

Observed Relationships between Economic and Technical Receipts Revisions in Federal Budget Projections

Abstract - *This paper presents results illustrating a close relationship between economic and technical errors in receipts projections made by the OMB and the CBO. The specific source appears to be the relationship between economic and technical errors for personal income tax receipts. Receipts projections generally are efficient in the use of prior information, although some evidence exists to suggest that OMB economic receipts revisions are related to prior economic information. The results indicate a greater sensitivity of changes in receipts projections to changes in the performance of the economy than typically realized.*

INTRODUCTION

Budget and tax analysts are familiar with the regular process of publication of revised budget projections on the part of the Office of Management and Budget (OMB) and the Congressional Budget Office (CBO), as well as the accounting for revisions to outlays and receipts projections on the basis of changes in policy, economic assumptions, and technical factors.¹ OMB and CBO also regularly publish estimates of the sensitivity of budget projections to changing economic assumptions, illustrating implied rules of thumb for how a change to the economic outlook would change the budget outlook. What is not well understood, however, is the relationship that exists between economic and technical revisions. It has been recognized that changing technical tax receipts relationships were responsible for significant receipts gains in the mid- to late-1990s—that is, that the identified effects from the cyclical surge in the economy explained only part of the sharp rise in tax receipts (Kasten, Weiner, and Woodward, 1999). Similarly, the fiscal year 2001 results showed large negative technicals for receipts coinciding with the economy being in recession.

At the time this paper was written, the behavior of economic and technical surprises to receipts projections had

John Kitchen
Committee on the Budget, U.S. House of Representatives, Washington, DC 20515

National Tax Journal
Vol. LVI, No. 2
June 2003

¹ Economic changes in the budget projections are those that are identified to arise directly from the specific economic assumptions used to produce budget estimates; technical changes are effectively a residual, changes that are not due to explicit economic assumptions or legislation.

taken on added significance. Incoming data for fiscal year 2002 receipts indicated that a large negative technical receipts surprise would occur at the mid-year updates for OMB and CBO receipts projections for fiscal year 2002 and perhaps subsequent fiscal years. However, it was not clear, at the time whether an analogous negative economic revision would occur in the receipts projection. Preliminary incoming data indicated that National Income and Product Accounts (NIPA) data would be revised to show lower income estimates, but NIPA revisions do not always occur at a convenient time for the OMB and CBO to include them in their updated mid-year budget and receipts projections.^{2,3} This problem highlights the general uncertainty at any given time about the ultimate source of the receipts technicals. What is classified as a “technical” revision for any given set of economic assumptions, perhaps could have been determined to be an “economic” change if “better” economic data from the NIPAs were available at the time the projection updates were made. It is also possible that receipts technicals may be able to forecast subsequent income revisions in the NIPAs. If some of the correlation between economic and technical revisions reflects future NIPA revisions, receipts may in fact respond to the economy as expected, but the movement of the economy and the underlying incomes would be known only with a lag.⁴ The various subtleties of these distinctions are beyond the scope of this paper.

The purpose of this paper is to examine the relationship between the observed economic and technical components of changes in receipts projections.⁵ The analysis covers projections for both the OMB and the CBO over the past two decades. An additional line of inquiry pursues the question of whether the revisions to receipts projections are efficient in the sense of whether receipts projections use all available information from when the projections were made. The results show a close relationship between the economic and technical components of changes in receipts projections for both the OMB and CBO. The primary source of that relationship appears to occur in personal income receipts projections. In addition, some evidence exists to suggest inefficiency for OMB receipts projections, notably for the economic component of its receipts projection revisions. The apparent observed inefficiency may be a natural result of the political environment in which budget projections are produced.

The observed relationships in this paper between receipts technical revisions and receipts economic revisions over time suggests a greater degree of sensitivity of the budget to changes in the economic outlook than indicated solely by changes in budget estimates ascribed to changes in economic projections. If the relationship between technical revisions and changes related to economic assumptions were not properly accounted for, the budget effects associated with a changing economic outlook would be understated. The

² See Bureau of Economic Analysis, “State Per Capita Personal Income and State Personal Income, 2001,” *Survey of Current Business*, May 2002. Because of the expected—but uncertain—revision to the NIPAs, it was unclear to what extent the revenue shortfall would be classified as technical or economic. The classification would depend on whether the expected NIPA revision were included in the economic assumptions prior to the revision. After the fact, OMB published their estimates in advance of the NIPA revisions while CBO waited to release their projections until the NIPA revisions could be accounted for.

³ For a recent discussion of the 2002 revenue surprise see the CBO policy briefs: “Where Did the Revenues Go?”

⁴ This point was made by an anonymous referee.

⁵ Auerbach (1999) examined the combined economic and technical projection error in detail, but did not focus on the primary issue discussed in this paper of the relationship between economic and technical projection errors.

existence of such a relationship between economic and technical revisions also underscores the difficulties associated with making dynamic revenue projections (see, e.g., Mauskopf and Reifschneider, 1997).

SOME BACKGROUND ON BUDGET PROJECTIONS AND ACCOUNTING FOR CHANGES IN PROJECTIONS

OMB and CBO each typically publish two sets of official economic and budget projections annually.⁶ OMB publishes budget projections in (1) the Administration's *Budget of the U.S. Government* by the first week of February, and (2) the *Mid-Session Review of the Budget* in mid-July or later. CBO submits budget projections in (1) *The Economic and Budget Outlook*, typically in January, and (2) *The Economic and Budget Outlook: An Update*, typically in August. CBO also has irregularly updated its budget baseline in the February to May period as part of its *Analysis of the President's Budgetary Proposals* publications. CBO usually has published a table in each budget publication showing the changes in baseline budget projections that have occurred since the previous set of projections, with the changes being identified as resulting from (1) policy or legislative changes, (2) economic changes, and (3) technical changes. OMB usually has published a table with such comparisons only in the *Mid-Session Review of the Budget*, but not in the *Budget of the U.S. Government* publications.

As the OMB noted in a discussion about allocating changes in surplus projections, technical changes are effectively a residual:

Technical changes are those changes that are not due to explicit economic assumptions or legislation, such as income from stock options and the effective tax rate on corporate profits.⁷

Similarly, CBO defines technical changes as "[r]e-estimates that cannot be ascribed to new laws or to changes in CBO's economic assumptions."⁸

Economic changes in the budget projections are those that are identified to arise directly from the specific economic assumptions used to produce budget estimates. Tables with the major economic assumptions are published in the budget documents, although more detailed sets of assumptions are provided internally to produce the spending and receipts estimates. For example, for the Administration, detailed data are provided to the OMB, Treasury's Office of Tax Analysis, and the various Federal departments and agencies. These economic assumptions cover key macroeconomic variables such as real and nominal gross domestic product (GDP), the consumer price index (CPI), the unemployment rate, 3-month and 10-year Treasury security interest rates, and the various measures of taxable income by type at a macroeconomic level for NIPA data (e.g., wages and salaries, corporate profits, proprietors income, personal interest, dividend, and rental income).⁹

As a supplement to the budget projections, OMB and CBO typically have published tables showing the sensitivity of budget projections to changes in economic assumptions. OMB, for example, has published a table entitled "Sensitivity of the

⁶ Although the OMB publishes the Administration's budget and projections, the budget numbers technically are the President's or the Administration's as a whole and not just the OMB's. For example, the Office of Tax Analysis of the Treasury Department is more responsible for the Administration's tax receipts estimates than is the OMB. In this paper, because OMB publishes the Administration's budget and tax projections, OMB is used as a shorthand descriptor for the Administration in the text discussion.

⁷ *Analytical Perspectives, Budget of the U.S. Government, Fiscal Year 2003*, p. 27.

⁸ *The Economic and Budget Outlook: Fiscal Years 2003–2012*, p. 11.

⁹ For more information on the Administration's "Troika" process for generating economic assumptions, see Donihue and Kitchen (2000).

Budget to Economic Assumptions” in the *Analytical Perspectives* volume of the *Budget*, and CBO has published separate appendices for “How Changes in Assumptions Can Affect Budget Projections” in its *The Budget and Economic Outlook* documents. As discussed by the CBO,

To illustrate how assumptions about key economic factors can affect federal budget projections, the [CBO] uses what it terms rules of thumb. Those rules are rough orders of magnitude for gauging how changes in individual economic variables, taken in isolation, will affect the budget’s totals. ... The calculations that appear ... are merely illustrative of the impact that changes in assumptions can have. ... Moreover, budget projections are subject to other kinds of inaccuracies that are not directly related to economic forecasting.¹⁰

Note at the end of this discussion the stated view that “other kinds of inaccuracies”—which must be considered “technical” by the definitions of the allocations by type of change—are not directly related to economic forecasting.” This view seems to imply that no discernible relationship exists between technical changes and economic changes.

As shown in this paper, however, for receipts projections the “other inaccuracies”—technical changes—have in fact been closely related to economic changes historically. OMB and CBO have informally discussed such a relationship and, in addition, some efforts have been made to address the uncertainty of budget projections related to such interdependencies. For example, in its January 2002 *The Budget and Economic Outlook* (p. 136), CBO stated: “The technical factors involved are closely related to the economic outlook—most important, revisions to projections of capital gains realizations and adjust-

ments for unexplained shortfalls in tax collections.” Similarly, OMB stated in its *Analytical Perspectives, Fiscal Year 2003* (p. 27): “Because of the interaction of economic developments and technical factors, it is difficult to estimate accurately their separate budgetary impacts.” Hence, the potential existence of a relationship between economic and technical budget revisions is recognized, but that potential relationship is not well understood either in terms of sources or magnitudes. Much of the problem may simply be related to the long lag times in attaining accurate tax and income data.

The difficulties associated with understanding the sources of—and relationships between—economic and technical changes also are reflected in the approach CBO recently has adopted to illustrate the uncertainties in its budget projections (CBO, February 2002). In that effort, CBO chose to examine the general inaccuracy of its projections excluding legislative changes, debt service, and discretionary spending. In effect, the approach CBO adopted combined the economic and technical errors for receipts and non-interest, mandatory spending. Analysis was then conducted using the aggregate economic-technical outlays and receipts projection errors, including estimation of the cyclical behavior of the aggregate projection error.

EMPIRICAL RELATIONSHIPS BETWEEN ECONOMIC AND TECHNICAL REVISIONS

As discussed above, changes in budget receipts projections are identified as coming from one of three sources: from (1) policy or legislative changes, (2) economic changes, or (3) technical changes. In notation:

$$[1] \quad R(t,j) = P(t,j) + E(t,j) + T(t,j),$$

¹⁰ *The Budget and Economic Outlook: Fiscal Years 2003–2012*, Congressional Budget Office, January 2002, p. 125.

where

- $R(t,j)$ is the receipts projection revision for projection year j in year t ;
- $P(t,j)$ is the policy or legislative revision for projection year j in year t ;
- $E(t,j)$ is the economic receipts revision for projection year j in year t ; and
- $T(t,j)$ is the technical receipts revision for projection year j in year t .

Because of the arbitrary nature of policy-induced changes in receipts, in the analysis in this paper the focus is on $E(t,j)$ and $T(t,j)$, the economic and technical components of the receipts revisions.¹¹

The Data

In order to examine the historical relationship between economic and technical revisions to receipts projections, data were acquired for OMB and CBO budget projection revisions for various years and publications. CBO has regularly published tables explaining the identified sources of change for receipts and outlays projections as part of its *The Economic and Budget Outlook* and *Update* publications. For CBO budget projection changes, data were acquired for February 1984 to January 2002.¹² For the CBO data, because of the irregular nature of the budget baseline updates at the time of the publication of the *Analysis of the President's Budgetary Proposals* and in order to assure consistency of comparisons, the reported changes for that publication were added to the reported changes for the *Update* publications to capture the full change

from the budget projection early in the year to mid-year. For OMB, published data identifying the sources of changes in budget projections typically were only available in the *Mid-Session Review of the Budget* (MSR) documents; data were acquired from MSRs from 1982 to 2001.¹³ The data for the OMB economic and technical revisions are presented in Appendix Table 1; the CBO data are presented in Appendix Table 2.

In this paper, the focus is solely on the relationships and results for receipts projections and not outlays projections as estimation efforts were unable to identify any relationship between economic and technical outlay changes.¹⁴ Also, the data on outlays were not as "clean" as that for receipts in the sense that the debt service effects were not always clearly identified in the outlays data, making it difficult or impossible to make sure the data were correct or that the proper comparisons independent of debt service costs were being made. In contrast, the published receipts change data were only for the identified receipts changes and not for any related debt service costs.

Empirical Evidence

Some casual empiricism helps to illustrate the potential for an observed relationship between economic and technical revisions to receipts forecasts. Figure 1 shows the contemporary-year economic and technical receipts revisions from the OMB *Mid-Session Review* publications. A casual examination of Figure 1 reveals a likely positive relationship between eco-

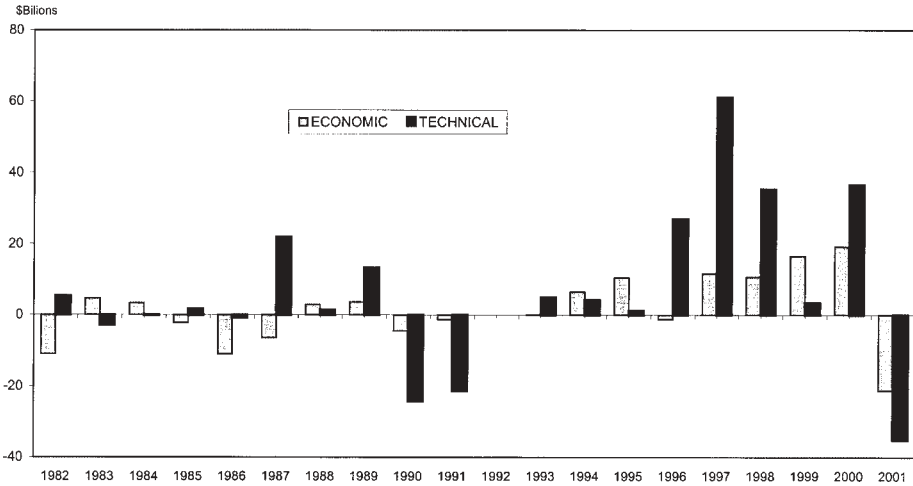
¹¹ As an anonymous referee pointed out, there may be a relationship between legislative changes and economic and technical revisions, as well. The direction of causation would work both ways: legislative changes can affect the economy, but perhaps more importantly estimates of legislative effects are done based on the economic forecast at the time of proposal or enactment. If the economy performs differently than expected, the estimate of the legislative effect could change as well.

¹² This represents a subset of all CBO projections; consistent data were not always available from budget projection documents for periods covered in the sample and for prior periods.

¹³ One exception is 1992 when only combined economic and technicals data were published.

¹⁴ In the early 1990s, for example, technical changes to outlays projections were heavily affected by spending related to the Resolution Trust Corporation to acquire assets of failing financial institutions.

Figure 1. Administration Economic and Technical Receipts Revisions From Mid-Session Reviews, for Contemporary Year



conomic and technical revisions—or at least certainly for the experience of the post-1988 period.

To further examine the relationship, regressions of the following form were estimated:

$$[2] \quad T(t,j) = a + bE(t,j) + e(t,j)$$

for $j = 0, 1, \dots, 5$

with the data defined as above. Because of the growing size of the economy and the resulting growing size of projected receipts levels—and the associated growing size of errors in absolute terms—the equations were estimated using Whites’s heteroskedasticity consistent covariance matrix estimation.

Table 1 shows the results for the slope coefficients from the regressions shown in equation [2] above. The results for the full available samples for both OMB and CBO show significant estimated relationships between technical changes in receipts projections and economic changes in receipts projections across the entire budget projection horizon covering the current year

and following five years. The OMB results, however, show much larger estimated coefficients for the first several projection years than for CBO. The current-year result for OMB, in particular, is quite large, indicating that technical changes in receipts estimates related to the economic change have tended to be about 1.3 times as large as the economic changes to receipts. For the following projection years, the magnitude of the estimated relationship for OMB declines to levels similar to that of CBO. The CBO results suggest that technical changes in receipts related to economic changes have been about one-half as large as the economic changes in receipts for the first several years of the projection horizon, and thereafter steadily decline to about one-quarter the size at the four- to five-year projection horizon. Generally, the close and highly significant relationship observed between the technical and economic changes in receipts projections is striking.

It is possible that the difference in estimated relationships for OMB and CBO for the first several years of the projection horizon is attributable to the different

TABLE 1
ESTIMATED COEFFICIENTS FOR RELATIONSHIP BETWEEN TECHNICAL AND ECONOMIC RECEIPTS CHANGES

$$T(t,j) = a + bE(t,j) + e(t,j)$$

Forecasting Agency	Sample	n	Slope Coefficients for Budget Projection Year (j)					
			Current	+1	+2	+3	+4	+5
OMB	Full Available Samples	18	1.31** (0.43)	0.61** (0.18)	0.56** (0.14)	0.41** (0.11)	0.34* (0.12)	0.26* (0.1)
	<i>Mid-Session Reviews</i> 1982-91, 1993-2001							
CBO	<i>Outlooks and Updates</i> Feb. 1984-Aug. 1985, Aug. 1986-Jan. 2002	35	0.52** (0.08)	0.46** (0.08)	0.43** (0.10)	0.35** (0.09)	0.27** (0.08)	0.28** (0.1)
	Equivalent Sample Periods							
OMB	<i>Mid-Session Reviews</i> 1984-91, 1993-95, 1997-2001	16	1.50** (0.44)	0.77** (0.18)	0.66** (0.16)	0.49** (0.14)	0.36* (0.13)	0.27* (0.11)
	<i>Updates</i> 1984-91, 1993-95, 1997-2001							
CBO	<i>Updates</i> 1984-91, 1993-95, 1997-2001	16	1.06** (0.26)	0.57** (0.11)	0.45** (0.09)	0.37** (0.09)	0.29* (0.1)	0.24* (0.11)

Notes:

* Represents significant at the 0.05 level.

** Represents significant at the 0.01 level.

n Number of observations.

Standard errors of coefficient estimates are presented in parentheses.

CBO *Update* data include changes from baseline updates for *Analysis of President's Proposals*.

Data sources: Office of Management and Budget; Congressional Budget Office

sample periods and the larger sample for the CBO. The bottom half of the table presents results from sample periods restricted to cover equivalent periods for both the OMB and CBO estimations. Although OMB and CBO did not always produce or release their estimates at mid-year at precisely the same time, the sample periods used provide for a close comparison for estimates produced with roughly equivalent information sets available to each budget forecaster. The results show that the disparity between the estimated OMB and CBO technical-economic receipts relationships is reduced somewhat, albeit with both the OMB and CBO estimated coefficients generally increasing in value. For the current-year projection in the restricted subsamples, OMB's technical changes in receipts estimates were about 1-1/2 times as large as its identified economic changes in receipts. The estimated relationship for the current-year projection for the CBO also increased, but it should be noted that the standard

errors of the coefficient estimates increased as well in several cases. The smaller standard errors for the estimated coefficients for the CBO data indicate a somewhat more precise estimation.

The general result from Table 1 is that a close and highly significant relationship exists between technical and economic changes in receipts projections across the budget projection horizon. In addition, for changes in budget projections from the beginning of the year to the mid-year update, the technical receipts revision is not only closely related to the economic receipts revision, but also the technical revisions related to the economic revisions tend to be as large or larger than the economic revision in the current-year projection. It may be surprising that the receipts technical is as large as it is relative to the receipts economic component, but it probably should not be surprising that the estimated relationship is larger in the first budget-projection year than in subsequent projection years. Any technical re-

ceipts surprises that occur in a given year likely would only be carried forward partially in subsequent years by receipts estimators. For example, a large positive surprise to incoming receipts that could not be explained by the economic assumptions for nominal GDP or nominal incomes would imply a large increase in the effective tax rate for the particular aggregate measure of income. In practice, and reflecting the relative lack of contemporaneous information on tax liability data, it would be more likely that receipts estimators would adjust receipts projections in such a way that a large one-time jump in an effective tax rate would be gradually reduced over the projection period toward the prior projected effective tax rate path. That is, a one-time receipts surprise likely would not be assumed to be permanent. Such a process would generate the observed pattern of a declining relationship between technical and economic changes in receipts projections observed in Table 1.¹⁵

The larger magnitude of the observed relationship for the full OMB sample and for the equivalent observation subsamples for OMB and CBO probably should not be surprising. Much of the uncertainty about the aggregate receipts for a given fiscal year is resolved by the flow of tax receipts through April and May. Once those data are received, the projected results for the full fiscal year are more reliable and the likely errors in the receipts projections for the year—the combined economic and technical changes—would also be more readily known. In contrast, revisions from the mid-year updates to the subsequent year's initial budget projections likely would be subject to lower "signal" (evidence from the true relationship) and higher "noise" for any relationship between economic and technical changes.¹⁶

ADDITIONAL EVIDENCE: ECONOMIC AND TECHNICAL RECEIPTS ERRORS BY TYPE OF INCOME

The OMB publishes a table in each *Budget* document (in *Analytical Perspectives* in recent years) that decomposes the projection error for the most-recent fiscal year receipts realization, comparing the actual result with the projection made from that fiscal year's budget two years prior. The decomposition of the error occurs by the same components discussed above: legislation, policy, and technical. Although the data by fiscal year and type of income and their decomposition were not made at the same projection horizons used above, they can be used to better understand which components of receipts (by type of income) are responsible for the close relationship between technical and economic projection errors. Data on economic and technical receipts projection errors by type of income were taken from the OMB *Budget* documents for fiscal years 1982 through 2001. The data are presented in Appendix Table 3.

Table 2 shows the results from analogous regressions to those of Table 1, using data on economic and technical errors by type of income. Because of the two-year lag between when the original projection was made relative to when the projection error is observed, the regressions were estimated including two moving average terms. The results show a significant relationship between the technical and economic components only for individual income tax receipts.

The results presented in Table 2 cover a longer horizon from the time the fiscal year projection was made until the actual receipts were observed (about two years) than the horizon for Table 1, which covered the change in the receipts projection

¹⁵ To aid in the understanding of this relationship, it should be emphasized that the regressions are based on the year-to-year observed revisions and not on the cumulative revisions over the projection period.

¹⁶ Auerbach (1999) found a "seasonal" pattern for receipts projections errors, a result likely related to the seasonal flow of information—particularly for tax receipts—within the budget year.

TABLE 2
ESTIMATED RELATIONSHIP BETWEEN OMB ECONOMICS AND TECHNICALS BY TYPE OF INCOME
Number of Observations = 20

OMB Receipts by Type	Coefficient	Standard Error	P--value
Individual income	0.58	0.28	0.05
Corporate income	0.13	0.11	0.25
Social Insurance	0.07	0.10	0.50
Excise	0.06	0.04	0.16
Estate & Gift	-2.43	1.75	0.18
Customs	-0.22	0.12	0.08
Miscellaneous	-0.20	0.27	0.47

Data source: Office of Management and Budget

from one budget projection period to the next (about six months). Although the different horizons limit the direct comparison of results across the tables, the results in Table 2 should be viewed as illustrative of the source of the economic-technical receipts relationships shown in Table 1. Over the longer projection horizon for Table 2 and for individual income tax receipts, the contribution of the technical projection error relative to the economic error is somewhat smaller than indicated for total receipts in Table 1.¹⁷

DO THE ECONOMIC AND TECHNICAL PROJECTION ERRORS SUGGEST INEFFICIENCY?

The relatively large magnitude of the economic and technical changes to the budget projections—and their close relationship—beg the question of whether we can identify any prior information that existed at the time the projections were made that would have helped explain the subsequent projection errors. That is, the question is whether the budget projections are “optimal” in the sense discussed in

Diebold and Lopez (1996, p. 10): “The key property of optimal forecast errors, from which all others follow . . . is unforecastability on the basis of information available at the time the forecast was made.” Alternatively, are the correlated economic and technical receipts “surprises” just that—surprises that could not be foreseen?¹⁸

For this analysis, efforts were made to see if any data series could be identified that would provide significant explanatory power for the economic and technical projection errors. One approach to examine whether the budget receipts projections are optimal is to regress the economic and technical receipts changes on data and information available at the time the original budget projection was made. Caution must be exercised in such an approach: many available economic data series are continually revised and current vintages of those data series would not represent the real-time series available at the time the projections were made. In practice, then, the effort is restricted to using only the data available in “real time” when the budget projections were made.

¹⁷ The small sample sizes used in this study warrant a note of caution. In particular, the question arises: “To what extent is the observed relationship between economics and technicals dependent on the cyclical performance of the past five or six years?” Despite having 20 years of data, the analysis only covers two business cycles. The estimation of Table 2 for the individual income case was replicated for two subsamples that split the full sample in half (each subsample roughly corresponded to a business cycle). The results for the latter period continued to show a significant positive relationship; results for the earlier period, however, showed a positive relationship but below usual levels of significance.

¹⁸ Auerbach (1999) presented a detailed discussion and analysis of the combined economic and technical receipts projection error. Auerbach found that the combined economic and technical forecast errors are volatile, with large standard errors, but also exhibiting some evidence of inefficiency.

In the case of examining the economic and technical receipts changes observed in the OMB *MSRs* and the CBO *Updates*, the original economic and budget projections would have been made around December of the previous year or near the turn of the year. Numerous variables were considered that *ex ante* could in theory have explanatory power for subsequent receipts projection errors. Readily-available sources of “real time” data—e.g., data that are not subsequently revised—include financial market data (e.g., interest rates, stock market indexes), contemporaneous survey data (e.g., consumer confidence, business expectations, purchasing managers indexes), and inflation (CPI). For other variables, real-time data had to be drawn from a contemporary source; as in Campbell and Ghysels (1995), data on key variables were drawn from various issues of the *Economic Report of the President*.

Table 3 shows probability values for F-statistics for selected regression equations for examining whether prior data had explanatory power for subsequent receipts projection errors. The regression results shown are for those yielding some of the “strongest” evidence—regressions employing prior changes in industrial production and in consumer confidence. The regression results imply that, even in these

“best” cases, the implied marginal explanatory power of available prior information is not substantial. Results for two sample periods are shown: (1) the full equivalent sample period for OMB and CBO projections; and (2) a subset employing only post-1986 observations. The full sample results suggest only slight evidence of inefficiency for CBO (based on the results for prior growth in industrial production) for the combined economic and technical receipts projection error and the separate economic projection error. For the post-1986 sample, greater evidence of possible inefficiency exists for both OMB and CBO and for both economic and technical receipts projection errors. In general changes in consumer confidence do not provide significant explanatory power.

Beyond the results observed for industrial production, regression results for other variables did not yield much evidence of inefficiency of the economic and technical components of the budget receipts projections. One might have speculated that prior information on stock market valuation would have explanatory power because changes in receipts from capital gains income—or from related changes in the income distribution—apparently have been important determinants of the changing receipts flow over

TABLE 3
SELECTED REGRESSION RESULTS FOR EFFICIENCY OF PROJECTIONS
F-STATISTIC PROBABILITIES

	Full Equivalent Sample		Post-1986 Equivalent Sample	
	n = 16		n = 14	
	6-month percent change in:		6-month percent change in:	
	Industrial Production	Consumer Confidence	Industrial Production	Consumer Confidence
OMB Results				
Economic and Technical	0.142	0.130	0.042	0.136
Economic	0.187	0.208	0.121	0.252
Technical	0.173	0.148	0.046	0.142
CBO Results				
Economic and Technical	0.075	0.224	0.026	0.252
Economic	0.074	0.225	0.074	0.312
Technical	0.135	0.301	0.034	0.290

Data sources: Office of Management and Budget; Congressional Budget Office; Federal Reserve; Conference Board.

the past decade. Despite that *ex ante* potential, stock market variables in various specification forms did not exhibit significant explanatory power for subsequent receipts projection errors. This does not rule out the possibility, however, that evolving information on the stock market or other variables would have contemporaneous or *ex post* explanatory power for receipts or receipts projection errors. In fact, the changing economic information is precisely the identified source of the economic receipts error. Given the observed close relationship between the economic and technical receipts errors in this paper, one might expect to be able to explain the technical error with the evolving economic information that becomes available after the economic and budget projections are made.

Campbell and Ghysels (1995) describe the limitations of the “parametric” regression tests such as those discussed above and highlight the use of nonparametric tests for testing the efficiency of projections. To further consider the possible evidence of inefficiency suggested by the regression results presented in Table 3, Table 4 presents results for nonparametric tests for the efficiency of the budget receipts projections for the post-1986 equivalent sample period. Results are only presented for prior industrial production growth as no evidence of inefficiency was observed in any case for prior growth in consumer confidence. The table

shows results for the sign test and Wilcoxon sign test—which effectively test for whether the set of observations for the product of the receipts projection errors and the centered information variable deviates significantly from a binomial distribution or a centered random ranking. The results for the OMB economic component of the receipts projection change indicates inefficiency with significant prior information contained in the growth in industrial production. The results for the OMB technical component and the combined economic and technicals are at the margin of usual levels of significance.

Reasons exist to explain why the economic portion of the receipts projection could, *ex post*, be observed to not include all available information. In many instances, the economic forecast underlying the budget projections could purposely be made more or less optimistic than suggested by the information in existing data (such as the path of industrial production or other cyclical or trend economic data). As in the discussion above concerning how receipts estimators would likely phase down the jump in effective tax rates from any one-time shock, so too would the economic forecasters of the budget agencies likely phase any economic shock back toward the previous path. For example, in the mid- to late-1990s, the unexpected better performance of the economy—particularly the upward jump in productivity growth—was not initially

TABLE 4
NONPARAMETRIC EFFICIENCY RESULTS—POST-1986 EQUIVALENT SAMPLE

	Industrial Production Growth	
	Sign Test	Wilcoxon Sign Test
OMB Results		
Economic and Technical	0.057	0.052
Economic	0.013	0.014
Technical	0.057	0.060
CBO Results		
Economic and Technical	0.791	0.233
Economic	0.180	0.149
Technical	0.424	0.315

Data sources: Office of Management and Budget; Congressional Budget Office; Federal Reserve

assumed to persist in the economic assumptions underlying the budget projections. Rather, despite the recognition that productivity growth had, in fact, been higher in the short term and that it potentially could persist, initially the economic projections assumed a return to lower trend GDP and productivity growth until evidence accumulated that the shift in trend productivity was in fact persisting. If a proper loss function for the projections and those making them were considered, such an approach and result may be reasonable. Because of the importance of short-term budget projections for policy decisions and for political purposes as well, in an uncertain economic and technical environment absolute accuracy and efficiency of projections could be of less importance than the perceived risk associated with making persisting one-side projection errors—or making a forecast that some might criticize as “rosy.” As an example, the following statement from the 2002 *Economic Report of the President* (p. 60) reveals this cautious nature of economic and budget forecasting:

The Administration believes that the economy may be able to grow faster than assumed in the budget, once the new tax policy is in place. The reductions in marginal tax rates are expected to lead to increases in labor force participation and increased entrepreneurial activity. The budget, however, uses economic assumptions that are close to the consensus of forecasters. As such, the assumptions provide a prudent, cautious basis for the budget projections.

The analogous opposite case to making too-cautious projections when the economy is doing well is to make too optimistic projections when the economy is in a slow-growth phase or in a downturn. Such a view corresponds to the lack of evidence of inefficiency for the CBO while some evidence suggests inefficiency for the OMB. That is, the OMB economic fore-

casts typically are presented as “policy” forecasts in the sense that they represent what the economy would look like under the adoption of the President’s policy proposals. The specific, direct policy components of the budget projections are not included in the analysis of this paper, but the economic assumptions could explicitly incorporate the effects of the policy outlook. The lack of efficiency observed in this paper may be symptomatic of efforts on the part of Administrations at times in the past to adopt and present politically convenient sets of economic and budget projections.

CONCLUSIONS

The results and interpretation presented in this paper illustrate the existence of a close relationship between identified economic changes and technical changes in receipts projections made by the OMB and the CBO. The existence of a close relationship indicates a greater sensitivity of budget projections to changes in the economic outlook than typically realized. The relationship is observed to persist beyond the immediate budget year to the full 5-year budget projection horizon examined in this paper. The primary source of that relationship appears to result from the relationship between technical and economic errors for personal income tax receipts.

The budget receipts projection errors generally appear to indicate that receipts projections are efficient in the use of prior information, although some evidence exists to suggest that OMB economic receipts revisions are related to prior economic information, specifically the prior growth in industrial production. Aside from the observed result for the OMB economic receipts component, the results in this paper generally are consistent with those observed in Campbell and Ghysels (1995), where the efficiency of OMB Federal budget revenue projections could not

be rejected. However, the Campbell and Ghysels results were based on OMB's prior "policy" budget projections compared to the subsequent actual budget outcomes. As a result, the Campbell and Ghysels data include the "policy" or "legislative" changes that are not included in the economic and technical components addressed in this paper. As discussed in Calomiris and Hassett (2002), an apparent relationship has existed between prior receipts surprises and subsequent legislated spending changes. Such a relationship calls into question the observations in Campbell and Ghysels of inefficiency of OMB budget outlay projections to the extent that to be efficient OMB budget projections would have had to also efficiently forecast subsequent legislation to change spending. In contrast, OMB budget projections are for the President's policy proposals and not for what OMB thinks ultimately will be passed by Congress. Efforts to test for inefficiency are better served by using data that do not include policy projections or changes, as in this paper. Auerbach's analysis of the efficiency of budget receipts projections properly excludes the policy effects that could compromise testing for inefficiency.

The results presented in this paper are useful for providing a closer understanding of the sensitivity of budget projections to the economic outlook, and the results suggest greater sensitivity of changes in receipts projections—receipts "surprises"—to changes in the performance of the economy than typically realized. An area not explored in this paper, however, and one that would be fruitful for subsequent research, is to better explain the evolution of the economic and technical surprises as they occur. Such a "real time" description of the receipts surprises would aid policymakers by providing better information on the evolving budget situation and outlook, as well as providing better contemporaneous information for managing Federal debt and cash flow.

This paper provides only partial information regarding the reasons for the observed correlation between the economic and technical receipts errors—that the relationship occurs primarily for the personal income tax receipts category. Further research analyzing the relationship awaits more complete income and tax data for recent years that is not yet available. Even so, some preliminary observations can be made. First, we know from Kasten, Weiner, and Woodward (1999) and from the CBO's 2002 *Budget and Economic Outlook* that the positive revenue surprise of the mid-to-late 1990s was largely attributable to several identifiable factors, including: higher capital gains realizations and taxes; growth of taxable income relative to GDP; the bracket creep from higher real income growth; and a change in the income distribution with a greater growth of income in high-tax regions. It would not be surprising to see a reversal of these effects when the data become available and the negative revenue surprise for the 2001–2002 period can be examined. Second, the recent experience has exhibited an extraordinarily close correlation amongst several key series: the "output gap" between actual real GDP and its potential; the relative valuation of corporate equities (for example, the percentage deviation of a measure of Tobin's q from a long-run value); and the average effective personal income tax rate. Taken together, these observations indicate a strong relationship over the past decade among the stock market, the cyclical performance of the economy, and tax receipts. In practice, that results in close correlations of the economic basis of personal income tax receipts and the factors typically classified by receipts estimators as "technicals"—e.g., changes in the income distribution, changes in relative capital gains liabilities, and changes in effective income tax rates. Such relationships also indicate why tax receipts projections may have been inaccurate yet still

relatively efficient: it is difficult enough to forecast turning points in the economy, but effectively impossible to project the future behavior of the stock market. As long as the tax system relies on taxing volatile and often unpredictable measures of income, tax projections will continue to be subject to potentially large revisions and errors.

Acknowledgments

The author acknowledges helpful comments from Alex Brill, Doug Holtz-Eakin, Ralph Monaco, Editor Rosanne Altshuler, and two anonymous referees. The views expressed are my own and not necessarily those of any institutions with which I am affiliated.

REFERENCES

- Auerbach, Alan J.
 “On the Performance and Use of Government Revenue Forecasts.” *National Tax Journal* 52 No. 4 (December, 1999): 767–82.
- Bureau of Economic Analysis.
 “State Per Capita Personal Income and State Personal Income, 2001.” *Survey of Current Business* 82 No. 5 (May, 2002): 34–59.
- Calomiris, Charles W., and Kevin A. Hassett.
 “Marginal Tax Rate Cuts and the Public Tax Debate.” *National Tax Journal* 55 No. 1 (March, 2002): 119–31.
- Campbell, Bryan, and Eric Ghysels.
 “Federal Budget Projections: A Nonparametric Assessment of Bias and Efficiency.” *Review of Economics and Statistics* 77 No. 1 (February, 1995): 17–31.
- Congressional Budget Office.
The Budget and Economic Outlook, various issues.
- Congressional Budget Office.
An Analysis of the President’s Budgetary Proposals, various issues.
- Congressional Budget Office.
The Budget and Economic Outlook: An Update, various issues.
- Congressional Budget Office.
 “Uncertainties in Projecting Budget Surpluses: A Discussion of Data and Methods.” A Supplement to *The Budget and Economic Outlook: Fiscal Years 2003–2012*, (February 2002).
- Congressional Budget Office.
 “Where Did the Revenues Go?” *Revenue and Tax Policy Brief*, August 13, 2002.
- Council of Economic Advisers.
Economic Report of the President. Washington, D.C.: GPO, various issues.
- Diebold, Francis X., and Jose A. Lopez.
 “Forecast Evaluation and Combination.” NBER Working Paper No. t0192. Cambridge, MA: National Bureau of Economic Research, 1996. Also published in *Handbook of Statistics 14: Statistical Methods in Finance*, edited by G.S. Maddala and C.R. Rao, 241–68. Amsterdam: North-Holland, 1996.
- Donihue, Michael, and John Kitchen.
 “The Troika Process: Economic Forecasts and Macroeconomic Policy in the USA.” In *Empirical Models and Policy Making: Interaction and Institutions*, edited by Frank A. G. den Butter and Mary S. Morgan, 229–43. London: Routledge, 2000.
- Kasten, Richard A., David J. Weiner, and G. Thomas Woodward.
 “What Made Receipts Boom and When Will They Go Bust?” *National Tax Journal* 52 No. 3 (September, 1999): 339–48.
- Mauskopf, Eileen, and Dave Reifschneider.
 “Dynamic Scoring, Fiscal Policy, and the Short-Run Behavior of the Macroeconomy.” *National Tax Journal* 50 No. 3 (September, 1997): 631–55.
- Office of Management and Budget.
Analytical Perspectives, Budget of the U.S. Government. Washington, D.C.: GPO, various issues.
- Office of Management and Budget.
Budget of the U.S. Government. Washington, D.C.: GPO, various issues.
- Office of Management and Budget.
Mid-Session Review of the Budget. Washington, D.C.: GPO, various issues.

DATA APPENDIX

APPENDIX TABLE 1
OFFICE OF MANAGEMENT AND BUDGET PUBLISHED ECONOMIC AND TECHNICAL RECEIPTS REVISIONS
Fiscal Years, \$Billions

Mid-Session Review Projection	Economic Revisions										Technical Revisions				
	Current	Projection Year					Current	Projection Year							
		+1	+2	+3	+4	+5		+1	+2	+3	+4	+5			
July 1982	-11	-27.6	-16.8	-18.3	na	na	5.3	1.1	1.6	2.2	na	na	na		
July 1983	4.7	15.5	17	19.6	20.5	21.9	-2.9	-1.2	-1.3	-1.5	-2.2	-2.2	-3.4		
August 1984	3.3	7.1	6.4	3.9	3.8	1.3	-0.1	4.4	0.2	-2.3	-3.5	-3.5	-7.3		
August 1985	-2.2	-13.8	-10.4	-11.9	-11.5	-12.3	1.6	0.2	-0.7	-0.8	-1.5	-1.5	-2.1		
August 1986	-11	-19.7	-16.3	-7.4	-6.2	-11.1	-0.7	0.9	0.6	-0.5	1	1	-0.4		
August 1987	-6.4	-9.4	-8.9	-9.9	-4.4	-0.1	21.9	2	5.3	10	10.7	10.7	6.1		
July 1988	2.9	8.2	4.8	1.4	0.3	1.9	1.4	0.8	0.9	0.2	-2.7	-2.7	-1.9		
July 1989	3.6	4.8	na	na	na	na	13.2	9.9	na	na	na	na	na		
July 1990	-4.5	-7.2	-8.7	-5.8	-2.5	0.5	-24.2	-2.7	-31	-38.2	-35.7	-35.7	-39.4		
July 1991	-1.3	-1.7	-2.9	-6.3	-6.5	-7.7	-21.2	-17.8	-16.5	-24.7	-33.7	-33.7	-36		
July 1992*	na	na	na	na	na	na	na	na	na	na	na	na	na		
September 1993	0.1	-0.3	-0.1	0.1	0	-0.1	4.9	1.6	2	2.1	3.3	3.3	0.1		
July 1994	6.5	9.2	9.8	10	7	4.8	4.2	3.3	5.9	4.2	11.6	11.6	10.4		
July 1995	10.5	12.2	13.8	13.5	13.3	13.7	1.2	-12.9	-11.3	-12.8	-9.5	-9.5	-7.6		
July 1996	-1.2	-4.2	-1.1	1.3	6.2	5.9	2.7	8.6	9.5	7.1	7.4	7.4	8.1		
September 1997	11.7	16.1	16.2	8.1	3.3	2.3	61	50.8	36.5	31	28.3	28.3	28.6		
May 1998	10.7	16.1	13.7	14.3	13.9	15.1	35.3	25.4	27.3	25.5	27	27	28.8		
June 1999	16.6	19.4	20.2	20	25.9	33.2	3.4	9.9	9.7	8.9	11.5	11.5	6.7		
June 2000	19.2	43.8	54.3	68.7	80.3	83.3	36.6	30.6	30.4	26.9	21.2	21.2	14.7		
August 2001	-21.2	-27.3	-9.8	3.7	5.3	-4.5	-35.1	-26.2	-12.2	-6.4	0.9	0.9	2.5		

Source: Office of Management and Budget.

* Note: The July 1992 Mid-Session Review of the Budget reported only combined "Economic projections and technical reestimates" data.

APPENDIX TABLE 2
CONGRESSIONAL BUDGET OFFICE ECONOMIC AND TECHNICAL RECEIPTS REVISIONS
Fiscal Years, \$Billions

Projection	Economic Revisions					Technical Revisions						
	Current	Projection Year				Current	Projection Year					
		+1	+2	+3	+4		+5	+1	+2	+3	+4	+5
February 1984	10	17	26	39	51	na	-4	-6	-7	-8	-6	na
August 1984	10	5	-2	-8	-10	-6	-1	2	2	3	4	5
February 1985	-18	-24	-27	-30	-37	na	3	3	2	0	0	na
August 1985	-1	2	-2	-4	-6	-10	3	-3	-1	1	4	6
August 1986	-6	-16	-8	-4	0	6	-6	-3	-1	-4	-4	-4
January 1987	-13	-18	-22	-21	-22	na	2	-2	0	1	3	na
August 1987	-7	-12	-17	-25	-32	-38	26	9	9	9	10	10
February 1988	-7	-12	-13	-15	-20	na	-3	-5	-5	-5	-6	na
August 1988	19	29	27	20	17	9	8	2	-4	-4	-3	-2
January 1989	5	6	8	7	5	5	-1	-2	-2	-1	0	0
August 1989	3	6	2	6	16	25	5	-4	-4	-7	-9	-12
January 1990	-2	1	0	-6	-13	na	-1	0	-1	-4	-4	na
July 1990	3	5	0	-2	-3	-4	-27	-19	-16	-15	-15	-17
January 1991	-40	-46	-38	-39	-43	na	-7	-5	-3	-2	3	na
August 1991	-15	-16	-16	-21	-27	-34	-19	-12	-11	-11	-10	-11
January 1992	-29	-29	-20	-18	-18	na	-13	-16	-16	-17	-17	na
August 1992	-1	-12	-13	-11	-16	-30	1	-3	-6	-7	-8	-6
January 1993	-15	-23	-27	-28	-36	na	-6	-4	-5	-6	-5	na
September 1993	1	1	4	7	4	-5	-10	-4	-3	-3	-2	-3
January 1994	-4	-6	-8	-8	-10	na	-3	0	0	0	2	na
August 1994	-9	-20	-20	-12	-6	-5	-6	-4	-2	-1	1	3
January 1995	2	9	8	3	0	na	6	5	6	9	11	na
August 1995	2	9	12	12	11	9	-4	-5	-5	-3	-5	-6
May 1996	-2	1	1	2	5	6	1	5	7	7	8	9
January 1997	-23	-19	-17	-15	-12	-9	0	-5	-7	-9	-11	-11
September 1997	23	41	45	47	50	57	46	37	26	22	17	17
January 1998	16	21	14	9	0	-4	14	10	14	14	13	14
August 1998	7	13	15	5	0	-3	45	58	55	51	49	50
January 1999	3	5	12	19	22	25	11	15	15	19	16	17
July 1999	14	33	36	30	21	11	-8	2	3	1	4	3
January 2000	23	41	52	54	53	53	34	39	39	39	38	38
July 2000	28	55	68	76	80	87	33	29	24	24	15	11
January 2001	-6	7	32	56	72	88	33	29	20	20	10	11
August 2001	-23	-44	-44	-31	-21	-12	-30	-27	-20	-14	-15	-8
January 2002	-105	-80	-48	-44	-45	-48	-46	-43	-51	-50	-49	-45

Source: Congressional Budget Office.
Note: The August 1998 technical revisions shown in the table include technical revisions announced in March 1998; the August 2001 technical revisions include technical revisions announced in May 2001.

APPENDIX TABLE 3
OFFICE OF MANAGEMENT AND BUDGET TOTAL ECONOMIC AND TECHNICAL RECEIPTS PROJECTION ERRORS
 Fiscal Years, \$Billions

Fiscal Year Budget	Economic Projection Errors							Technical Projection Errors						
	Individual Income	Corporate Income	Social Insurance	Excise	Estate and Gift	Customs Duties	Misc. Receipts	Individual Income	Corporate Income	Social Insurance	Excise	Estate and Gift	Customs Duties	Misc. Receipts
1982	-12.8	-14.7	-8.8	-12.9	-0.1	-0.2	1.9	5.5	0.6	0.0	-3.1	0.7	1.2	0.2
1983	-24.4	-17.2	-12.7	-7.8	-0.3	-0.4	-1.4	8.1	-9.9	-4.0	-2.6	0.4	-0.3	0.2
1984	5.9	11.8	3.5	-1.7	0.0	0.8	1.1	-1.4	-7.3	-1.4	-1.0	0.1	1.4	1.9
1985	-2.7	-11.0	-0.5	-1.3	0.0	0.9	0.9	4.5	-6.2	0.4	-1.7	0.8	2.0	1.3
1986	-14.8	-13.1	-0.5	-2.8	0.0	1.1	-1.9	0.4	1.5	-0.6	-0.2	1.6	-0.1	3.1
1987	0.0	-21.9	-3.7	-2.9	-0.5	0.8	-2.4	13.3	-9.8	4.4	0.2	2.6	0.6	1.6
1988	3.1	-17.3	-0.2	-0.1	-0.5	2.2	0.8	5.9	-9.1	1.6	1.1	1.3	-1.3	0.3
1989	13.4	-6.6	13.9	0.2	0.7	1.5	2.6	19.4	-9.3	-7.4	-0.8	0.3	-1.4	0.5
1990	2.9	-28.7	2.5	-0.2	0.8	0.2	4.5	2.6	0.7	-14.0	-0.8	2.6	-0.9	0.4
1991	-22.7	-26.0	-14.3	-0.3	-0.7	-3.0	1.5	-35.2	-7.6	-10.1	-4.8	2.1	0.4	-3.2
1992	-18.0	0.9	-12.2	-0.3	-0.4	-1.7	-3.0	-20.1	-4.1	-3.8	-1.8	-1.8	-0.2	5.7
1993	-13.5	1.9	-9.8	0.3	0.0	1.4	-4.8	4.1	7.7	-6.3	-0.3	-0.3	-0.5	2.8
1994	0.8	4.5	-0.9	0.3	0.1	0.4	0.9	-7.6	15.7	-1.9	0.2	2.4	-0.4	1.0
1995	3.6	5.2	0.3	0.5	0.0	2.1	3.9	-10.1	9.4	-7.7	0.5	0.9	-1.7	2.9
1996	17.0	11.8	4.3	0.3	-0.1	-2.2	-2.3	12.9	2.7	-4.3	-3.6	0.5	-1.4	-1.8
1997	1.5	-3.4	2.5	0.6	0.0	-0.8	-0.5	75.0	5.1	1.0	0.7	2.8	-1.3	-5.5
1998	20.9	0.4	16.4	0.3	0.1	0.1	0.3	108.1	2.1	-1.4	2.9	5.2	-0.4	2.9
1999	27.9	-4.8	14.7	1.2	-0.2	-0.5	-1.7	60.2	-6.9	1.4	-1.5	7.5	0.4	-0.2
2000	39.0	24.7	16.2	2.2	-0.1	1.8	3.9	61.2	-3.1	0.4	1.4	2.4	-0.9	-0.2
2001	17.0	8.2	6.7	1.0	0.3	-0.9	0.8	39.7	-14.8	5.2	-3.8	-3.9	-1.2	1.0

