughout the World. These data are compiled from detailed inventory reports submitted by federal agencies. In 1985 the GSA estimated that the federal government owned 723.0 million acres of rural land and 3.7 million of acres of urban land, which had a total acquisition cost of $12.9 billion. Given the significant share of national wealth accounted for by land, it is perhaps surprising that there is not a large body of carefully-derived data on land prices. We construct a price index for federal rural land that gives equal weight to the U.S. Department of Agriculture's estimated average value of farmland and to stumpage prices paid for timber harvested in national forests. Our price index for federal urban land is based on the average site price per square foot of one-family homes purchased with FHA-insured mortgages. We estimate the value of federal urban and rural land in each year by applying our price index for each to

the corresponding GSA acreage series.[44]

In Table 13 we present estimates of federal, state-local and total government land values for 1946-85. We have used the GNP deflator to convert the estimates drawn from Goldsmith, Milgram, and our calculations into 1985 dollars. We estimate the value of federal land in 1985 at $231.3 billion, with urban land accounting for more than three-fourths of the total value despite comprising only 0.5% of total acreage. (See Table 14 for a breakdown of the total federal land stock into rural and urban components and Figure 15 for a chart of government land values.) The sizable increase in the federal total from $99.4 billion in 1968 results from an increase of about 160% in urban acreage, which is far more valuable than rural land, and from increases in both our land price indices that exceed the general inflation rate. The real value of federal urban land more than triples over 1968-85, and most of the increase occurs in 1970-74 and 1979-81. The rural land series primarily reflects price changes, and it increases gradually until the late 1970s and early 1980s before decreasing sharply. Our 1985 total value estimate is 8% lower than the

---

44. Although there is a clear upward trend in urban acreage from 1.4 million acres in 1968 to 3.7 million acres in 1985, the observations for three years are outliers, i.e., there is a change in the time series of more than 20% which is reversed in the following year. These aberrations are due to temporary reclassifications of land between the urban and rural categories, twice in the Department of the Navy and once in the Interior Department. We have replaced the irregular values for the agencies in these instances with the average of the previous and following years' values.

Table 13

ESTIMATES OF GOVERNMENT LAND VALUES
(BILLIONS OF 1985 DOLLARS)

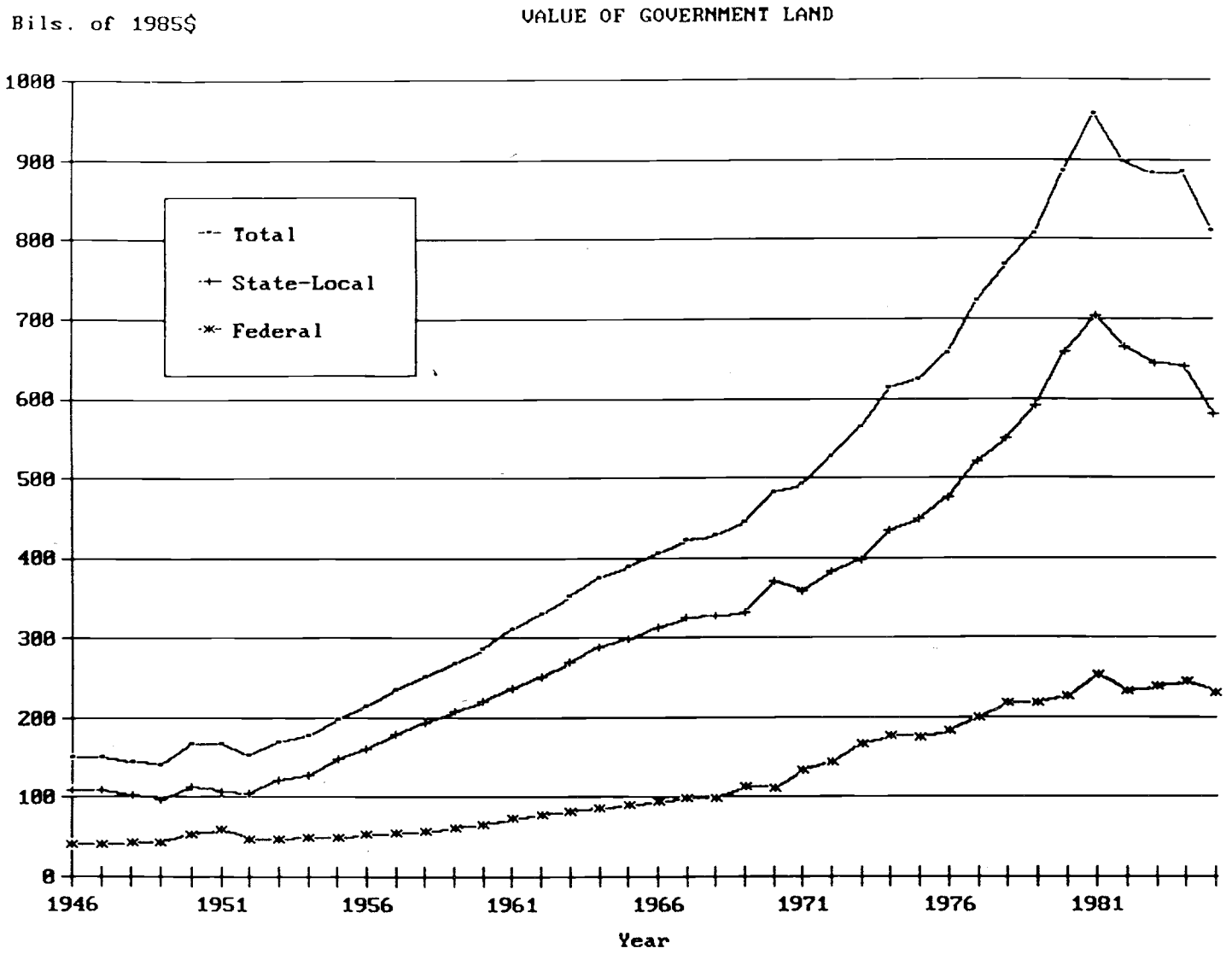
	FEDERAL	STATE-LOCAL	TOTAL
1946	40.3	108.8	149.1
1947	42.0	108.2	150.1
1948	42.1	101.8	143.9
1949	43.3	97.4	140.7
1950	53.7	112.2	165.9
1951	59.6	107.7	167.3
1952	47.3	103.8	151.1
1953	46.4	121.6	168.1
1954	48.8	128.4	177.2
1955	50.3	147.4	197.7
1956	53.3	161.3	214.5
1957	55.3	178.6	233.9
1958	57.2	193.2	250.5
1959	61.0	207.1	268.2
1960	66.4	219.1	285.4
1961	73.6	237.3	310.9
1962	77.4	252.1	329.5
1963	82.3	268.8	351.1
1964	86.7	287.4	374.1
1965	90.1	297.8	388.0
1966	94.1	312.3	406.4
1967	98.1	324.5	422.6
1968	99.4	328.0	427.4
1969	112.1	331.6	443.7
1970	111.8	370.5	482.2
1971	132.6	358.9	491.5
1972	144.0	382.1	526.2
1973	167.6	396.8	564.4
1974	177.6	435.1	612.7
1975	175.6	447.9	623.5
1976	182.7	474.8	657.5
1977	200.5	521.4	721.9
1978	217.1	550.0	767.1
1979	217.6	590.0	807.6
1980	226.5	659.3	885.8
1981	252.7	704.6	957.2
1982	233.3	664.6	897.9
1983	238.9	644.4	883.3
1984	244.5	640.6	885.2
1985	231.3	580.5	811.8

Table 14

VALUE OF FEDERAL LAND: RURAL, URBAN, AND TOTAL
(BILLIONS OF 1985 DOLLARS)

	RURAL	URBAN	TOTAL
1956	20.6	32.7	53.3
1957	19.7	35.6	55.3
1958	19.5	37.8	57.2
1959	22.6	38.4	61.0
1960	25.9	40.5	66.4
1961	30.2	43.4	73.6
1962	31.8	45.6	77.4
1963	33.0	48.6	81.6
1964	35.3	51.4	86.7
1965	37.7	52.4	90.1
1966	39.7	54.5	94.1
1967	42.1	56.0	98.1
1968	43.1	56.3	99.4
1969	50.4	61.7	112.1
1970	47.7	64.0	111.8
1971	44.1	88.4	132.6
1972	50.7	93.4	144.0
1973	55.0	112.6	167.6
1974	61.9	115.7	177.6
1975	54.1	121.5	175.6
1976	62.7	120.0	182.7
1977	73.4	127.2	200.5
1978	83.7	133.1	216.8
1979	83.9	133.7	217.6
1980	73.4	153.1	226.5
1981	76.0	176.7	252.7
1982	56.1	177.2	233.3
1983	60.5	178.4	238.9
1984	58.0	182.4	240.4
1985	49.9	181.4	231.3

Figure 15.


VALUE OF GOVERNMENT LAND
Bils. of 1985$
1000
900
800
700
600
500
400
300
200
100
0
Total
State-Local
Federal
1946
1951
1956
1961
1966
1971
1976
1981
Year

peak attained in 1981.[45]

Less information is available on land owned by state and local governments; there are neither estimates of total acreage nor a breakdown between rural and urban components. Yet the significance of these land holdings is indicated by Milgram's finding that they were more than three times as valuable as federal land in 1968. Thus, it is important to update the previous work on state and local government land also. Here we follow Milgram's methodology almost exactly, partly because a paucity of data constrains us from doing otherwise. We construct one price index for all state-local land which gives equal weight to USDA average farmland values and to the average site price per square foot of homes purchased with FHA-insured mortgages. To estimate acquisitions, we use a Census Bureau data series on state and local governments' "capital outlays for land and existing structures." Lacking other information, we follow Milgram in reducing these values by 10% to adjust for both the value of

---

45. The uncertain nature of government land value estimates is illustratd by using the same price and acreage data in the slightly different formulas used by Milgram. The differences in methodology arise in the treatment of land that has been newly acquired or reclassified as urban or rural. Milgram uses the change in the GSA acquisition cost series to measure total net land acquisitions instead of relying on the GSA acreage series and price data. In contrast to our procedure, Milgram's estimate of total federal land value does not increase when government land is reclassified from rural to urban, since the original acquisition cost is unchanged. There is an increase in the value of urban land that is exactly offset by a decrease in the value of rural land. These differences cause Milgram's method to generate much lower estimates of federal land values. The 1985 value for Milgram's method is $133 billion. We prefer our method since reclassification of land from rural to urban as cities expand reflects genuine increases in the value of land. However, the large difference in estimates derived from somewhat different methods suggests that further research remains a high priority.

existing structures located on these lands that are purchased for continuing use and for sales of state and local government land, which are not reported separately in the Governmental Finances data. We use this net acquisitions series A_t and our price series P_t to calculate the value of state-local land V_t as

$$V_t = V_{t-1}\left(\frac{P_t}{P_{t-1}}\right) + A_t$$

Estimated values of state and local government land are found in column 2 of Table 13. Our 1985 market value is $580.5 billion. As can be seen in Figure 15, the value of this land grows steadily at a slightly increasing rate between 1968 and 1981. This reflects real increases in average land prices and yearly net acquisitions of 1-2% of the stock. Since 1981 the value of state-local land has decreased a total of 18%, as a significant decrease in nominal farmland values and a levelling off in urban land values have caused our composite price index to decrease.

9. Contingent Liabilities

The federal government and closely allied federally sponsored agencies engage in activities which generate contingent liabilities (and also assets) for the government. The most important of these are loans, loan guarantees, and deposit insurance. The recent developments in real estate, agriculture, energy, and less developed country loans threaten the solvency of the two major deposit insurance programs -- the Federal Deposit Insurance Corporation (FDIC) and the Federal Saving and Loan Insurance Corporation (FSLIC). The agricultural debt crisis has already brought the Farm Credit System (FCS), a federally regulated and sponsored financial intermediary, to Congress for emergency financial relief. Agricultural

loan guarantees by the Farm Home Administration (FmHA) are in the process of major default and substantial federal payouts. Other federal insurance programs of questionable solvency include the Pension Benefit Guarantee Corporation (PBGC) and Social Security. We discuss Social Security in the next section.

The exact nature and extent of these federal liabilities and those of the smaller but often analogous state-local insurance program liabilities are unclear. Various statements have been made which provide estimates of the "maximum" exposure or risk or potential liabilities of the federal government. For example, the federal government publishes annually a document showing total insured deposits. Arthur Anderson & Co. (1986) presents estimates of the maximum risk exposure in notes appended to a government balance sheet. But as documented in Boskin, Barham, Cone and Ozler (1987), the history of deposit insurance has been primarily one in which the uninsured deposits are insured as well. These amount to thirty percent of all bank deposits. But it is also unlikely that a severe financial crisis would result in such payoffs. It is only imaginable in a state of the world where the entire economy is in chaos and the government would be forced to resort to hyperinflation to pay its debts.

On the other hand, current budgetary treatment of deposit insurance, loans, and guarantees is misleading and inaccurate. There is no sense of accrual accounting, usually only net spending (net of revenues) is reported, there is no separate capital account, and no adjustment from par to market value. Still, it is helpful to have some rough idea of the size and nature of these contingent liabilities. Table 15 presents postwar time series data on the total outstanding -- at par value -- of direct loans, loan guarantees, and federally sponsored enterprise debt. It should be

Table 15
New Commitments & Total Outstanding For Direct Loans
& Loan Guarantees in Millions of Dollars at Par Value, 1952-1986

Year	Direct Loans Total Outstanding	Loan Guarantees Total Outstanding (Gross)	Federally Sponsored* Enterprises Total Outstanding(Gross)
1952	14,020	24,384	2,945
1953	15,656	35,052	3,003
1954	14,740	40,460	3,014
1955	16,088	45,392	3,602
1956	17,116	51,097	4,292
1957	17,503	55,939	5,578
1958	18,454	58,515	5,947
1959	22,458	63,337	7,446
1960	22,579	67,263	9,106
1961	23,932	71,849	9,545
1962	27,264	76,967	11,296
1963	29,459	81,461	11,600
1964	31,326	85,645	13,568
1965	33,054	91,414	15,331
1966	32,997	99,225	19,390
1967	42,208	99,500	19,040
1968	51,799	108,071	22,883
1969	46,856	117,703	26,955
1970	51,078	125,514	37,515
1971	53,156	143,549	38,939
1972	50,149	165,713	43,322
1973	43,891	183,292	54,816
1974	46,132	197,159	71,160
1975	49,777	218,273	84,635
1976	53,404	243,213	90,788
TR	54,220	247,816	93,598
1977	67,637	284,289	101,902
1978	76,526	317,292	129,987
1979	82,972	387,172	163,575
1980	91,663	454,725	195,807
1981	91,287	505,405	231,417
1982	100,220	547,327	275,361
1983	223,000	519,646	261,000
1984	229,300	565,528	314,100
1985	257,400	613,101	369,940
1986	251,600	691,921	453,300

*The Federally Sponsored Enterprises are the Federal National Mortgage Association (FNMA)m the Federal Home Loan Banks, Federal Land Banks, Federal Home Loan Mortgage Corporation, the Federal Intermediate Credit Banks, Banks for Cooperatives and the Student Loan Mortgage Association.

emphasized that the total outstanding figures are not only at par value, but include some double counting as there are secondary guarantees. To avoid the double counting, a rough rule is that twenty or twenty-five percent of the total outstanding in the recent years are secondary guarantees.

Each year new commitments amount to a tremendous volume of lending and guaranteeing. For example, in 1986, new commitments of loan guarantees were almost $300 billion. Of this total, the overwhelming bulk were renewing previously extended guarantees that had expired. The total outstanding year to year changes reflect the net new commitments. These figures do not include deposit insurance or Social Security. Of these hundreds of billions in outstanding loans and guarantees, what is a sensible estimate of the contingent liability of the federal government? It is clearly implausible that all the loans will default with probability one, so the total outstanding amounts are a substantial upper bound (although Bartlett (1983) adds them to the regular national debt). While some loans are ultimately forgiven and cost the government the original amount, many are repaid completely. The likely course of future repayments will reflect various factors including economic conditions such as commodity prices, interest rates, the level of real economic activity and the like.

It is possible to develop a lifecycle projection of new loan guarantee commitments to determine, based on longitudinal data, the net spending equivalent in present value terms that is likely to occur per dollar of new commitments of loan guarantees and correspondingly for direct loans and agency debt. While in some contingencies the historically based data might prove to be exceedingly inaccurate, it is potentially useful to develop some insight into the historical pattern of actual government spending and support of guarantees and loans. Boskin, Barham, Cone and Ozler (1987) present an analytical schema and apply it to longitudinal data on cohorts of

loan guarantees for government agencies, especially the Small Business Administration, and they estimate that for each dollar of new commitment, the present value of ultimate spending in support of that commitment is approximately 12 cents. If -- and it is a big if -- such a figure could be applied to other programs, a rough estimate of the likely value of the ultimate federal government liability based on the value of the loans would be about 12% of the figures reported in Table 15, about $30 billion dollars in support of loans, $80 billion in support of loan guarantees, and perhaps $50 billion in support of federally sponsored enterprises in 1985. There are a variety of reasons to believe that the 12% figure may be too low or too high in various circumstances for different kinds of lending activity, but we only mention this because it has become somewhat fashionable either to ignore these contingent liabilities or to report them as the maximum risk exposure or the total value outstanding, as if that figure was readily comparable to, say, the privately held regular national debt. Clearly, that procedure is inappropriate.

Deposit insurance raises similar, through in some ways more subtle and more quantitatively important issues. First, the nature of the banking deposit insurance system is that the risks are systematically correlated to a much greater extent than in other federal government lending programs. There is a small probability of extremely high payouts. But even defining the maximum exposure of the FDIC or FSLIC is questionable. As noted above, the Treasury notes the total insured deposits. But that exceeeds by a factor of at least 50 the properly measured net worth of the FDIC or FSLIC. By law, the FDIC and FSLIC (and several other smaller analogous organizations) have a line of credit at the Treasury, but this line of credit is quite modest. Does the Treasury and/or the Federal Reserve stand

behind all insured deposits? All deposits? Or only the amount in the funds plus the standby borrowing authority at the Treasury? Total deposits at insured banks were $1.974 trillion -- coincidently about the size of the privately held national debt -- in 1985, whereas the insured amounts were $1.503 trillion. The total assets of the FDIC were $26.4 billion in 1985, and the standby borrowing authority at the Treasury, $3 billion.

The FDIC and FSLIC are technically independent agencies, so they could legally default on their liabilities without giving their creditors a claim on the Treasury. Clearly, the potential liabilities of the FDIC and FSLIC substantially exceed their assets in bad case scenarios. What is a sensible expected present value to put forth for such contingent liabilities? Surely, they are substantially less than either the total deposits insured at institutions, or the total insured deposits. Formally, we would like to sum the present discounted value of expected payouts in each period to obtain an appropriate loss reserve as the best single number to provide as a contingent liability. This would depend not only on future economic conditions, but on the interpretation of the various rules, laws and political decisions concerning backing the thrift industry. Rather than present a time series of estimates, we refer the interested reader to Boskin, Barham, Cone and Ozler (1987) for analytical discussion and report in the balance sheets presented in Section 11 alternative estimates of these contingent liabilities of the deposit insurance system.

As noted above, state-local government also have various contingent obligations, including those to state chartered banks, unfunded pension liabilities, etc. We raise these issues here but do not attempt to elaborate the analysis.

10. Social Security

Because the Social Security program looms so large in the financial picture of so many and because, until recently, it has been more or less a pay-as-you-go system, the currently unfunded liabilities of the Social Security system at any point in time are usually large, subject to substantial variation depending upon assumed patterns of economic and demographic trends, and subject to enormous change with seemingly minor (relative to the intense debate over budget deficits and tax reform) changes in rules relating to benefits or taxes. It is not our purpose here to review the voluminous literature concerning the potential impact of Social security "wealth" on real economic activity, such as the saving/consumption choice or retirement decisions.[46]

How to define the expected obligations of the Social Security system is also a subject of much controversy. Under a closed group approach, the expected future taxes and benefits paid by particular cohorts, for example, all those currently alive or currently above a certain age, such as 18, would be calculated, discounted to the present, and compared. The difference between the expected present value of benefits and taxes would be the surplus or deficit. This concept, using current participants as the group, is adapted by Arthur Anderson & Co. (1986). Under an open group concept, the expected present value of benefits and taxes paid over some time period, often taken to be the 75-year long-term actuarial projection period of the Social Security Administration, would be compared, with the

---

46. The interested reader might consult Hurd and Boskin (1984), Diamond and Hausman (1984), Feldstein (1974), and Barro (1974).

difference being the deficit or surplus. Thus, taxes paid in the early working years of the currently unborn, and benefits paid to persons during retirement who are not yet in the labor force, would be counted. While 75 years is an extremely long time period, and modest changes in growth rates or demographic assumptions can make huge swings in the expected balances in Social Security, swings the size of the regular national debt, the time frame is somewhat arbitrary, as are the various assumptions involved.

Table 16 presents estimates of the long-term actuarial deficit in the retirement and disability part of Social Security over the next 75 years under alternative economic and demographic scenarios (as developed by Boskin and Puffert (1987) and Boskin (1987b)). The annual amounts are adjusted for inflation and discounted to the present at a real discount rate of 2% (the interest rate assumed earned on Social Security balances by the Social Security Trustees). As can be seen, in the base case, the Social Security Administration's intermediate assumptions for economic and demographic trends over the next 75 years, there is a deficit of almost one-half trillion dollars, slightly under one-half percent of taxable payroll over the period. Under the SSA actuary's optimistic assumptions, there is a $3.4 trillion surplus, while under the overall pessimistic assumptions, there is a $2.6 trillion deficit. Thus, moving all of the economic and demographic projections from intermediate to either optimistic or pessimistic results in a change which is larger than the privately held national debt. But all of the assumptions do not have to change for there to be an enormous variation in the expected surplus. For example, leaving all the other assumptions aside and just adopting the high wage growth assumptions of the SSA actuaries results in a surplus of almost $900 billion, a $1.4 trillion increase over the base case. Adopting the low mortality assumption, holding

Table 16

OASDI System Finances, Various Economic & Demographic Scenarios
75 Year Totals (1986-2060)
(1986 $billions, discounted to 1986)[1]

Scenarios	Surplus	Variation of Surplus fr Base Case
Base Case	-$495	0
Overall Optimistic for Trust Fund	$3,389	+$3,884
Overall Pessimistic for Trust Fund	-$2,567	-$2,072
High Wage Growth	$878	+$1,373
Low Wage Growth	-$948	-$453
High Mortality	$468	+$963
Low Mortality	-$1,700	-$1,205
Benefit-Ratchet - Unfunded	-$3,690	-$3,195
Pay-As-You-Go Tax Rates	0	+$487

[1]Source: Boskin and Puffert (1987).

all the other demographic assumptions and economic assumptions to those of the intermediate case, results in a deficit of $1.7 trillion, a $1.2 trillion increase.

The numbers revealed in Table 16 are substantial, and Social Security looms large in the lives of many Americans -- there are 37 million current beneficiaries and over one hundred million taxpayers, the majority of whom pay more in Social Security taxes than in income taxes. It would be surprising if there were no effects of these variations. However, the 75 year period is somewhat arbitrary. The deficit occurs for a variety of reasons, not the least of which is the passage of the extra large baby boom generation into retirement, followed by the baby bust generation paying high tax rates to finance the benefits of the baby boom. The period beyond the 75 year projections would be one of surplus if the benefits were raised no further and the high tax rates maintained as the ratio of workers to retirees edges upwards as the baby bust generation retires.[47]

For a variety of reasons, projections of Social Security deficits should be taken with a certain degree of caution. Not only are they enormously sensitive to these economic and demographic assumptions, about which reasonable people might disagree, but future Social Security benefits are also not contractual obligations in the same way as the regularly issued national debt. While the national debt is issued in bonds of nominal dollar value, and hence could be altered substantially by unexpected inflation as emphasized by Eisner (1986), it is unlikely to be repudiated, even in part. Social Security benefits and taxes and their difference, on the other hand,

---

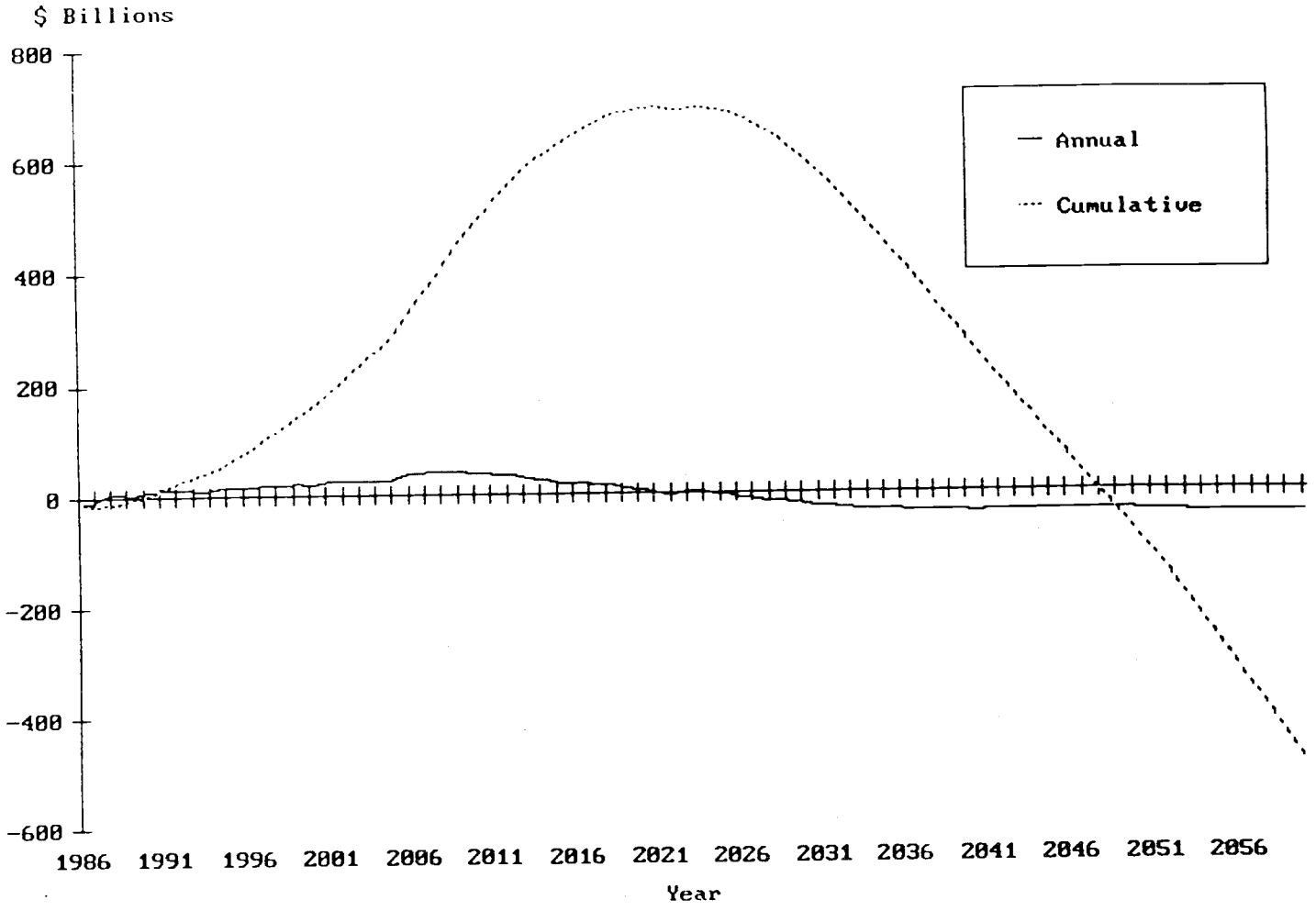
47. However, it will not return to the current ratio as gains in life expectancy result in a permanent increase in the aged dependency ratio.

are really potential future obligations. They can be changed by Congressional action changing the benefit formulae, e.g., changing the bend points in the retirement plan as proposed, but rejected, in the early 1980s, taxing all Social Security benefits, or one-half of them as was done in 1983, changing marginal tax rates in the income tax, as was done in the Tax Reform Act of 1986, or raising the age of eligibility for future Social Security beneficiaries, as was done in 1983 prospectively for the early twenty-first century, etc.

Another important issue surrounds the fact that for the first time Social Security retirement funds are projected to be on a path which deviates systematically from pay-as-you-go finance. Under pay-as-you-go finance, the long-term actuarial deficit in Social Security is identically zero, as each year's benefits are paid by each year's taxes, although they may not line up so evenly for a particular age group, income group or families of different marital status. Concern about the long-run deficit really seems to be concern about whether taxes will be raised or benefits reduced when projections create a situation where the two are likely to diverge systematically. For the old age and survivors insurance system, the real discounted value of the projected surplus peaks around 2020 at almost $800 billion (see Figure 16), and several hundred billion dollars would be added by the disability fund. To provide some insight into the possible difference in the Social Security retirement system's long-run surplus, consider two scenarios: we use the temporary surplus to raise benefits without correspondingly raising taxes later on in the 75 year period; or we revert to pay-as-you-go finance by lowering tax rates during the period of the surplus. As the final two rows of Table 16 reveal, the long-run actuarial deficit in the retirement part of the system increases to $3.7 trillion under the benefit-ratchetting up case, but is eliminated

Figure 16.

Old Age and Survivors Insurance System
Projected Real Discounted Surplus for
Base Case, Annual and Cumulative



under the pay-as-you-go tax rate reduction case (in which tax rates are reduced during years of surplus and raised during the years of deficits to restore the pay-as-you-go nature of the system).

The hospital insurance system is projected to be in much worse shape than OASDI (see Figure 17), because the tax rate for HI is fixed at 2.9% of taxable payroll, while health care expenditures are growing, partly for demographic reasons and partly because of differential growth in health care costs versus general inflation. Even if the latter is brought under control, the demographics will cause the expenditures under the hospital insurance part of medicare to rise, so when compared with slowly growing tax revenues, the deficit must widen. Thus, over the next several decades the options for Social Security are:

(1) Accruing a surplus in the retirement and disability funds;

(2) Dissipating it for other uses such as assigning some of the tax proceeds to medicare, etc.

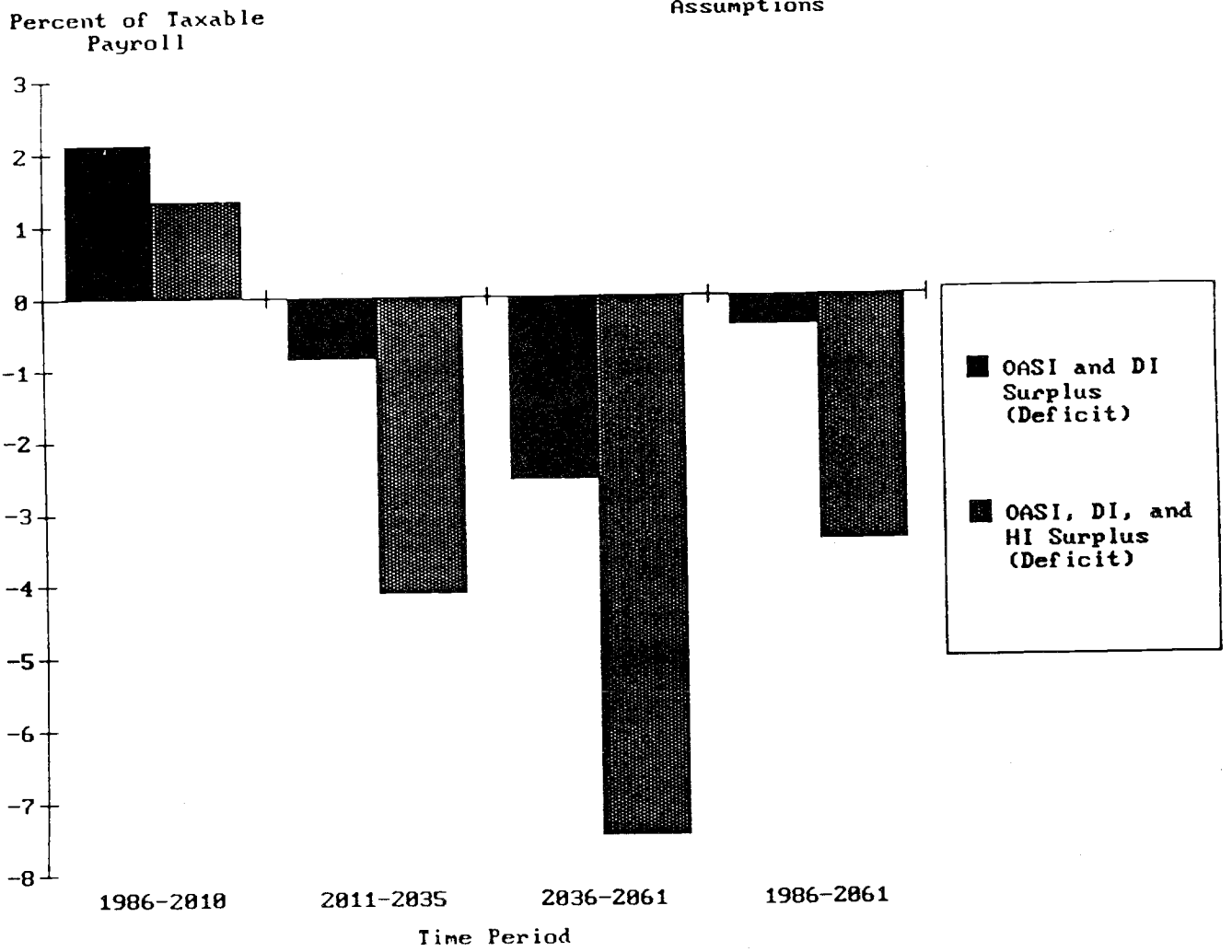
For all these reasons we prefer to provide the supplemental information concerning Social Security as additional potential liabilities in any balance sheet for the government sector. We do not propose to add it to the regular national debt.[48]

---

48. In addition to the Social Security system's accrued liabilities, the federal government has substantial other accrued pension liabilities as well. These include military, veteran, and civilian retirement and disability compensation plans. Various studies have been done analogous to those on Social Security, attempting to estimate these liabilities. The pension funds of current military employees and the civil service pension system, while probably subject to revision in years ahead, represent some substantial degree of contractual obligation of the federal government. They amount to well over one trillion dollars among them. The unfunded pension liabilities of state and local governments have been, at times, substantial. Again, similar caveats to those mentioned above apply.

Figure 17.

Projected Social Security Finances Under Intermediate (IIB) Assumptions



11. Government Balance Sheets

With our estimates of government tangible and financial assets and liabilities, the temptation to create government balance sheets is irresistible. Before giving in, however, we must stress numerous caveats and cautions.

While we believe that we have developed improved estimates of tangible assets, each of the major categories of assets and liabilities presents conceptual and measurement difficulties. The 'net worth' figures we shall present are, accordingly subject to substantial error. Moreover, extremely important classes of liabilities - contingent and potential - are excluded, at least above the line, because, unlike financial liabilities or assets, they are mostly not traded on a market or easily quantified with existing data and are subject to large uncertainty. Presenting rough estimates of contingent liabilities on loans, guarantees, and deposit insurance and potential liabilities in unfunded pension programs (especially Social Security) "below the line" is not meant to suggest that they are less important than those included above the line. However, they are subject to different degrees of precision, contractual olbligation and conceptual estimation. Also, they are taken from other sources (althougy some are by Boskin). Of course, governments have enormous intangible assets, including the power to tax, so a negative net worth would not imply bankruptcy or imminent debt repudiation. Accordingly, our calculations, like similar ones by Eisner and Pieper (1984) and Eisner (1986), should probably be viewed as illustrative of trends, rather than accurate point estimates of net worth.

Further, how to add up various components is by no means obvious. Finance theory tells us we should place greater value on future income streams which are negatively correlated with other sources of income.

Thus, if one concludes that the value of government mineral rights will rise substantially when oil prices accelerate sharply, and this is associated with a deep recession or some other long-lived economic event, these revenues may be systematically negatively correlated with other sources of government revenue; and similar issues arise on the outlay side. The conceptually proper thing would be to apply a risk charge to the various components in the various time periods based on subjective probability distributions of outcomes and estimates of the risk tolerance (the reciprocal of the Arrow-Pratt measure of risk aversion), and discount them to the present. We have not sought to do this here, but do wish to emphasize that the variability of likely future returns or outlays stemming from various government activities is large, as it is for the private sector, but there may also be systematic covariance among components which should be taken into account in establishing a balance sheet.

Estimates of the real change in net worth have important, but still limited, uses. The net worth provides some indication of future tax liabilities. When oil was discovered in Alaska, expected future tax liabilities of Alaskan residents dropped dramatically.

Changes in net worth indicate what legacy, in the form of future government service net of tax liabilities, current generations are providing future generations. Of course, this does not imply that the only ethical course is to leave net worth unchanged. If future generations will be richer, or if the current generation has made large sacrifices, as, for example, in World War II, it may be entirely appropriate to pass tax burdens forward.

Changes in net worth are not necessarily a good indicator of fiscal tightness. But information on conventional deficits may usefully be

supplemented by various adjustments to government assets and liabilities. Eisner and Pieper (1984) and Eisner (1986) provide some evidence that changes in real net debt are a better measure of fiscal policy than conventional deficits. Boskin (1986a) presents evidence that the private propensity to consume out of the excess of government tangible capital over explicit debt is 0.04, about the same as generally found for private wealth. This suggests that public and private saving are substitutes in the sense that increased government tangible capital increases private consumption and decreases private saving. These studies indicate that the type of data generated in this paper may be of some use in the studies of the impact of fiscal policy on short-run stabilization and/or long-run growth.

Having discussed their usefulness and limitations, we turn to the numbers. In Table 17, balance sheets for the federal government for 1970, 1980, and 1985 are provided. As throughout this paper, the figures are in 1985 dollars. While real liabilities of the federal government grew by 18% between 1970 and 1980, the net debt, due in part to rising gold prices, fell by 14%. Net worth grew by $692 billion, to over $1.0 trillion. While many were bemoaning record deficits, the value of federal assets, especially oil and gas, was growing rapidly. In the 1980's, the picture is very different. Despite large investment in reproducible assets, particularly for the military, the value of federal assets increased by about 8% (less if 1986 were considered, because of falling real oil prices). Meanwhile, federal liabilities reached record levels. The result is that net worth dropped by $727 billion in only five years, unravelling the gains made over the '70s. Most of this drop occured after the end of the recession.

State and local government net worth, excluding pension obligations, also grew substantially during the '70s, as shown in Table 18. Tangible

Table 17
"Balance Sheet" for Federal Government, Selected Years
(Billions of 1985 dollars)

	1970	1980	1985
Tangible Assets[a]	1,063.1	1,661.0	1,787.7
Reproducible Assets	776.6	941.8	1,064.9
Residential Structures	15.8	27.8	29.5
Nonresidential Structures	358.7	469.1	443.1
Equipment	247.4	274.8	376.7
Inventories	154.6	170.1	215.5
Land	111.8	226.5	231.3
Mineral Rights	174.7	492.7	491.5
Financial Assets	619.7	939.5	1,031.1
Currency, demand & time deposits	46.8	40.8	53.4
Gold	31.9	203.2	86.4
Foreign Exchange-SDRs	9.0	20.3	32.1
U.S. Government Securities	206.4	169.2	205.8
Treasury Issues	205.8	157.2	194.3
Agency Issues	0.5	12.0	11.5
Mortgages	86.7	172.4	224.9
Other loans	173.4	262.6	317.7
Taxes receivable	15.2	9.3	10.6
Miscellaneous Assets	50.3	61.7	100.2
Total Assets	1,682.8	2,600.5	2,818.8
Liabilities			
Treasury currency & SDR ctfs.	16.0	17.7	18.0
Demand deposits & currency	138.3	158.4	182.4
Bank reserves & vault cash	83.0	61.7	54.1
Credit market instruments	900.2	1,097.3	1,954.2
Treasury issues	654.5	814.8	1,590.1
Agency issues	104.5	193.4	279.4
Savings bonds	141.2	89.2	84.7
Insurance, retirement reserves	92.8	111.4	159.0
Misc. liabilities	58.0	67.5	92.3
Total Liabilities	1,288.3	1,514.0	2,460.0
Net Debt	668.6	574.5	1,428.9
"Net Worth"	394.5	1,086.5	358.8
Note: Contingent liabilities[b]:		90.0	
loss reserve estimate for loans and guarantees	27.0	90.0	145.0
Deposit Insurance	N.A.	30.0	50.0
Potential liabilities(rough est):			
unfunded pensions-civil service[c]	-	575.0	
-military[d]	-	525.0	
Social Security: OASDI[e]	-	-	200.0
HI	-	-	2,500.0

[a] Includes real revaluations as discussed in text.
[b] See text for loans and guarantees. Deposit insurance very rough estimates from Boskin, Barham, Cone and Ozler (1987) and sources cited therein.
[c] From H. Leonard (1985).
[d] From H. Leonard (1987). Estimates are for 1982.
[e] From Boskin (1987b) and sources cited therein.

Table 18
"Balance Sheet" for State and Local Governments, Selected Years
(Billions of 1985 dollars)

	1970	1980	1985
Tangible Assets[a]	1,624.4	2,680.3	2,554.5
Reproducible assets	1,253.9	1,896.0	1,863.2
Residential structures	38.6	57.0	56.0
Nonresidential structures	1,161.6	1,765.3	1,723.1
Equipment	52.2	70.3	80.1
Inventories	1.6	3.4	3.9
Mineral Rights	*	125.0	110.8
Land	370.5	659.3	580.5
Financial Assets	188.0	268.2	466.3
Currency, demand & time deposits	91.2	92.9	78.0
Security RPs	0.0	18.2	48.8
U.S. Government Securities	69.4	90.1	231.8
Treasury Issues	59.8	54.4	166.3
Agency Issues	9.6	35.7	65.5
State and local obligations	6.1	7.8	8.3
Mortgages	11.7	40.3	78.3
Taxes receivable	9.6	18.9	21.1
Total Assets	1,812.4	2,948.5	3,020.8
Liabilities			
State and local obligations	368.1	326.0	482.6
Short-term	34.9	18.6	18.5
Other	333.2	307.3	464.1
U.S. government loans	12.8	9.9	26.8
Trade Debt	17.0	23.6	23.0
Total Liabilities	397.9	359.5	532.4
Net Debt	209.8	91.2	66.1
"Net Worth	1,414.5	2,589.0	2,488.4
Note: Unfunded Pension Liabilities[b]	-	400.0	-

*State-local mineral rights estimates are calculated only for 1980 and 1985 and because of the data limitations are perhaps less reliable than the other items included. Tangible assets and "net worth" for 1970 are understated because of the absence of a mineral rights estimate.

See text for a discussion of contingent liabilities and unfunded pensions.

[a]Includes real revaluations as discussed in text.
[b]From R. Inman (1985). Estimates are for 1980 and include teachers retirement systems only; they are therefore a lower bound.

assets increased by about $1.0 trillion, while net debt fell. Net worth grew by more than 80% in real terms. Neither net debt nor tangible assets changed much from 1980 to 1985, so that net worth remained about $2.5 trillion. The net worth of state and local governments is still larger, according to our calculations, than the total financial liabilities of the federal government.

Finally, with the provisos mentioned above, we report estimates from other sources of large contingent and potential liabilities. For example, the estimate of the unfunded liability for the retirement and disability part of Social Security is almost $500 billion under the intermediate economic and demographic projections; for hospital insurance, it is over two trillion dollars (see Boskin (1987b) and Boskin and Puffert (1987)). Federal civil service and military retirement systems unfunded liabilities amounted to over $1 trillion for 1980.

12. Conclusion

We have presented above new, updated, and adjusted estimates of various components of the government's contribution -- positive or negative -- to national wealth and its growth in the postwar period. We have invoked numerous caveats along the way, and have attempted to highlight what we believe are some important points. We have not gone as deeply into some aspects of these issues as some other previous authors, in order to go further in other dimensions of the problem. Our primary substantive conclusions are as follows:

(1) The share of national output devoted to consumption has risen substantially, while that devoted to net saving has fallen sharply, in the period 1951-85. The private consumption rate has risen about six percentage points, from 63% to 69% over this period, while the

government consumption rate has fallen slightly. The national saving rate has fallen about four percentage points.

(2) The federal government consumption rate has fallen dramatically, from 13.7% to 8.7% from 1950-85. In the same period, the state and local consumption rate has risen from 9.7% to 12.6%.

(3) The extension of traditional saving and investment measurement to include consumer durable and government tangible investment raises the national saving rate substantially, as do our depreciation estimates. For example, in 1985, the gross and net saving rates rise from a traditionally measured 13.8% and 3.2% to 24.5% and 8.8%, respectively, about one and a half percentage points of the increased net saving rate resulting from our lower estimates of depreciation on conventionally defined business capital.

(4) The federal government's assets, tangible and financial, are substantial; throughout the 1970's, they grew much more rapidly than the national debt. By 1980, in constant 1985 dollars we estimate federal tangible assets at $1.7 trillion and financial assets at $940 billion compared to liabilities of $1.5 trillion.

(5) Since about 1980, the "net worth" news is much worse, as conventional liabilities have grown much faster than assets, causing about a $727 billion decline in federal "net worth".

(6) The state and local government sector also contributes importantly to government and national wealth. The state and local sector fixed reproducible capital is about twice the federal amount, $1.9 trillion in 1985 versus $1.0 trillion. The difference between assets and liabilities is also greater, as well as more stable, for state and local governments. The estimated "net worth" of state and local goverments was

about $2.5 trillion in both 1980 and 1985.

(7) Total government reproducible capital amounts to a sizeable fraction of corresponding private capital. In 1985, the public capital stock was 55% of the private nonresidential capital stock.

(8) Government net investment has often been sufficient to turn the government sector into a net saver despite large budget deficits, i.e. assets were accruing more rapidly than liabilities.

(9) It is important, if difficult, to go beyond traditional structures and equipment investment and capital stocks. Inventories, mineral rights, and land are quantitatively quite important (over $900 billion in 1985 for the federal government alone) and the most volatile components of government saving. Real revaluations of tangible capital, inventories, land and mineral rights are frequently substantial.

(10) Very large contingent and potential liabilities must be considered, although we prefer not to add them directly to the more contractual obligations. Changes in rules governing social security, for example, can produce changes in potential unfunded liabilities almost as large as the regular privately held national debt. Some previous attempts to incorporate contingent liabilities and unfunded pensions have inappropriately focused on either the maximum risk exposure in the former and a closed group concept of liabilities for the latter.

In establishing the value of various components and aggregate government assets, liabilities and net worth, the covariance of the likely revenues or outlays associated with the assets and liabilities with other returns and outlays for the government, and indeed, other components of national income, must be considered. We have not even begun to do so here. Additional considerations concern the government's power to print money and to tax.

We hope that this study, by focusing attention on the role of the government sector in the generation and formation of national wealth will join a growing list of important studies enabling us to improve the system of accounts used in reporting economic activity in the United States and in analyzing the performance of the economy. Much research remains to be done before some of the thorny issues addressed here are resolved to the extent that such accounts can stand alongside traditional national income accounts on a daily basis,[49] but the evidence from this and other recent studies suggest that failing to do so may seriously distort our notion of the levels and rates of growth of national saving, capital formation, and other dimensions of economic performance.

---

49. Attempts to measure either private or government saving, investment or consumption and correspondingly private and government capital should use depreciation methods consistent in treatment of relative vintages of the capital stock, i.e., depreciation methods consistent between formation of the capital stock series and the imputed rental flow series. This is not true of the national income and product accounts depreciation, nor of the depreciation methods and estimates used in most studies of growth accounting. Two recent important exceptions are Jorgenson, Gollop and Fraumeni (1987) and the Bureau of Labor Statistics (1983). While it is not our purpose to evaluate the importance of these distinctions in growth accounting, some studies (see Jorgenson (1986)) suggest that these differences can be enormously important in partitioning the sources of growth. For our purposes it is clear that the depreciation series, and therefore the net investment series and capital stock series, differ substantially, primarily because of differences in the treatment of structures, relative to NIPA and the BEA capital stock series.

BIBLIOGRAPHY

Alaska, State of, 1986, Petroleum Production Revenue Forecast, Quarterly Report, (Juneau: Department of Revenue), December.

Arthur Anderson & Co., 1986, Sound Financial Reporting in the U.S. Government: A Prerequisite to Fiscal Responsibility.

Barro, R., 1974, "Are Government Bonds Net Wealth?," Journal of Political Economy, November/December, 82:1095-1117.

Bartlett, B.R., 1983, "The Federal Debt: On-Budget, Off-Budget and Contingent Liabilities," a Staff Study for the Joint Economic Committee, Congress of the United States, Washington: Govenment Printing Office.

Boskin, M.J. 1982, "Federal Government Deficits: Myths and Realities," American Economic Review, May, 72:296-303.

Boskin, M.J. 1986a, "Alternative Measures of Government Deficits and Debt and Their Impact on Economic Activity," in K.J. Arrow and M.J. Boskin, eds., Economics of Public Debt, forthcoming, MacMillan, 1988.

Boskin, M.J., 1986b, "Theoretical and Empirical Issues in the Measurement, Evaluation and Interpretation of Postwar U.S. Saving," in G.F. Adams and S.M. Wachter, eds., Savings and Capital Formation: The Policy Options, Lexington, Massachusetts: Lexington Books.

Boskin, M.J., 1987a, The Real Federal Budget, Cambridge: Harvard University Press, forthcoming.

Boskin, M.J., 1987b, "Future Social Security Financing and National Saving," NBER Working Paper No. 2256.

Boskin, M.J., B. Barham, K. Cone, and S. Ozler, 1987, "The Federal Budget and Federal Insurance Programs," in M. Boskin, ed., Modern Developments in Public Finance, Oxford: Basil Blackwell, Ltd.

Boskin, M.J., L. Kotlikoff, D. Puffert, and J.Shoven, 1987, "Social Security: A Financial Appraisal Across and Within Generations," National Tax Journal, Vol. XL, No.1, March, pp. 19-34.

Boskin, M.J. and D.J. Puffert, 1987, "The Financial Impact of Social Security by Cohort Under Alternative Financing Assumptions," mimeo.

Boskin, M.J. and J.M. Roberts, 1986, "A Closer Look at Saving Rates in the United States and Japan," Washington,D.C.: American Enterprise Institute Working Paper.

Boskin, M.J., M.S. Robinson, and A. Huber, 1987, "New Estimates of State and Local Government Tangible Capital and Net Investment," National Bureau of Economic Research Working Paper No. 2131.

Boskin, M.J., M.S. Robinson, T. O'Reilly, and P. Kumar, 1985, "New Estimates of the Value of Federal Mineral Rights and Land," American Economic Review, December, 75:923-936.

Boskin, M.J., M.S. Robinson, and J.M. Roberts, 1986, "New Estimates of Federal Government Tangible Capital and Net Investment," in D.W. Jorgenson, ed., Technology and Capital Formation, forthcoming.

Christensen, L.R. and D.W. Jorgenson, 1973, "Measuring Economic Performance in the Private Sector," in M. Moss, ed., Measurement of Economic and Social Performance, (New York: National Bureau of Economic Research), 233-337.

Cox, W.M. and E. Hirschhorn, 1983, "The Market Value of U.S. Government Debt: Monthly, 1942-1980," Journal of Monetary Economics, March, 11:261-272.

David, P. and J. Scadding, 1974, "Private Saving: Ultrarationality, Aggregation and Denison's Law," Journal of Political Economy, March/April, 82:225-249.

DeLeeuw, F., 1981, "Discussion," in C.R. Hulten, ed., Depreciation, Inflation, and the Taxation of Income from Capital, (Washington: Urban Institute), 126-129.

Denison, E.F., 1957, "Theoretical Aspects of Quality Change, Capital Consumption, and Net Capital Formation," in Conference on Research in Income and Wealth, Problems of Capital Formation, (Princeton: Princeton University Press).

Denison, E.F., 1962, Sources of Economic Growth in the United States and the Alternatives Before Us, (New York: Committee for Economic Development).

Denison, E.F., 1967, Why Growth Rates Differ, (Washington: The Brookings Institution).

Denison, E.F., 1972, "Final Comments," Survey of Current Business, May, 52(5), Part II:95-110.

Denison, E.F., 1974, Accounting for United States Economic Growth, 1929-1969, (Washington: The Brookings Institution).

Denison, E.F., 1979, Accounting for Slower Economic Growth, (Washington: The Brookings Institution).

Denison, E.F., 1985, Trends in American Economic Growth, 1929-1982, (Washington: The Brookings Institution.

Diamond, P.A. and J.A. Hausman, 1984, "Individual Retirement and Savings Behavior," Journal of Public Economics, 23(112):81-114.

Economic Report of the President, 1986, 1986, (Washington:GPO).

Eisner, R., 1980, "Capital Gains and Income: Real Changes in the Value of Capital in the United States, 1946-77," in D. Usher, ed., The Measurement of Capital, (Chicago: University of Chicago Press), 175-346.

Eisner, R., 1985, "The Total Income System of Accounts," Survey of Current Business, January, 65(1):24-35.

Eisner, R., 1986, How Real is the Federal Deficit? (New York: The Free Press).

Eisner, R. and D.H. Nebhut, 1982, "An Extended Measure of Government Product: Preliminary Results for the United States, 1946-76," Review of Income and Wealth, Series 28, March, pp.33-64.

Eisner, R. and P. Pieper, 1984, "A New View of Federal Debt and Budget Deficits", American Economic Review, March, 74:11-29.

Jack Faucett Associates, Inc., 1974, Capital Stock Measures For Transportation, (Washington: Department of Transportation, Asst. Secretary for Policy, Plans, and International Affairs, Office of Transportation Planning Analysis).

Federal Reserve System Board of Governors, 1986, Flow of Funds Accounts: Financial Assets and Liabilities Year-End, 1962-85, Washington, D.C.

Feldstein, M., 1974, "Social Security, Induced Retirement and Aggregate Capital Accumulation," Journal of Political Economy, September/October, 82:905-926.

Gale, W., 1987, "Federal Lending Policies and the Market for Credit," Stanford University, mimeo.

Goldsmith, R., 1955, A Study of Saving in the United States, 3 vol., (Princeton: Princeton University Press).

Goldsmith, R., 1962, The National Wealth of the United States in the Postwar Period, (Princeton: Princeton University Press).

Goldsmith, R., 1982, The National Balance Sheet of the United States, 1953-1980, (Chicago: University of Chicago Press).

Gorman, J.A., J.C. Musgrave, G. Silverstein, and K.A. Comins, 1985, "Fixed Private Capital in the United States," Survey of Current Business, July, 65(1):36-47.

Holloway, T.M., 1987, "Present NIPA Saving Measures: Their Characteristics and Limitations," in R.E. Lipsey and H.S. Tice, eds., Issues in the Measurement of Income and Wealth.

Hulten, C.R. and G.E. Peterson, 1984, The Growth of the Public Capital Stock: 1958-82, (Washington: Urban Institute), mimeo.

Hulten, C.R., J.W. Robertson, and F.C. Wykoff, 1986, "Energy, Obsolescence, and the Productivity Slowdown," WEA Conference Paper.

Hulten, C.R. and F.C Wykoff, 1981, "The Measurement of Economic Depreciation," in C.R. Hulten, ed., Depreciation, Inflation, and the Taxation of Income from Capital, (Washington: Urban Institute), 81-125.

Hurd, M. and M.J. Boskin, 1984, "The Effect of Social Security on Retirement in the Early 70's," Quarterly Journal of Economics, November:767-90.

Inman, R., 1985, "The Funding Status of Teachers Pensions: An Econometric Approach," NBER Working Paper No. 1727.

Jorgenson, D.W., 1973, "The Economic Theory of Replacement and Depreciation," in W. Sellekaerts, ed., Econometrics and Economic Theory, (New York: MacMillan).

Jorgenson, D.W., 1986, "Capital as a Factor of Production," Harvard Institute of Economic Research Discussion Paper No. 1276.

Jorgenson, D.W., F.M. Gollop, and B.M. Fraumeni, 1987, Productivity and U.S. Economic Growth, (Cambridge: Harvard University Press).

Jorgenson, D.W. and Z. Griliches, 1972, "Issues in Growth Accounting: A Reply to E.F. Denison," Survey of Current Business, May, 52(4), Part II:65-94.

Katz, A.J., 1983, "Valuing the Services of Consumer Durables," Review of Income and Wealth, Series 29, December, 405-427.

Kendrick, J.W., 1961, Productivity Trends in the United States, (Princeton: Princeton University Press).

Kendrick, J.W., 1973, Postwar Productivity Trends in the United States, 1948-1969, (New York: National Bureau of Economic Research).

Kendrick, J.W., 1976, The Formation and Stocks of Total Capital, (New York: National Bureau of Economic Research).

Leonard, H., 1985, "The Federal Civil Service Retirement System: An Analysis of Its Financial Condition and Current Reform Proposals," in D. Wise, ed., Pensions, Labor, and Individual Choice, (Chicago: University of Chicago Press), 399-443.

Leonard, H., 1987, "Investing in the Defense Work Force: The Debt and Structure of Military Pensions," in D. Wise, ed., Public Sector Payrolls, (Chicago: University of Chicago Press), 47-73.

Martin, F., J.S. Landefeld and J. Peskin, 1982, "The Value of Services Provided by the Stock of Government Owned Fixed Capital, 1948-79," Washington: U.S. Department of Commerce, Bureau of Economic Analysis, Working Paper No. 2.

Milgram, G., 1973, "Estimates of the Value of Land in the United States Held by Various Sectors of the Economy, Annually, 1952 to 1968," in R.W. Goldsmith, ed., Institutional Investors and Corporate Stock - A Background Study, (New York: National Bureau of Economic Research), 341-377.

Musgrave, J.C., 1979, "Durable Goods Owned by Consumers in the United

States, 1925-1977," Survey of Current Business, March, 59:17-25.

Musgrave, J.C., 1980, "Government-Owned Fixed Capital in the United States, 1925-1979," Survey of Current Business, March, 60:33-43.

Musgrave, J.C., 1986, "Fixed Reproducible Tangible Wealth in the U.S.: Revised Estimates," Survey of Current Business, January, 66:51-75.

Reeve, J.E., et al., 1950, "Government Component in the National Wealth," in Studies in Income and Wealth, No. 12, New York: National Bureau of Economic Research.

Seater, J.J., 1981, "The Market Value of Outstanding Government Debt, 1919-1975," Journal of Monetary Economics, July, 8:85-101.

Taubman, P., 1981, "Discussion," in C.R. Hulten, ed., Depreciation, Inflation, and the Taxation of Income from Capital, (Washington: Urban Institute), 129-133.

U.S. Department of Agriculture, 1986, Agricultural Resources: Agricultural Land Values and Markets Situation and Outlook Report.

U.S. Department of Commerce, Bureau of the Census (annual), Governmental Finances, Washington, D.C.: Government Printing Office.

U.S. Department of Commerce, Bureau of Economic Analysis, 1977, The National Income and Product Accounts of the United States, 1929-1974: Statistical Tables, A Supplement to the Survey of Current Business, Washington, D.C.: U.S. Department of Commerce.

U.S. Department of Commerce, Bureau of Economic Analysis, 1982, Fixed Reproducible Tangible Wealth in the United States, 1925-79, (Washington:GPO).

U.S. Department of Energy, 1986a, Petroleum Supply Outlook 1985, (Washington: GPO).

U.S. Department of Energy, 1986b, Reserves of Crude Oil and Natural Gas in the United States, (Washington: GPO).

U.S. Department of Interior, Minerals Management Service, 1985, Mineral Revenues, December.

U.S. Department of Labor, Bureau of Labor Statistics, 1983, Trends in Multifactor Productivity, 1948-81, Bulletin 2178, Washington, D.C.: U.S. Department of Commerce.

U.S. General Accounting Office, 1986, Social Security: Past Projections and Future Financing Concerns, Washington, DC.

U.S. General Services Administration (annual), Summary Report of Real Property Owned by the United States Throughout the World.

U.S. Geological Survey, 1981, Estimates of Undiscovered Recoverable Conventional Resources of Oil and Gas in the United States; Circular

860, (Washington).

Young, A.H. and J.C. Musgrave, 1980, "Estimation of Capital Stock in the United States," in D. Usher, ed., The Measurement of Capital, (Chicago: University of Chicago Press), 23-82.

Source Notes for Tables and Figures

Table 1. Fixed reproducible capital includes equipment and nonresidential and residential structures. The BEA series are 1982$ constant cost estimates updated to 1985$ by our use of price series implicit in the BEA current and constant cost estimates of net capital stocks and depreciation flows for each asset category. The same procedure was used to convert our estimates from 1982$ into 1985$. Our estimates employ the perpetual inventory method and use BEA gross investment data. Given the evidence of Hulten and Wykoff (1981) on the depreciation of private assets, we assume geometric depreciation of government capital with a declining-balance rate for equipment of 1.65/(service life) and for structures of 0.91/(service life). We use BEA estimated service lives, including detailed lives available for some types of capital based on observed usage, to infer depreciation rates, except that we assume a shorter 40 year service life for highways and streets. The 1986 BEA wealth data tape, unpublished BEA data kindly provide by John Musgrave, and several Survey of Current Business articles are our principal data sources. See text for further details on our methods.

Table 2. See note to Table 1 and text.

Table 4. Source: Unpublished BEA 1982 constant dollar estimates of end-of-year stocks of federal government military, federal government nonmilitary, and state and local government inventories were each updated to 1985 constant dollars by multiplying by the ratio of the 1985 BEA current dollar stock to the 1985 constant (1982) dollar stock for each type. Revaluations are calculated as described in text.

Table 5. Private nonresidential capital includes our estimates of fixed private nonresidential capital and inventories. Inventory data is from the

1986 Economic Report of the President, Table B-17; 1982 constant dollar stocks were updated to 1985$ by multiplying by the ratio of 1985 current to constant (1982) dollar stock.

Our estimates of the private fixed nonresidential capital stock may be considered an updating of those in Hulten and Wykoff (1981). We use gross investment data from the 1986 BEA wealth data tape. We assume geometric depreciation patterns and generally use the depreciation rates estimated by Hulten and Wykoff. For asset categories where depreciation rates were inferred by Hulten and Wykoff from the the average relationships δ =1.65/(service life) for equipment and δ =0.91/(service life) for structures and where the BEA estimated service lives have been revised, as reported in Gorman et al (1985), we calculated revised depreciation rates. Where there are now multiple service lives for asset subcategories within a type of capital, we have used the subcategory service life closest to the previous single service life for the asset type to infer a single depreciation rate. We convert our constant dollar estimates from 1982$ to 1985$ by using the price indices implicit in BEA current and constant cost estimates for each asset type.

Our estimates of net private residential capital are based on BEA gross investment and service life data and a geometric depreciation rate of 0.91/(service life), which is the average relationship for nonresidential structures found by Hulten and Wykoff (1981). Gross investment data is from the 1986 BEA wealth data tape and the BEA detailed industry investment tape. BEA service lives are listed in Gorman et al (1985).

For consumer durables our estimates use BEA gross investment data from the 1986 BEA wealth data tape and employ BEA estimated service lives to infer geometric depreciation rates for some assets (see Musgrave (1979)). For durables other than vehicles we assume double-declining balance

depreciation. For vehicles we use the depreciation rates for the corresponding business categories estimated by Hulten and Wykoff. Again, our 1982$ estimates are updated to 1985$ by using price indices implicit in the BEA current and constant dollar data for each type of consumer durable.

Government reproducible capital includes equipment, inventories, and all structures. See notes to Tables 1 and 4.

Table 7. Our adjustments to NIPA measures to better account for government capital and consumer durables are described in Table 5 and in the text. Here we use current dollar data and present our saving, investment, and capital consumption series as percentages of expanded GNP, i.e. NIPA GNP expanded to include rental flows from general government capital and consumer durables. For the three decades from 1951 to 1980 we present simple averages of annual figures for the decade.

Government saving equals the traditionally measured budget balance plus government net investment in reproducible capital and land. Our net investment estimates and the capital consumption figures reported use our estimates of the depreciation of government capital, fixed private capital, and consumer durables; the latter is included here in "private capital consumption."

Table 8. These estimates are derived from our 1985 constant dollar adjustment of the NIPAs to account for government capital and consumer durables. Denominators (GNP or NNP for gross and net saving rates respectively) in each column have been expanded to include the rental flows associated with the types of government investment included in the numerator. The depreciation estimates used are from our calculations, as described earlier. For this reason the net saving rates reported here in column 1 differ from those calculated from NIPA data, which obviously uses

the NIPA capital consumption allowance instead.

Table 10. Source: Par-to-market indices kindly provided by Paul Pieper and described in an appendix to Eisner (1986) were applied to end-of-year 1985 data on government financial assets and liabilities contained in the Federal Reserve Flow of Funds Accounts. See text.

Table 11. Net debt is defined by Eisner as the excess of government financial liabilities over financial assets. Current dollar series on the estimated market value of government financial liabilities and assets for 1945-84 are taken from Eisner (1986) and converted into 1985$ via the GNP deflator. The differences in these series for federal and state-local governments are reported here as net debt. Estimates for 1985 are from Table 10.

Table 12. The value of oil and gas rights for 1981 was obtained from estimates of proven and undiscovered, but economically recoverable, reserves on federal land, 1981 prices, royalty rates, historic ratios of bonuses to future royalties. The values for other years was obtained by adjusting for bonuses and royalties paid and price changes. A detailed description of the methodology and underlying assumptions, as well as sensitivity analyses, are given in Boskin, Robinson, O'Reilly and Kumar (1985). The series was converted to 1985 dollars using the GNP deflator.

Table 13. Sources for government land value estimates:

1946-51 Goldsmith (1962)
1952-68 Milgram (1973)
1969-85 Our updating of Milgram's estimates

with all estimates converted from current dollars into 1985 dollars by the GNP deflator.

Table 15. Source: Boskin, Barham, Cone and Ozler (1987).

Table 16. Source: Boskin and Puffert (1987).

Figure 4. Source: Our calculations, using BEA gross investment and service life data for military and nonmilitary government capital and geometric depreciation rates based on Hulten and Wykoff (1981). See Table 1 and text for details. The time series data plotted here are available on request.

Figure 5. Source: Our calculations, as described in Table 1 and text. The time series data plotted here are available on request.

Figure 8. Source: Our calculations as described in text and notes for Table 5. The time series data plotted here are available on request.

Figure 9. Source: Our calculations as described in texts and notes for Table 5. The time series data plotted here are available on request.

Figure 16. Source: Boskin and Puffert (1987).

Figure 17. U.S. General Accounting Office (1986).