Government Forecasts and Budget Projections:
An Analysis of Recent History

by

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OTA Paper 58   October 1987

[*] The views expressed in this paper are those of the author, and do not necessarily represent the views of the U.S. Department of the Treasury. Comments from Howard "Skip" Nester, Janet Holtzblatt, Tom Neubig, Marty Sullivan, Pat Driessen and Doug Norwood are appreciated. Particular thanks is owed David Weiner for discussions and comments. All errors are my own.

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I. INTRODUCTION

In recent years, increasing attention has been paid to budget-related economic forecasts published by the Congressional Budget Office (CBO) and the Office of Management and Budget (OMB). With the passage of the Gramm-Rudman-Hollings "Balanced Budget and Emergency Deficit Control Act of 1985" (G-R-H)[1], forecasts of budget receipts, outlays, and the deficit made by these agencies are used to determine the amount of spending reductions needed in an upcoming fiscal year if the federal deficit is estimated to exceed a predetermined level.

As a result of the increased legislative focus on budget estimates, and the implications of a deficit estimate which exceeds the G-R-H guidelines, the accuracy of government economic forecasts has come under greater scrutiny. Some commentators have suggested that budget estimates are inherently sensitive to political pressures which, it is presumed, sacrifice accuracy in order to mitigate the need to undertake program cuts. While others have examined the accuracy of selected government macroeconomic forecasts, none have focused upon the accuracy of the economic forecasts under which budget estimates are made.

This paper examines the record of accuracy of the receipt, outlay, and deficit estimates derived from administration and congressional macroeconomic forecasts to determine the historical reliability of each agency's estimates. The results suggest that short-run forecasts (two to three years forward) of both CBO and OMB do not contain systematic bias. Over longer periods, however, the forecasts deteriorate rapidly, particularly that of the budget deficit, as they reflect long term goals for proposed economic policy rather than an actual forecast.

II. BACKGROUND

An abbreviated timetable of the budget process is shown in Figure 1. Beginning in December, OMB produces a forecast of the U.S. economy used in the preparation of the President's transmittal to Congress of the Budget of the United States Government for the forthcoming fiscal year. This forecast is used by the executive branch agencies as the basis for estimates for tax receipts and program outlays for the current and five subsequent fiscal years. As part of the budget submission, two sets of estimates are presented for each fiscal year. The first, current services, is defined by the Congressional Budget Act of 1974 as:

> ...the estimated budget levels and proposed budget authority that would be included in the budget for the following year if programs and activities of the United States Government were carried on during that year at the same level as the current year without a change in policy.[2]

The purpose of the current services estimates are to provide a benchmark against which the effects of the Administration's proposals can be compared.[3] Since any legislation enacted in a given year can have implications for the level of tax receipts or required government outlays, the concepts included in the current services estimate will change from year to year. Additionally, changes by OMB in the definition of what constitutes prior-year levels, and in the classification of on-budget and off-budget activities, will affect the measure of government activity.

The second set of estimates accompanying the President's proposals -- proposed law -- are the estimates of outlays and receipts that would be realized if all the President's budget proposals were enacted to the exclusion of any other proposals which would affect the budget. Paralleling the work of the Administration, the CBO produces its own set of macroeconomic and current service forecasts, as well as an analysis and re-estimation of the Presidents proposals using its economic assumptions.[4] Receipt and outlay estimates are re-evaluated later in the fiscal year as part of the Midsession Review, using updated economic and legislative assumptions.

The budget process was recently modified by the enactment of G-R-H, which established special procedures for FY 1986 - 1991 budgets, along with maximum allowable deficit levels.[5] If the deficit estimate for the upcoming fiscal year as calculated by CBO and OMB on August 15 exceed the predetermined maximum for that year, spending reductions must be proposed to reduce the level of outlays.

A general perception, at least in the popular press, is that forecasts produced by the government are biased.[6] Penner [1982] has argued that the passage of the Congressional

FIGURE 1
SUMMARY TIMETABLE OF BUDGET RELATED ACTIVITY

```
|October 1:  Beginning of fiscal year t-1.
|  30 (approx.):  Final receipt, outlay, and deficit estimates released for fiscal year t-2.
|
|          |December:  Administration distributes economic forecast underlying fy-t budget submission.
|          |
|          |     |January (first Monday after January 3):  President's budget submission for fy-t.
|          |     |
|          |     |     |February:  Congressional Budget Committee hearings begin.
|          |     |     |  15:  CBO budget outlook and analysis of President's fy-t budget submitted to Budget Committees.
|          |     |     |  25:  Committees submit views and estimates to Budget Committees.
|          |     |     |
|          |     |     |     |March:  Department of Commerce releases final GNP estimates for previous calendar year.
|          |     |     |     |  Congressional Budget Committees draft budget resolutions for fy-t.
|          |     |     |     |  15:  Corporate income tax returns due for calendar year corporations.
|          |     |     |     |
|          |     |     |     |     |April 1:  Senate Budget Committee reports concurrent resolution the budget.
|          |     |     |     |     |  15:  Congress completes action on concurrentnt resolution on the budget.
|          |     |     |     |     |  15:  Individual income tax returns due.
|          |     |     |     |     |
|          |     |     |     |     |     |May 15:  Annual appropriation bills may be considered in the House.
|          |     |     |     |     |     |
|          |     |     |     |     |     |     |June 10:  House Appropriations Committee reports last annual appropriation bill.
|          |     |     |     |     |     |     |  15:  Congress completes action on reconciliation.
|          |     |     |     |     |     |     |  30:  House completes action on annual appropriation bills.
|          |     |     |     |     |     |     |
|          |     |     |     |     |     |     |     |July:  Midsession Reviews of the fy-t budget released by CBO and OMB.
|          |     |     |     |     |     |     |     |
|          |     |     |     |     |     |     |     |     |August 15:  CBO & OMB estimate fy-t deficit.
|          |     |     |     |     |     |     |     |     |  20 & 25:  CBO & OMB report findings to Congress and the President.
|          |     |     |     |     |     |     |     |     |  25:  President issues initial sequestration order.
|          |     |     |     |     |     |     |     |     |
|          |     |     |     |     |     |     |     |     |     |September 1:  Initial Presidential order setting spending reductions for fy-t (if required).
|          |     |     |     |     |     |     |     |     |     |  30:  Senate completes work on annual appropriation bills.
|          |     |     |     |     |     |     |     |     |     |
|          |     |     |     |     |     |     |     |     |     |September - October:  Congressional alternative to presidential order, if any, developed and
|          |     |     |     |     |     |     |     |     |     |                      adopted.
|          |     |     |     |     |     |     |     |     |     |
|          |     |     |     |     |     |     |     |     |     |October 1:  Beginning of fy-t.  Initial sequestration order becomes effective.
|          |     |     |     |     |     |     |     |     |     |  10 & 15:  CBO & OMB submit revised reports to Congress and the President.
|          |     |     |     |     |     |     |     |     |     |  15:  Final Presidential reduction order issued (if required), and becomes effective.
|          |     |     |     |     |     |     |     |     |     |  20-25:  Majority leaders introduce joint resolutions on President's notification report.
|          |     |     |     |     |     |     |     |     |     |
|          |     |     |     |     |     |     |     |     |     |     |November 15:  Comptroller General issues compliance report.
|          |     |     |     |     |     |     |     |     |     |     |
|__|____|____|____|____|____|____|____|____|____|____|____|____|____|____|____|____|____|____|____|____|____|____|____|____|____|
|Oct  Nov  Dec  Jan  Feb  Mar  Apr  May  Jun  Jul  Aug  Sep |Oct  Nov  Dec  Jan  Feb  Mar  Apr  May  Jun  Jul  Aug  Sep |Oct  Nov  Dec
|                                                           |                                                            |
|Fiscal Year t-1                                            |Fiscal Year t                                               |Fiscal Year t+1
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Adapted from: "Congressional Budget and Impoundment Control Act of 1974, as Amended," S. Prt 99-117, Dec. 1985, "Gramm-Rudman-Hollings
and the Congressional Budget Process," S. Prt 99-119, Dec. 1985, and House Report 100-313 on Resolution HJRes 324,
September 21, 1987.

Budget and Impoundment Control Act of 1974, increased the political pressure on budget forecasts.[7] He argues that biases arise because changing the set of economic assumptions affecting a proposal or program is politically more acceptable than changing the policy.[8] This compromising of forecasts to accommodate policy would hold true for both congressional activity, where economic assumptions are voted upon as part of the process, and for budget preparations, where the assumptions could be altered to make the budget proposal more attractive. The amount of influence these pressures have had on economic assumptions has not been suggested to be large or statistically significant.

Mitigating this possibility, however, would be the existence of competing bureaucratic pressures on any economic assumption, particularly macroeconomic assumptions. What may be a favorable revision in economic assumptions for one program could be an unfavorable change for another. For example, a decrease in forecast values for inflation and interest rates will reduce the cost of carrying any specified amount of government debt, and reduce anticipated outlays of programs tied to the CPI (such as social security payments). However, the decline in inflation will also reduce the expected level of government receipts, and the future incomes of those constituencies who expect cost of living increases. Given this possibility of competing interests for any forecast variable, either within or outside the government, the pressures may well cancel each other out.

A number of authors have examined the reliability of government macroeconomic forecasts, usually concentrating on three or four variables. Zarnowitz [1986], as part of his most recent study of short-term forecasts and forecasting methodology, included the forecast published in the Council of Economic Advisors Economic Report of the President among those he studied.[9] Beginning in 1963, and broken down into thirteen different sub-periods, summary measures of errors in annual forecasts were compared for three variables: the growth rate of nominal GNP, the growth rate of real GNP, and the rate of inflation in the GNP implicit price index. The mean absolute percent errors of the forecast variables for the period of his study were 1.2, 1.1, and 1.0 percent, respectively. Of the nine sub-periods which included the CEA's forecast, the mean absolute percent error of the CEA forecast was lower than the mean of the group in four, equal to the mean in three, and higher than the mean in two. For all forecasts evaluated, Zarnowitz finds that "the mean absolute error measures ... display no systematic upward or downward trends."[10] All forecasts showed large errors associated with changes in the business cycle.[11]

Kamlet et. al. [1987] analyzed the accuracy of short- and long-term macroeconomic forecasts of OMB and CBO, with particular attention to whether politically motivated or explainable biases were present. The government forecasts were compared to the ASA/NBER series and to simple ARIMA time series models constructed by the authors. Focusing on real GNP growth, inflation, and the unemployment rate, they found that "the Executive branch was slightly optimistic on average" for the years 1962-84 and the sub-period 1969-84, but the "optimism is small in magnitude ... and in no case approaches statistical significance". For the sub-period of 1976-84, CBO and OMB were found to be slightly pessimistic.[12] In

general, the authors conclude that no evidence exists to support the hypothesis that government short-run economic forecasts contain systematic bias.[13] Their conclusion is consistent with Penner's, that "the January forecasts were particularly good for the year in which they were made".[14]

Turning their attention to long term forecasts (beyond two years) Kamlet et. al. conclude that the forecasts of CBO and OMB are generally biased toward optimism. However, in the forecast's first two years the optimism of these agencies is less than would exist if the authors' ARIMA forecast process were substituted, and more so thereafter. They conclude that their results support Reischauer's description of long-range projections "not as extended forecasts, but as attainable, non-cyclical paths ... toward the national goals of full employment and low inflation."[15] This is consistent with the Budget's own statement that longer-term assumptions are achievable and dependent upon the adoption of all of the Administration's programs.[16] In contrast to Boskin [1982] they conclude that the forecasts have not improved over time.[17]

While the works cited above have examined the accuracy of some of the federal government's macroeconomic forecasts, none have examined the accuracy of the forecasts on which the G-R-H process focuses so much attention, namely receipts, outlays, and the resultant deficit estimate.

Receipt and outlay estimates may be better measures of the overall accuracy of government forecasts since they incorporate all of the forecast information produced by OMB or CBO. While aggregate forecasts may be overly/underly optimistic, receipt and outlay forecasts will incorporate other aspects of the forecast which could magnify errors, or, through offsetting errors, minimize the effects of inaccuracy in the macroeconomic forecast. While relatively simple methods could be used to forecast individual macroeconomic variables, no one has suggested an alternative way for OMB or CBO to produce a comprehensive national income accounts forecast necessary to the budget process.

CBO has examined the accuracy of their own and Treasury's estimates. In 1981, a CBO staff study evaluated the accuracy of short run Treasury receipts forecasts for the period 1963 to 1978.[18] The CBO study found that after adjusting for changes in economic and legislative assumptions, receipts estimates "were accurate to within 1 percent of actual collections."[19]

In June 1984 CBO analyzed the reasons for errors in its budget estimates for FY's 1980 - 1982.[20] Errors were divided into four categories: economic, legislative, administrative, and technical assumptions. On the revenue side, CBO found economic assumptions to be primarily responsible for errors in estimates, along with errors in assumed legislative outcomes. Overall, the errors were not found to be large: "less than 2 percent in six of seven budget resolutions examined."[20] Errors in outlay estimates did not arise from a single source, but were largely the result of economic, legislative, and technical assumptions.

III.   THE ACCURACY OF RECENT BUDGET
FORECASTS

To evaluate the accuracy of government budget forecasts we examine four sets of published estimates: GNP, and the current service estimates of receipts, outlays, and deficits.   We focus on estimates made since CBO was formed in 1974, so that a comparison can be made of the relative accuracy of CBO and OMB.

Current service measures were chosen since they reflect the assumption of no change in policy.[22]   As mentioned earlier, the current services estimates are volatile because the base changes from year to year as new laws are enacted.   Using the current services series as a basis for evaluating forecasting accuracy has two effects: 1) since even those budget proposals which were likely to be adopted were not included in the estimates, the comparison will overstate the amount of error in the forecast,[23]   and 2) it will cause severe mis-estimates in years when major unpredicted policy took place, for example, when a new tax law was enacted.   However, for these same reasons, use of the current services forecasts has the advantage of making it easier to differentiate sources of the error.

Estimates were drawn from the budget documents released by OMB (in January) and the CBO (usually in February).   From each budget, the actual value for the previous year was drawn along with the new forecast for the current and five future fiscal years.[24]   None of the series have been corrected for subsequent revisions such as the rebenchmarking of the National Income and Product Account by the Bureau of Economic Analysis that occurred in 1975, 1982, and 1986.   Since none of these revisions were available at the time of the forecasts, and budget estimates are not historically rebenchmarked, we will obtain the best picture of accuracy by comparing the estimates to their unrevised realized value.

We examine only the levels of the variables, rather than the rates of change focused on in the macroeconomic evaluations discussed earlier.   The nature of the budget process, and the G-R-H process, concentrates on the level of the variable.   As such, what is important to policy makers is the degree of accuracy associated with the forecast levels they must use.

A.   GNP Projections

We begin our analysis with a comparison of nominal GNP forecasts produced by the OMB and CBO.   Forecasts of nominal GNP implicitly include forecasts for both inflation and real GNP.   The top half of Table 1 lists the calendar year GNP forecasts produced by the OMB since January 1976, the time the FY 1977 budget was released, and the errors associated with each.[25]   The first entry in each row is the actual for the most current year in which data had been released at the time the forecast was published.   Subsequent entries in the row list the forecast for the level of GNP for each future year.   Reading down any column gives the history of the forecast variable for that year.   For example, in Table 1, the column under 1984 shows that the first OMB forecast for 1984 (published in the FY 1980 budget) was

TABLE 1

CBO AND OMB FORECASTS OF NOMINAL GROSS NATIONAL PRODUCT, 1975 - 1987

OMB forecast

Calendar year → budget document year	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1977	1407												
1978	1499	1516											
1979	1684	1693	1706										
1980	1890	1880	1890	1887									
1981	2124	2092	2099	2106	2128								
1982	2376	2334	2335	2343	2369	2414							
1983	2636	2579	2587	2565	2567	2627	2626						
1984	2877	2784	2858	2825	2842	2928	2922	2938					
1985	2963	3133	3090	3206	3312	3160	3058	3073					
1986	3103	3156	3336	3619	3524	3262	3309	3305					
1987	3400	3595	3546	4052	3883	3566	3642	3661	3775				
1988	3465	3989	4156	4258	3890	3974	3948	3992	4218	4274	4285	4319	4232
						4611	4651	5081	4651	4529	4541	4963	
actual 1986................													4235

CBO forecast

Calendar year → budget document year	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1977	1407												
1978	1476	1516											
1979	1685	1698	1706										
1980	1889	1885	1898	1887									
1981	2128	2085	2107	2107	2128								
1982	2378	2304	2334	2351	2369	2414							
1983	2640	2547	2582	2395	2555	2626	2626						
1984	2915	2809	2854	2894	2849	2941	2922	2938					
1985	3103	3156	3229	3210	3323	3140	3058	3073					
1986	3465	3595	3611	3734	3515	3266	3310	3305					
1987	3989	4050	4135	3882	3580	3651	3661						
1988	4529	4541	4259	3903	3995	3993	3998						
			4963	4659	4221	4339	4269	4238	4216				
actual 1986................													4235

percent error of OMB forecast

Calendar year → budget document year	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1977	0.00												
1978	-1.12	0.00											
1979	-1.29	-0.76	0.00										
1980	0.16	-0.37	0.16	0.00									
1981	-0.19	-1.69	-1.36	-1.03	0.00								
1982	-1.57	-3.31	-3.27	-2.94	-1.86	0.00							
1983	0.38	-1.79	-2.72	-1.49	-2.32	-2.25	0.04	0.00					
1984	-2.08	-5.24	-2.72	-3.85	-3.27	-0.34	-0.54	0.00					
1985	-3.58	1.95	0.94	0.55	4.33	7.78	2.83	-1.30	0.12	0.00			
1986	2.87	-6.07	7.34	9.50	12.50	6.63	2.86	-5.54	-3.52	-0.60	-3.02	-0.15	0.00
1987	12.51	10.09	15.33	6.50	-2.70	-0.08	-1.25	0.92	-0.40				
1988	19.98	9.82	-0.07	1.98	1.18	-0.92							
actual 1986................													0.00

percent error of CBO forecast

Calendar year → budget document year	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1977	0.00												
1978	-2.64	0.00											
1979	-1.23	-0.49	0.00										
1980	0.11	-0.13	0.58	0.00									
1981	-0.02	-2.01	-0.99	-0.99	0.00								
1982	-1.51	-4.54	-3.32	-2.61	-1.86	0.00							
1983	0.53	-3.01	-1.67	-8.80	-2.70	0.10	0.00						
1984	-0.78	-4.40	-2.86	-1.50	-3.03	0.00	-0.54	0.00					
1985	0.96	2.71	5.08	4.46	8.14	2.18	-0.49	0.00					
1986	4.85	8.77	9.26	12.98	6.35	-1.18	0.15	0.00					
1987	5.67	7.28	9.54	2.83	-5.17	-3.28	-3.02	0.00					
1988	13.28	13.58	6.53	-2.38	-0.08	-1.78	-0.13	0.00					
	17.19	10.01	-0.33	2.46	0.07	0.80	-0.45	0.00					
actual 1986................													4235

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$3546 billion. In the FY 1981 budget the estimate was revised upward to $4052 billion. The FY 1987 budget reports the actual value for 1984 GNP was $3775 billion.

The second section of Table 1 shows the percent error associated with each OMB forecast value. The value of the entry shows the percent error of the forecast made at that time in comparison to the final value. Using the same example from the previous paragraph, the FY 1980 forecast of 1984 GNP was off by -6.07%. In this section of the table, the diagonal elements are zero (errors associated with actual values), and the elements to their right show the errors associated with that year's estimate of next years' value (for the FY 1988 budget, prepared in the winter of 1986, estimates of 1986 activity).

The bottom half of Table 1 presents the same information for the nominal GNP forecasts produced by the CBO.

Although there is considerable fluctuation in the estimates, the general trends in Table 1 show increasing error as the time horizon lengthens. The forecasts in the FY 1982 budget (released in January of 1981) show the greatest amount of error. This was due to a number of factors outlined by Rivlin [1987]. Largest among them, an erroneous consensus among most forecasters that economic growth would be strong in 1981, rather than the realized downturn.

Table 2 summarizes the forecasting errors of nominal GNP by OMB and CBO. In each section, errors are listed by vintage, that is, all of the errors associated with forecasts made for the year just ending, (GNP_{-1}), the current year (GNP_0), and extending five more periods. In the case of OMB short-term forecasts, the average error for the value of nominal GNP in the year just ended was -0.756 percent. For the current fiscal year and the fiscal year of the budget submission, the average errors were -0.989 and -0.095 percent. For the CBO the respective percent errors were -0.822, -0.984, and -0.773. These errors compare favorably to the short-run forecast errors reported by Zarnowitz. As would be expected, longer-run forecasts show increased average percent and average absolute percent errors, and appear to be optimistic on average for the years beginning after the date of the budget document. The relative accuracy of these longer forecasts is difficult to determine, since private forecasters generally do not forecast as far forward.

The t-statistics for the hypothesis that the mean of the errors were equal to zero is presented for each set of forecast errors. Comparing these values with the critical values listed at the bottom of the table shows that the hypotheses that the mean error of the forecasts were equal to zero cannot be accepted for either CBO or OMB's prior and current year nominal GNP projections at the 95% level. Additionally, for CBO's t+4 and t+5 forecasts we cannot accept the hypothesis of a zero mean with either a one- or two-tailed test. The hypothesis that the mean error of OMB and CBO was the same for each year cannot be rejected.[26] The results in Table 2 further suggest that we cannot accept the general conclusion of Kamlet et. al. that government macroeconomic forecasts are pessimistic in the short run (t+1 through t+3) based upon the signs of the errors. For all GNP forecasts, the test statistics for the hypothesis that the signs on the errors are drawn from a random binomial distribution are within a 95 percent confidence region with the exception of the

TABLE 2
SUMMARY OF NOMINAL GNP FORECAST ERRORS

Office of Management and Budget

forecast year		GNP(-1)	GNP(0)	GNP(+1)	GNP(+2)	GNP(+3)	GNP(+4)	GNP(+5)
	1975	-1.121	-1.290	0.159	-0.188	-1.574	0.381	-2.076
	1976	-0.762	-0.371	-1.692	-3.314	-1.790	-5.242	-3.580
	1977	0.159	-1.363	-3.273	-1.485	-2.723	1.952	2.874
	1978	-1.034	-2.941	-2.323	-3.846	0.553	0.938	-6.066
	1979	-1.864	-2.247	-3.268	4.328	9.501	7.338	12.506
	1980	0.038	-0.340	7.777	12.496	10.093	15.333	19.976
	1981	-0.545	2.831	6.626	2.861	6.503	9.823	
	1982	-0.488	-1.301	-5.536	-2.701	-0.071		
	1983	0.121	-3.523	-0.600	1.983			
	1984	-3.020	-1.251	1.181				
	1985	-0.150	0.921					
	1986	-0.401						

	GNP(-1)	GNP(0)	GNP(+1)	GNP(+2)	GNP(+3)	GNP(+4)	GNP(+5)
number of observations..	12	11	10	9	8	7	6
mean error..............	-0.756	-0.989	-0.095	1.126	2.562	4.360	3.939
variance................	0.784	2.841	16.638	23.434	24.417	40.663	87.424
mean absolute error.....	0.809	1.671	3.243	3.689	4.101	5.858	7.847
variance................	0.701	1.027	6.127	11.092	14.160	25.360	41.373
t-statistic, Ho: u = 0..	-2.956	-1.945	-0.074	0.698	1.466	1.809	1.032

Congressional Budget Office

forecast year		GNP(-1)	GNP(0)	GNP(+1)	GNP(+2)	GNP(+3)	GNP(+4)	GNP(+5)
	1975	-2.639	-1.231	0.106	-0.023	-1.512	0.533	-0.783
	1976	-0.487	-0.132	-2.011	-4.540	-3.008	-4.401	0.963
	1977	0.583	-0.987	-3.322	-1.668	-2.862	2.714	4.847
	1978	-0.987	-2.610	-8.797	-1.498	5.076	8.775	5.669
	1979	-1.864	-2.704	-3.029	4.458	9.259	7.285	13.282
	1980	0.000	0.102	8.135	12.980	9.536	13.582	17.190
	1981	-0.545	2.180	6.354	2.834	6.528	10.012	
	1982	-0.488	-1.180	-5.166	-2.376	-0.331		
	1983	0.151	-3.285	-0.075	2.456			
	1984	-3.020	-1.776	0.071				
	1985	-0.125	0.803					
	1986	-0.449						

	GNP(-1)	GNP(0)	GNP(+1)	GNP(+2)	GNP(+3)	GNP(+4)	GNP(+5)
number of observations..	12	11	10	9	8	7	6
mean error..............	-0.822	-0.984	-0.773	1.403	2.836	5.500	6.861
variance................	1.147	2.430	22.892	24.001	25.045	32.863	41.101
mean absolute error.....	0.945	1.545	3.707	3.648	4.764	6.757	7.122
variance................	0.931	1.012	9.751	12.659	10.390	17.451	37.452
t-statistic, Ho: u = 0..	-2.660	-2.093	-0.511	0.859	1.603	2.538	2.622

	GNP(-1)	GNP(0)	GNP(+1)	GNP(+2)	GNP(+3)	GNP(+4)	GNP(+5)
critical values for t-statistic (n-1, .95):							
two-tail..............	2.201	2.228	2.262	2.306	2.365	2.447	2.571
one-tail..............	1.796	1.812	1.833	1.860	1.895	1.943	2.015

t-statistic for equality of mean errors:

	GNP(-1)	GNP(0)	GNP(+1)	GNP(+2)	GNP(+3)	GNP(+4)	GNP(+5)
	0.159	-0.007	0.324	-0.114	-0.103	-0.325	-0.576

administration's GNP(0) forecasts, for which the probability of having nine of eleven errors of the same sign is 2.69 percent.[27]

One reason for the apparent bias in estimating current year forecasts is the rebenchmarking of the National Income accounts on a factor not explicitly accounted for in other studies. Normally when a rebenchmarking occurs it is because previously unmeasured or understated aspects of the accounts are more fully incorporated into the measure. Thus, rebenchmarking will tend to raise the published level of nominal GNP, causing previous forecasts to understate future levels, and alter expectations about future economic growth. Rebenchmarking of the National Income Accounts does not have an effect on the measurement of receipts or outlays of the government.

B.   Current Service Receipts

Tables 3 and 4 present the same descriptive data for receipts as were presented for nominal GNP above. Important to note in these and subsequent tables is that the time period covered by the data has been shifted from calendar years to fiscal years. Thus, when the budget is released in January, the final values for the previous fiscal year (ending September 30) are known, as are actuals for the first (and possibly second) month of the current fiscal year.[28]   As discussed earlier, a number of reasons, independent of any forecasting process, may cause systematic errors in estimates of current services receipts.

Table 3 shows that as with the GNP forecasts, the largest errors for any particular budget document were associated with the FY 1982 submission. In this case the reasons for the errors were two-fold, and were the result of changes not incorporated into the budget assumptions. First was the unpredicted economic downturn of 1981. Second, and even more important were the changes in the tax law brought about by the Economic Recovery Tax Act of 1981 (ERTA), signed into law on August 31, 1981. At the time of its passage, ERTA was estimated to reduce total receipts from forecast levels by $1.6 billion in FY 1981, increasing to -$267.7 billion in FY 1986.[29]

In addition to the FY 1982 estimates, substantial errors occurred in all submissions prior to FY 1984. These errors also appear to be primarily due to newly enacted legislation. Between the enactment of ERTA in August, 1981, and the Tax Reform Act of 1986 (TRA86), in October, 1986, eleven major pieces of legislation with revenue consequences were signed into law.[30]   Those with the most significant revenue effects were the Tax Equity and Fiscal Responsibility Act of 1982 (TEFRA), the Social Security Amendments of 1983, and the Deficit Reduction Act of 1984 (DEFRA).

Table 4 presents the summary analysis of receipt forecasting errors. The errors in the forecasts made by CBO and OMB were within one percentage point of each other throughout the forecast horizon. The average error of the current year forecast made by OMB and CBO was less than 0.3%. For the following year, that of the budget submission, the error increases to more than 2 percent for both CBO and OMB. In contrast to the error pattern in the GNP

TABLE 3

CBO AND OMB FORECASTS OF CURRENT SERVICE RECEIPTS, FY 1976 – FY 1987

OMB forecast

fiscal year (budget document year)	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1977	281	298	351	407	465	523	585					
1978		300	361	408	465	526	585	635				
1979			357	401	472	540	620	701	775			
1980				402	456	505	571	647	715	778		
1981					466	524	600	691	809	922	1061	
1982						520	608	712	809	921	1053	1189
1983							599	666	799	921	1053	1189
1984								618	627	723	797	861
1985									598	649	713	781
1986										600	667	737
1987											667	737
1988												769

CBO forecast

fiscal year	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1977	281	301	372	423	479	537	601	668				
1978		299	363	407	464	526	594	668				
1979			357	397	457	519	590	661	751			
1980				402	453	502	574	661	749	849		
1981					466	516	582	678	781	905	1053	
1982						520	612	709	810	920	1033	1159
1983							599	631	652	763	818	
1984								618	701	715	768	
1985									606	653	733	795
1986									601	663	735	788
1987										667	778	769
1988											734	

percent error of OMB forecast

fiscal year	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1977	0.00	-0.83	-1.57	1.17	-0.13	0.60	-2.32					
1978		0.00	1.12	1.39	-0.19	1.23	-2.45	2.75				
1979			0.00	-0.32	1.35	3.77	3.42	13.42	29.07			
1980				0.00	-2.12	-2.96	-4.67	4.66	19.16	16.70		
1981					0.00	0.73	0.12	11.86	33.07	38.11	44.56	
1982						0.00	1.37	15.22	34.80	38.38	43.39	54.53
1983							0.00	1.46	10.96	-0.38	8.48	11.95
1984								0.00	-0.38	-2.63	8.51	1.55
1985									0.00	0.02	0.44	-2.87
1986										0.00	0.38	4.46
1987											0.00	3.28
1988												0.00

percent error of CBO forecast

fiscal year	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1977	0.00	0.53	4.13	5.22	2.70	3.27	0.33					
1978		0.00	1.57	1.24	-0.41	1.15	-0.83	8.13				
1979			0.00	-1.24	-1.91	-0.19	-1.50	8.13	24.96			
1980				0.00	-2.70	-3.46	-4.17	6.99	24.63	27.38		
1981					0.00	-0.77	2.15	9.74	29.95	35.78	43.44	
1982						0.00	2.14	14.78	34.81	37.97	40.74	50.67
1983							0.00	8.49	5.18	3.94	6.36	
1984								0.00	0.83	-2.03	-0.14	
1985									0.00	-2.60	-0.15	
1986										0.00	0.12	2.46
1987											0.00	1.16
1988												0.00

TABLE 4
SUMMARY OF RECEIPTS FORECAST ERRORS

Office of Management and Budget

		R(0)	R(+1)	R(+2)	R(+3)	R(+4)	R(+5)
	1976	-0.833	-1.569	1.169	-0.129	0.596	-2.319
	1977	1.121	1.393	-0.193	1.231	-2.453	2.752
forecast	1978	-0.323	1.352	3.769	3.421	13.419	29.069
year	1979	-2.125	-2.962	-4.672	4.662	19.157	16.699
	1980	0.731	0.117	11.865	33.067	38.110	44.558
	1981	1.368	15.215	34.799	38.380	43.386	54.531
	1982	1.457	10.961	8.477	8.514	11.949	
	1983	-0.383	-2.626	-2.874	1.547		
	1984	0.015	0.436	4.460			
	1985	0.381	3.277				
	1986	0.962					
number of observations..		11	10	9	8	7	6
mean error..............		0.215	2.559	6.311	11.336	17.738	24.215
variance...............		1.073	31.898	125.638	206.015	261.220	429.618
mean absolute error.....		0.882	3.991	8.031	11.369	18.439	24.988
variance...............		0.342	22.523	100.971	205.284	235.867	391.578
t-statistic, Ho: u = 0..		0.690	1.433	1.689	2.234	2.904	2.862

Congressional Budget Office

		R(0)	R(+1)	R(+2)	R(+3)	R(+4)	R(+5)
	1976	0.535	4.133	5.224	2.704	3.269	0.334
	1977	1.569	1.244	-0.408	1.154	-0.835	8.126
forecast	1978	-1.244	-1.910	-0.192	-1.503	8.126	24.958
year	1979	-2.704	-3.462	-4.174	6.993	24.626	27.382
	1980	-0.769	-2.838	9.744	29.950	35.784	43.441
	1981	2.154	14.778	34.809	37.974	40.744	50.670
	1982	2.137	8.486	5.176	3.937	6.358	
	1983	0.832	-2.026	-2.602	-0.143		
	1984	-0.525	-0.150	3.368			
	1985	0.123	2.457				
	1986	1.157					
number of observations..		11	10	9	8	7	6
mean error..............		0.297	2.071	5.661	10.133	16.867	25.818
variance...............		2.069	29.998	123.114	199.114	239.035	315.636
mean absolute error.....		1.250	4.148	7.300	10.545	17.106	25.818
variance...............		0.595	17.080	101.873	190.607	230.933	315.636
t-statistic, Ho: u = 0..		0.684	1.196	1.530	2.031	2.886	3.560

	R(0)	R(+1)	R(+2)	R(+3)	R(+4)	R(+5)
critical values for t-statistic (n-1, .95):						
two-tail..............	2.228	2.262	2.306	2.365	2.447	2.571
one-tail..............	1.812	1.833	1.860	1.895	1.943	2.015

t-statistic for equality of mean errors:

	R(0)	R(+1)	R(+2)	R(+3)	R(+4)	R(+5)
	-0.145	0.186	0.117	0.158	0.095	-0.131

forecasts, both OMB and CBO were overly optimistic in seven of the eleven sample years. An examination of the test statistics show that the mean errors of the short-run receipt estimates are not statistically different from zero. However, the test statistics for longer-term forecasts, beginning with vintage t+3, suggests that we cannot accept the null hypothesis that the mean errors were equal to zero compared to the alternative that the average errors exceeded zero. In other words, for both CBO and OMB, the tests indicate an optimistic bias for the three most distant vintage forecast years during the period of study. The tests further indicate that for the period 1974 through 1986, the mean errors in CBO's and OMB's forecasts were not statistically different.

The likely reason for the bias in these out-year forecasts was the result of enacted legislation over the period. With the passage of ERTA, all receipts forecasts made prior to the FY 1983 budget were made obsolete. How well the forecasters incorporated the effects of the many changes in tax law during this period into GNP and receipts forecasts raises the additional question of how accurately the revenue consequences of tax proposals are estimated.

The two main sources of revenue estimates for proposed legislation are Congress's Joint Committee on Taxation (JCT), and the Department of the Treasury's Office of Tax Analysis (OTA). During the congressional deliberations on the TRA86, a number of articles suggested that the behavioral and economic assumptions employed by these groups were incorrect.[31] While it is beyond the scope of this paper to separately analyze the accuracy of revenue estimating procedures, we can make some inference about their aggregate accuracy. To the extent that the estimates of the effects of newly enacted legislation over the period were substantially incorrect, receipts forecasts which rely on those estimates would show substantial error as well.[32]

Tables 3 and 4 show that this was clearly not the case. After enacted legislation estimates were incorporated into the assumptions, the error of the estimates was greatly reduced. With respect to ERTA, Figure 2 shows OMB's receipt forecast based on September, 1981 assumptions both including and excluding the effect of ERTA. After the inclusion of the revenue consequences of ERTA, the error for FY 1982 receipts was 1.17%, and 1.95% for FY 1983. The forecasts understate receipts for FY 1983 onward due to the subsequent passage of TEFRA and DEFRA. Later adjustments for these tax bills are reflected in the sharp decline in errors for post-1983 budget submissions. CBO's errors for FY 1985 receipts projections declined from 40.74% to 3.94% between the FY 1982 and FY 1983 budget projections. The error then dropped to -2.60% for the FY 1984 budget submission, which was made prior to the tax increases called for in DEFRA. Afterwards, errors were less than two-tenths of one percent. For the OMB projections, the decline in error was equally dramatic.

FIGURE 2
Effect of ERTA on Receipts Forecast
September 1981 projections

Legend: □ actual   + mid82   ◇ mid82+erta

14
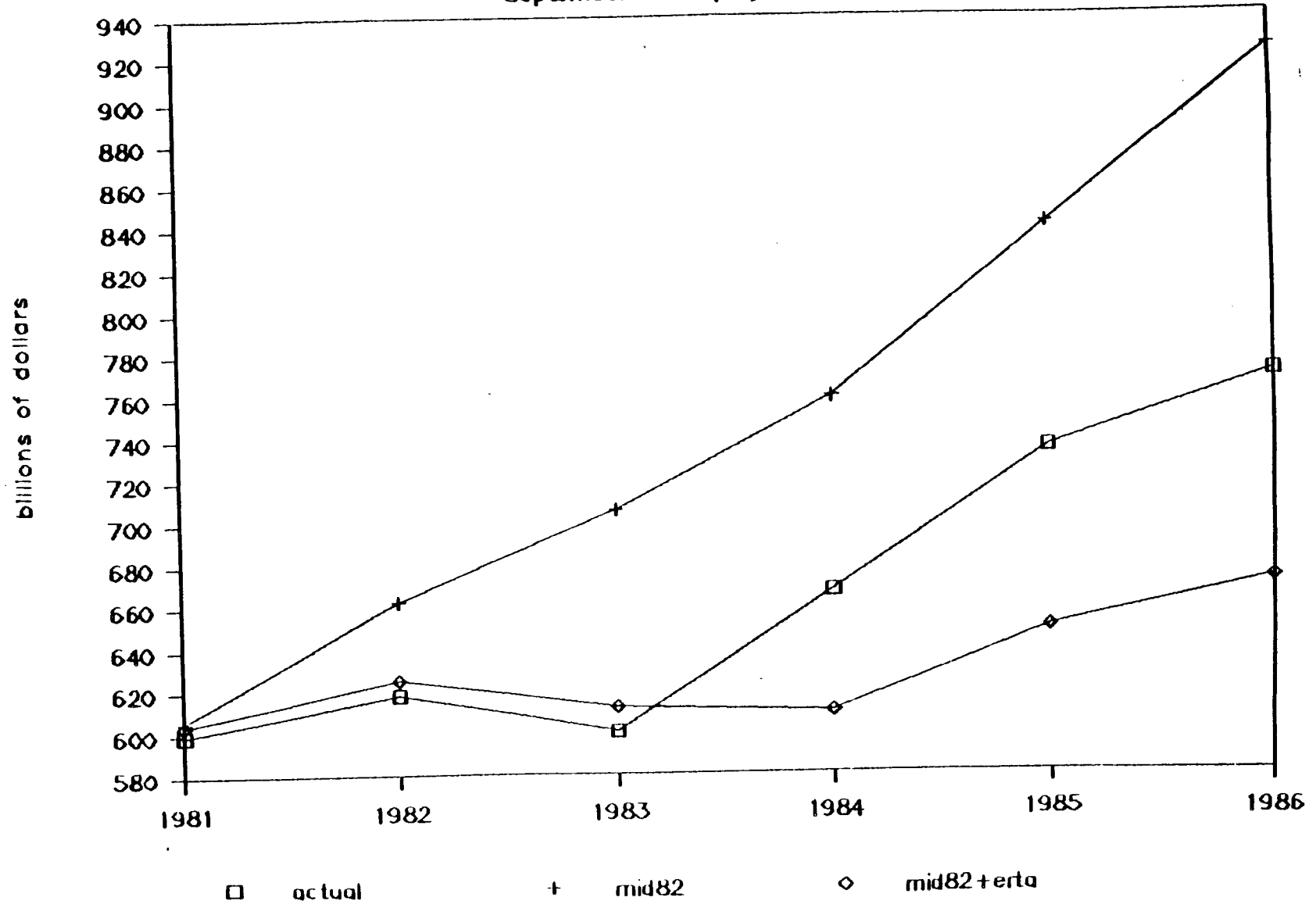
C.   Current Service Outlays

As with the receipts estimates, the use of current services outlays forecasts will be biased to the extent that changes in legislation or national needs affecting the desired level government spending occurred after the estimates were made.   Penner has highlighted may reasons for changes in outlays during a given period;   natural disasters may cause a sudden increase in necessary expenditures, or agencies may find that their spending plans are not fulfilled.[33] .

Table 5 shows the OMB and CBO's forecasts and errors for current service outlays. Comparing the summary data from each, in Table 6, we immediately notice two things.   First, as with receipts, the size of the errors made by OMB and CBO were very close, differing by less than one percent, and not statistically different.   Second, outlay estimates were more accurate than receipt forecasts, particularly as the time horizon lengthened.   This may well be due to the period chosen for our analysis, and a result of the changes in tax law outlined above.   While major changes were taking place in the laws governing tax receipts, government spending remained on a more stable path.

As for the accuracy of the forecasts, the t-tests again suggest that we cannot reject the null hypothesis that the mean error of OMB or CBO outlay estimates were different than zero in the short-run.   Beginning with CBO's $t+2$ forecast, and OMB's $t+3$ forecast, the errors show a statistically significant negative bias in their estimates of outlay levels.

D.   Deficits

Finally, we turn our attention to the deficit estimates made in each budget document. Deficit projections are not forecasts in and of themselves, but rather the calculated difference between projected receipt and outlay levels.   In addition, the deficit forecast used in the G-R-H process is not the January current service estimate (which we examine here), but the fall current law forecast, which includes newly enacted legislation and the lapsing of expiring legislation.   Given its timing, we would expect the G-R-H forecast to be less accurate than the current year's deficit forecast (D(0)), made approximately four months later), and more accurate than next year's estimate (D(+1)), made approximately eight months earlier).   Table 7 shows the OMB and CBO forecasts for the deficit.[34]

By its nature of being a residual, we expect the mean error of the deficit forecast to be larger than those for either receipts or outlays for three reasons.   First, statistically, the variance of the difference of two random variables will exceed the variance of either variable, so long as the covariance between the variables is not negative and greater than half of either's variance (in absolute value).[35]   If receipt and outlay estimates were independent, the variance of the deficit forecast would be the sum of the variance of receipts and outlay forecasts.   Second, and closely related, a small percentage error in either receipt or outlay estimates will cause a large percentage change in the residual,

TABLE 5

CBO AND OMB FORECASTS OF CURRENT SERVICE OUTLAYS, FY 1976 – FY 1987

OMB forecast

budget document year \ fiscal year	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1977	325	374	392	420	442	465	489					
1978		367	411	440	466	497	527	559				
1979			402	462	500	541	569	604	642			
1980				451	491	536	578	611	640	667		
1981					494	541	578	616	686	774	817	
1982						580	661	736	817	890	968	1050
1983							675	728	799	869	966	1052
1984								728	799	869	945	1019
1985									796	854	945	1025
1986										852	960	982
1987											946	982
1988												990

percent error of OMB forecast

budget document year \ fiscal year	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1977	0.00	1.96	-2.49	-6.74	-10.51	-19.77	-27.52					
1978		0.00	2.31	-2.40	-5.61	-14.32	-21.91	-23.30				
1979			0.00	2.37	1.20	-6.66	-15.68	-17.05	-19.41			
1980				0.00	-0.49	-7.51	-14.39	-16.17	-19.57	-21.68		
1981					0.00	-2.81	-8.76	-5.78	-1.51	-4.62		
1982						0.00	-2.13	1.07	2.68	4.52	2.28	6.11
1983							0.00	-0.10	0.38	2.92	2.92	6.28
1984								0.00	1.27	1.97	-0.50	0.93
1985									0.00	0.26	0.00	2.24
1986										0.00	-0.15	1.33
1987											0.00	-0.79
1988												0.00

CBO forecast

budget document year \ fiscal year	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1977	325											
1978	375	365										
1979	422	413	402									
1980	456	445	458	451								
1981	488	467	495	494	494							
1982	524	491	529	551	560	580						
1983	562	516	565	604	603	660	675					
1984	542	606	565	655	648	739	660	728				
1985	655	606	706	685	792	739	740					
1986	755	722	685	843	809	800						
1987	763	895	889	850	853	852						
1988	950	971	929	928	949	946						
	1052	999	1012	1003	986	990						

percent error of CBO forecast

budget document year \ fiscal year	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1977	0.00											
1978	2.77	0.00										
1979	5.10	2.79	0.00									
1980	1.15	-1.29	1.65	0.00								
1981	-1.26	-5.41	0.26	0.02	0.00							
1982	-9.59	-15.29	-8.73	-4.93	-3.38	0.00						
1983	-16.80	-23.54	-16.28	-10.51	-10.08	-2.24	0.00					
1984	-17.71	-16.80	-11.31	-11.04	-13.94	-11.38	0.00					
1985	-19.37	-15.26	-11.38	-19.37	-15.43	-5.43	2.61	-4.03				
1986	1.59	1.41	-0.50	-1.02	2.28	6.28						
1987	0.00	1.63	4.34	0.00	0.93							
1988	0.50	-1.02	-1.83	2.24								
	0.12	-0.23	-1.93	1.33	-0.38	0.00						

TABLE 6
SUMMARY OF OUTLAY FORECAST ERRORS

Office of Management and Budget

		O(0)	O(+1)	O(+2)	O(+3)	O(+4)	O(+5)
	1976	1.965	-2.488	-6.744	-10.512	-19.772	-27.515
	1977	2.314	-2.396	-5.611	-14.320	-21.914	-23.298
forecast	1978	2.374	1.195	-6.660	-15.676	-17.051	-19.410
year	1979	-0.486	-7.505	-14.387	-16.172	-19.573	-21.683
	1980	-2.812	-8.757	-5.780	-2.726	-1.514	-4.618
	1981	-2.134	1.071	2.676	4.520	2.283	6.112
	1982	-0.096	0.377	1.972	0.000	2.920	
	1983	1.269	3.346	2.124	6.254		
	1984	0.258	-0.148	2.970			
	1985	1.490	3.506				
	1986	-0.788					

	O(0)	O(+1)	O(+2)	O(+3)	O(+4)	O(+5)
number of observations..	11	10	9	8	7	6
mean error..............	0.305	-1.180	-3.271	-6.079	-10.660	-15.069
variance................	2.823	15.724	32.200	74.274	109.363	140.514
mean absolute error.....	1.453	3.079	5.436	8.773	12.147	17.106
variance................	0.804	7.637	13.350	34.271	75.463	74.960
t-statistic, Ho: u = 0..	0.602	-0.941	-1.729	-1.995	-2.697	-3.114

Congressional Budget Office

		O(0)	O(+1)	O(+2)	O(+3)	O(+4)	O(+5)
	1976	2.769	5.101	1.154	-1.256	-9.593	-16.802
	1977	2.787	-1.287	-5.408	-15.286	-23.544	-25.590
forecast	1978	1.653	0.263	-8.730	-16.284	-16.804	-17.714
year	1979	0.020	-4.934	-10.505	-10.077	-11.307	-11.385
	1980	-3.382	-10.653	-11.038	-13.945	-15.258	-19.370
	1981	-2.237	1.414	-0.503	-1.021	-5.432	-4.031
	1982	1.593	1.633	4.343	2.610	6.284	
	1983	0.503	-0.235	-1.828	0.929		
	1984	0.117	-1.934	2.243			
	1985	0.285	1.334				
	1986	-0.384					

	O(0)	O(+1)	O(+2)	O(+3)	O(+4)	O(+5)
number of observations..	11	10	9	8	7	6
mean error..............	0.338	-0.930	-3.364	-6.791	-10.808	-15.815
variance................	3.307	16.718	29.405	54.522	77.248	45.210
mean absolute error.....	1.430	2.879	5.083	7.676	12.603	15.815
variance................	1.377	9.295	14.878	41.720	35.215	45.210
t-statistic, Ho: u = 0..	0.617	-0.719	-1.861	-2.601	-3.253	-5.762

	O(0)	O(+1)	O(+2)	O(+3)	O(+4)	O(+5)
critical values for t-statistic (n-1, .95):						
two-tail..............	2.228	2.262	2.306	2.365	2.447	2.571
one-tail..............	1.812	1.833	1.860	1.895	1.943	2.015
t-statistic for equality of mean errors:						
	-0.043	-0.132	0.033	0.166	0.026	0.123

TABLE 7

CBO AND OMB FORECASTS OF THE CURRENT SERVICE DEFICIT, FY 1976 -- FY 1987

OMB forecast

fiscal year	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1977	-44											
1978	-76	-67										
1979	-43	-50	-45									
1980	-23	-38	-62	-49								
1981	10	-8	-61	-37	-28							
1982	41	24	-38	-29	-16	-60						
1983	76	53	9	-1	38	-55	-74					
1984	70	45	38	5	25	-28	-99	-111				
1985	76	73	82	-8	-92	-55	-208	-189	-194			
1986	159	107	85	32	-83	-184	-180	-177	-148			
1987	138	-66	-72	-184	-180	-224	-230					
1988			-185	-212	-206	-221						

percent error of OMB forecast

JAN 1986

fiscal year	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1977	0.00											
1978	14.29	11.78	0.00									
1979	-4.44	-22.54	26.64	0.00								
1980	-53.28	-72.20	118.77	35.02	0.00							
1981	-134.66	-140.77	-37.08	-51.34	-33.22	0.00						
1982	-168.12	-171.70	-111.63	-98.38	-78.62	-25.32	0.00					
1983	-202.14	-163.29	-140.87	-134.18	-104.34	-75.14	-10.85	0.00				
1984	-139.00	-137.21	-112.54	-95.91	-53.17	6.29	1.89	0.00				
1985	-157.47	-144.04	-117.27	-66.13	-55.26	-8.53	-0.86	0.00				
1986	-174.71	-139.90	-70.10	-33.08	-15.03	5.32	0.00					
1987	-162.62	-19.76	4.35	0.00								
1988	-6.84	0.00										

CBO forecast

fiscal year	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1977	-44											
1978	-74	-66										
1979	-51	-51	-45									
1980	-33	-38	-61	-49								
1981	-9	-3	-67	-41	-28							
1982	13	35	-61	-49	-44	-60						
1983	40	78	-49	-40	-21	-48	-74					
1984	126	-39	-10	-20	-30	-109	-157	-188				
1985	-19	13	0	18	76	-157	-194	-208	-234			
1986	34	0	138	-188	-197	-214	-231					
1987	5	209	-190	-195	-217	-215						
1988			-185	-195	-208	-212	-221					

percent error of CBO forecast

fiscal year	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1977	0.00											
1978	12.96	0.00										
1979	12.78	12.44	0.00									
1980	-32.38	-22.13	25.51	0.00								
1981	-67.51	-89.17	141.88	46.21	0.00							
1982	-120.97	-158.72	2.35	-17.79	-26.17	0.00						
1983	-153.44	-205.53	-33.71	-45.88	-71.59	-35.06	0.00					
1984	-213.92	-64.74	-91.41	-81.92	-72.88	-1.45	0.00					
1985	-90.28	-106.40	-100.00	-109.21	-19.65	1.46	-0.72	0.00				
1986	-118.08	-100.00	-141.01	-165.00	-102.36	-2.03	0.80	6.31	2.54	0.00		
1987	-194.70	6.03	4.67	-8.15	-1.68	0.80	0.00					
1988	-2.58	-5.75	0.00									

especially, as has been the case until recently, if the residual is a relatively small number. Suppose, for example, receipts were forecast to be 999, and outlays 1000, the estimate of the deficit would be -1. If actual outlays were 1002, (an error of .2%), the deficit amount would be -3 (yielding a forecast error of 200%). Finally, factors which affect receipts often affect outlays in a way that exacerbates the deficit. An economic downturn, for example, reduces revenues and increases government outlays.

In looking at Table 8, the comparison of the estimating errors, two things become apparent. First, as expected, the errors for the deficit forecast were much larger than either the receipt or outlay errors. For the current year forecast, the error in the deficit estimate was at least 6.6 times greater than the larger of the receipt or outlay forecast error. Second, the accuracy of the forecast deteriorated rapidly as the forecast period extended, and appears to contain a systematic bias. For both CBO and OMB, the hypothesis that the mean errors were equal to zero cannot be accepted in the case of a forecast beyond the budget year for which it was estimated.

This large amount of error is itself due to two factors. First, in the early part of the sample period, deficits were small relative to the overall size of the budget (15.7% of receipts in FY 1975 compared to 28.7% in FY 1986). Thus, even small errors in the level of receipts or outlays would have been magnified into large errors in the deficit. Second, the large increase in the level of the deficit over the period (from -$44 billion in FY 1975 to -$221 billion in FY 1986), particularly the $122 billion increase between FY 1981 and FY 1983, resulted in very large errors in the longer term deficit forecasts published in earlier budgets.

Regardless of the difficulties in longer term forecasts, the ability of both CBO and OMB to predict the level of the deficit for the current year, measured by the percent error of the forecast, has improved. Following substantial mis-estimates prior to FY 1982, the amount of error in the deficit forecast declined sharply, though it remained much larger than receipt and outlay estimates.[36]

While it is encouraging that the government's deficit forecast has improved, it is not clear that reliance on this estimate will yield the best results for the budget process. G-R-H requires a reduction in planned spending if the deficit forecast exceeds the legislated target by more than $10 billion. Unfortunately, given even a 10% average absolute percent error for the current year deficit forecast, the deficit must be $100 billion or less for the $10 billion range of error allowed for in G-R-H to approximate the range of uncertainty found in past estimates.

IV. SUMMARY

Since the mid-1970's, there has been an increased reliance on the government's ability to produce accurate economic, budget, and tax policy forecasts. In recent years this has

TABLE 8
SUMMARY OF DEFICIT FORECAST ERRORS

Office of Management and Budget

		D(0)	D(+1)	D(+2)	D(+3)	D(+4)	D(+5)
	1976	14.29	−4.44	−53.28	−134.66	−168.12	−202.14
	1977	11.78	−22.54	−72.20	−140.77	−171.70	−163.29
forecast	1978	26.64	118.77	−37.08	−111.63	−140.87	−139.00
year	1979	35.02	−51.34	−98.38	−134.18	−137.21	−157.47
	1980	−33.22	−78.62	−104.34	−112.54	−144.04	−174.71
	1981	−25.32	−75.14	−95.91	−117.27	−139.90	−162.62
	1982	−10.85	−53.17	−55.26	−66.13	−70.10	
	1983	6.29	1.89	−8.53	−33.08		
	1984	−0.86	−15.03	−19.76			
	1985	5.32	4.35				
	1986	−6.84					

	D(0)	D(+1)	D(+2)	D(+3)	D(+4)	D(+5)
number of observations..	11	10	9	8	7	6
mean error..............	2.02	−17.53	−60.53	−106.28	−138.85	−166.54
variance................	382.89	2910.14	1081.84	1241.54	956.87	366.83
mean absolute error.....	16.04	42.53	60.53	106.28	138.85	166.54
variance................	129.71	1408.58	1081.84	1241.54	956.87	366.83
t-statistic, Ho: u = 0..	0.343	−1.027	−5.520	−8.531	−11.876	−21.299

Congressional Budget Office

		D(0)	D(+1)	D(+2)	D(+3)	D(+4)	D(+5)
	1976	12.96	12.78	−32.38	−67.51	−120.97	−153.44
	1977	12.44	−22.13	−89.17	−158.72	−205.53	−213.92
forecast	1978	25.51	141.88	2.35	−33.71	−64.74	−90.28
year	1979	46.21	−17.79	−45.88	−91.41	−106.40	−118.08
	1980	−26.17	−71.59	−81.92	−100.00	−100.00	−102.36
	1981	−35.06	−72.88	−109.21	−141.01	−165.00	−194.70
	1982	−1.45	−19.65	1.46	−2.03	6.03	
	1983	−0.72	6.31	0.80	4.67		
	1984	2.54	−8.15	−1.68			
	1985	0.80	−2.58				
	1986	−5.75					

	D(0)	D(+1)	D(+2)	D(+3)	D(+4)	D(+5)
number of observations..	11	10	9	8	7	6
mean error..............	2.85	−5.38	−39.51	−73.72	−108.09	−145.46
variance................	452.46	3174.41	1744.57	3210.26	3981.27	2138.07
mean absolute error.....	15.42	37.57	40.54	74.88	109.81	145.46
variance................	222.80	1791.59	1662.61	3036.89	3606.09	2138.07
t-statistic, Ho: u = 0..	0.444	−0.302	−2.838	−3.680	−4.532	−7.706

	D(0)	D(+1)	D(+2)	D(+3)	D(+4)	D(+5)
critical values for t-statistic (n-1, .95):						
two-tail..............	2.228	2.262	2.306	2.365	2.447	2.571
one-tail..............	1.812	1.833	1.860	1.895	1.943	2.015

t-statistic for equality of mean errors:

	D(0)	D(+1)	D(+2)	D(+3)	D(+4)	D(+5)
	−0.090	−0.467	−1.118	−1.291	−1.072	−0.942

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become most apparent in the passage of the G-R-H Deficit Control Act, and in the "revenue-neutral" ground-rules adopted for the consideration of the Tax Reform Act of 1986. Overall, the evidence suggests that the government performs well as a forecaster of aggregate economic activity, particularly in the short-run, the period most critical in the making of policy decisions. No evidence of a systematic bias in forecasting was found in any of the budget variables examined for the current year or for the year of the budget submission.

Receipt and outlay forecasts, which rely on a more disaggregated forecast consistent with GNP projections, performed very well over the period of study. Receipt forecasts published by CBO and OMB for the current year averaged less than .3% error, with the average for outlay forecasts slightly higher. Looking one year further, the average error for outlay estimates rose to approximately 1%. Receipt forecast errors rose more quickly as the horizon of the forecast lengthened, primarily due to the many changes made in the tax code since 1980.

The receipts forecasts also suggest that, on the whole, estimates made of the revenue consequences of proposed tax law changes accurately anticipated the realized effects. Errors in receipt forecasts declined sharply after the existence of the new law was incorporated into the assumptions.

Finally, in examining deficit projections, the historical pattern of errors is quite large and shows a significant under-prediction bias beginning two years from the time of the budget submission. As with receipt estimates, however, much of the error during this period was due to changes in the deficit resulting from tax law changes. The apparent difficulty of obtaining accurate estimates of the deficit, and the inherent amount of variance in the forecast, suggest that the deficit forecast may be an inappropriate variable upon which to predicate fiscal policy.

FOOTNOTES

[1] P.L. 99-177.

[2] As quoted in Special Analysis A, p. A-1.

[3] For a detailed explanation see Executive Office of the President, Office of Management and Budget, *Special Analyses, Budget of the United States Government, Fiscal Year 1988*, Special Analysis A.

[4] For FY 1988 the relevant CBO publications are *The Economic and Budget Outlook: Fiscal Years 1988-1992*, January 1987; *Reducing the Deficit: Spending and Revenue Options*, January 1987; *An Analysis of the President's Budgetary Proposals for Fiscal Year 1988*, February 1987.

[5] On September 29, 1987, President Reagan signed "The Balanced Budget and Emergency Deficit Reaffirmation Act of 1987," (H.J.Res.324) which amended G-R-H in a number of ways. Among the changes included in the legislation was a revised timetable of deficit reductions which moved the year for achieving a balanced budget from FY 1991 to FY 1993. The specific targets, as amended, are -$171.9 billion in FY 1986, -$144.0 billion in FY 1987, -$144.0 billion in FY 1988, -$136 billion in FY 1989, -$100 billion in FY 1990, -$64 billion in FY 1991, -$28 billion in FY 1992, and $0 in FY 1993. See U.S. Senate, Committee on the Budget, "Gramm-Rudman-Hollings and the Congressional Budget Process: An Explanation", S. Prt. 99-119, December 1985, p. 3, and Conference Report (H.Rept. 100-313) on House Joint Resolution 324.

[6] See, for example, Rauch, [1987].

[7] The act requires the Congress, in preparation of a budget resolution, to agree on a set of underlying economic assumption, set up a budget timetable, and created the CBO.

[8] Penner, p. 98.

[9] The six other forecasts included in his sample were those of Joseph Livingston, the New York Forecasters Club, the ASA/NBER survey, the research Seminar in Quantitative Economics of the University of Michigan, Wharton Econometrics, and the mean end-of-year forecasts of a separate group of seven mostly private forecasts. The number of forecasts compared ranged from four to six in the samples including the CEA. See Zarnowitz [1986], Table 1 and notes.

[10] Ibid, page 5.

[11] Ibid, page 8.

[12] Kamlet, et. al. [1987], page 369.

[13] Ibid, page 375.

[14] Penner [1982], page 103.

[15] Reischauer, page 41.

[16] Budget supplement, page 3a-8.

[17] Boskin, page 128.

[18] See CBO, Feb. 1981. The Treasury's Office of Tax Analysis (OTA) is responsible for producing the Administration's estimates of tax receipts and estimating the effects of proposed and enacted tax legislation.

[19] Ibid, page 17.

[20] *An Analysis of Congressional Budget Estimates for Fiscal Years 1980-1982.*

[21] Ibid, p. 32.

[22] The alternative measure of receipts is proposed law, but it would be a less consistent target since it assumes all of the President's budget proposals are adopted to the exclusion of all others. The potential change in receipts levels due to proposals have varied from +1.22% to -1.90% for the fiscal year in which the budget is

transmitted, and from +3.50% to -6.90% for the budget year submission.

[23] If the direction of change from proposals is random, the mean error of the forecast will not be affected, but the variance will be larger.

[24] Actuals for all items but GNP are available in time for the January release. Final GNP data is usually not published until March. For early years, CBO reported high- and low-growth paths for "current policy": the average of these two series was taken as the baseline case.

[25] The 1976 transition quarter has been omitted from the analysis.

[26] The test statistic we use throughout for the one- and two-tailed test is:

$$Z = (\overline{X} - u_0)/(\sigma/\sqrt{n}),$$

where $\overline{X}$ is the mean error, $u_0 = 0$ (the value of X in the null hypothesis), σ is the standard deviation of the population, and n is the number of observations. The variance used is the population variance of the sample. Since we are restricting our analysis to the post-1974 period, we are encompassing the entire population. For the test of the equality of two means, we assume that $\sigma_1^2 = \sigma_2^2 = \sigma^2$, yielding the test statistic:

$$t = (X_1 - X_2)/\sqrt{[(1/n + 1/m)\sigma^2]},$$

where n and m are the size of the populations of X_1 and X_2.
See Morris and Rolph [1981], page 146.

[27] The probabilities were drawn from Beyer [1971]. For the GNP(-1) vintage, CBO shows eight, and OMB nine, of the twelve errors to be negative. The probability of this occurring in a random draw is .1208 and .0537, respectively.

[28] Monthly receipt and outlay data are published in the *Monthly Treasury Statement*, released approximately four weeks after the end of each month.

[29] *General Explanation of the Economic Recovery Tax Act of 1981*, prepared by the staff of the Joint Committee on Taxation, page 391.

[30] Budget supplement, p. 4-5.

[31] See Nester [1987] for a listing.

[32] CBO and OTA both use measures of the effects of recently enacted legislation in their receipts estimating process, although to different degrees, see Nester, 1987. Enacted legislation tables are updated and published each year as a part of the President's budget submission.

[33] Penner, pages 96 - 97.

[34] In some cases, the deficit reported by CBO did not equal the value of receipts minus outlays due to assumed fiscal policy responses. See CBO, *Five-Year Budget Projections: Fiscal Years 1981 - 1985*, p. 12.

[35] Let D = R - O. E(D) = E(R - O) = E(R) - E(O), and var(D) = var(R) + var(O) - 2cov(R,O). See the textbook by Freund [1971], chapter 6.

[36] An OLS regression of the absolute percent error of the current year deficit forecast on a constant and a time trend yields (standard errors in parentheses):
for OMB: y = 28.05 - 2.00t,   for CBO: y = 29.07 - 1.97t,
          (6.77) (1.00)   (8.79)   (1.30)
All coefficients are significant at at least the 90% level.

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