WORKING PAPER NO. 14-22
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August 2014

RESEARCH DEPARTMENT, FEDERAL RESERVE BANK OF PHILADELPHIA
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Fiscal Policy: Ex Ante and Ex Post

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The surge in fiscal deficits since 2008 has put a renewed focus on our understanding of fiscal policy. The interaction of fiscal and monetary policy during this period has also been the subject of much discussion and analysis. This paper gives new insight into past fiscal policy and its influence on monetary policy by examining the U.S. Federal Reserve Board staff's Greenbook forecasts of fiscal policy. We create a real-time database of the Greenbook forecasts of fiscal policy, examine the forecast performance in terms of bias and efficiency, and explore the implications for the interaction of fiscal policy and monetary policy. We also attempt to provide advice for fiscal policy by showing how policymakers learn over time about the trajectory of the U.S. federal government's fiscal balance as well as the changing roles of structural and cyclical factors.

JEL: E62, H68

Keywords: fiscal policy, deficits, forecasting, FOMC, Greenbook

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Research on monetary policy has focused on rules (such as the Taylor rule) and the evaluation of forecasts (such as those by the Federal Reserve Board's staff in the FOMC Greenbook). While fiscal policy has gained renewed attention in the aftermath of the 2008 financial crisis, the corresponding literature on fiscal policy rules and the quality of fiscal forecasts is much more sparse. Furthermore, as we argue below, some of the best work on fiscal policy in recent years has been done on Eurozone data, due in part to the availability of suitable data sets. This paper begins to remedy that situation by documenting and analyzing a new coherent database of high-quality forecasts of U.S. federal fiscal policy variables.

Much of the literature on forecasts of U.S. fiscal policy (as we discuss below) analyzes U.S. Congressional Budget Office (CBO) forecasts. But the CBO is required *by law* to produce forecasts under the assumption of no changes in tax policy or spending policy over the forecast horizon. For that reason, other forecasts are likely to be more realistic predictors of fiscal policy and better measures of expected fiscal policy.

Unlike the U.S. situation, the Eurozone Stability and Growth Pact mandated the creation of regular standardized fiscal forecasts for all member states by the European Commission (EC). In addition to forecasting government surpluses and deficits, the EC also estimated the cyclically adjusted (or "structural") surplus or deficit. While this has led to interesting analyses of the reliablity of fiscal forecasts and decompositions into cyclical and structural factors (see below), one limitation of this literature has been the relatively short time span covered, including only two business cycles since the Eurozone was created in 1999. In contrast, the data set analyzed here spans four decades and five full NBER business cycles.

The evaluation of fiscal forecasts and fiscal policy also raises a number of measurement-related issues. Evaluations are commonly based on currently available macroeconomic data. However, those data may differ in several ways from the information that was available to policymakers at the time. As Cimadomo (2011) notes, fiscal data are frequently revised. Others, such as Croushore (2011),

note that GDP data are also frequently revised and business cycle turning points are identified only with a lag, making real-time considerations important. We therefore carefully match fiscal forecasts with contemporaneous data vintages of other key variables to allow us to properly understand the information available to policymakers. We believe this is the first paper to do so for U.S. fiscal forecasts. We also examine estimates and forecasts of the cyclically adjusted deficit to understand better how fiscal policy relates to perceptions of economic conditions.

We begin the paper in section I with a discussion of the literature on forecasts of fiscal policy, followed by section II, which discusses fiscal data revisions and how they relate to the cyclical nature of fiscal policy. Section III describes the Greenbook data set and the data transformations we use. We evaluate the quality of the Greenbook forecasts in section IV, testing them for bias, bias around elections, and inefficiency. In section V, we analyze the relationship between structural surpluses and cyclical turning points in the economy. Section VI looks at variance decompositions of the forecast errors to measure the informativeness of the Greenbook forecasts. In section VII, we examine the ability of the Fed's staff to forecast deficits, depending on the extent to which fiscal surpluses are cyclical or structural. Section VIII examines how fiscal policy forecasts affect monetary policy, while section IX examines the cyclicality of discretionary fiscal policy. We summarize the results and draw conclusions in section X.

I. Literature on Fiscal Policy Forecasting

The literature on forecasting fiscal policy variables is sparse compared with that on forecasting monetary policy variables. Although there has been important new research on fiscal policy in the European Union (EU), largely due to the importance of fiscal policy discipline in the Eurozone, the institutional framework in the EU has been quite different from that in the United States. We will therefore review fiscal forecasting separately for the U.S. and the EU to set the stage for our later analysis.

A. The U.S. Experience

Two official government agencies forecast U.S. government spending, revenues, and deficits—the CBO and the Office of Management and Budget (OMB). The CBO is a nonpartisan arm of the U.S. Congress, which is supposed to provide nonpolitical analysis of government budget issues. The OMB is part of the U.S. Treasury Department and works for the President to analyze his budget proposals. Researchers have compiled data sets to analyze both forecasts on an ad hoc basis, but there is no continuing program to update such data sets or to make them available to other researchers.

In their recent analysis of the CBO forecasts, Kliesen and Thornton (2012) show that the CBO's one-year-ahead forecasts are not significantly better than a random walk model (which assumes that next year's deficit will equal last year's deficit). The CBO's five-year projections are worse (though not statistically significantly worse) than the random walk model. It might not be a surprise that the CBO forecasts are worse in recessions than in expansions, as is likely true for all forecasters.

In their more comprehensive analysis of CBO, OMB, and Global Insight forecasts, Croushore and Hunt (2008) examine forecasts of deficits, revenues, outlays, and macroeconomic variables. They find that the forecasts are inefficient and sometimes biased. The errors in the fiscal forecasts are attributable to poor forecasts of macroeconomic variables, including GDP, inflation, and unemployment. The results suggest that the government agencies would be better served by using private-sector forecasts of macroeconomic variables, rather than their own forecasts of those variables.

Other studies that examine both the CBO and OMB forecasts include Auerbach (1994), Auerbach (1999), and Plesko (1988). Auerbach (1994) shows that both CBO and OMB forecasts have generally been overly optimistic. Auerbach (1999) examines the revisions to the fiscal forecasts, finding that forecast revisions are serially correlated, suggesting inefficiency, especially for OMB forecasts. Plesko

finds that long-horizon revenue forecasts are biased upwards, but most other forecasts are unbiased.

A few other studies have looked at particular aspects of fiscal forecasts. One study, Belongia (1988), compares the CBO's forecasts of deficits with those of the Council of Economic Advisers (CEA) and private-sector forecasts and finds no evidence of bias in the forecasts, though private-sector forecasts were more efficient than the CBO or CEA forecasts. Another study, Reischauer (1990), showed that the Gramm-Rudman-Hollings Act changed the nature of the OMB's summer forecasts, which were used to determine sequestration under the law, making them more optimistic (forecasting smaller deficits) than the OMB's winter forecasts, which did not affect sequestration. In contradiction to Plesko's results, Blackley and DeBoer (1993) find that forecasts of outlays were biased during Republican administrations, perhaps because those administrations used the forecasts as a bargaining tool. However, Campbell and Ghysels (1995) confirm Blackley and DeBoer's findings that the OMB's outlay forecasts are inefficient.

Compelling rationales for the bias and inefficiency of the CBO and OMB forecasts exist. The OMB is part of the government administration, and its forecasts are often used as a tactical weapon in political budget battles. The CBO is nonpartisan but is constrained to forecast according to the *current law* on revenues and expenditures, so it cannot condition on expected changes that will affect revenues and expenditures. These inherent limitations create a void for researchers attempting to model or measure expected fiscal policy.

The Greenbook forecasts that we examine below are not unconditional forecasts: They are conditional on monetary policy assumptions. Improbable monetary policy assumptions will make fiscal policy forecasts unrealistic to the extent that those monetary assumptions affect forecast economic activity and the financing costs of the government debt. Given that previous studies have found Greenbook forecasts for economic activity to be quite good as *unconditional* forecasts, we expect such effects to be small. Thus, we expect the Greenbook forecasts to

be of great interest. To our knowledge, the only previous study to have used Greenbook forecasts of fiscal variables is Auerbach and Gorodnichenko (2012), who used them only to construct measures of fiscal innovations and provide no direct analysis of their properties.[1]

B. Lessons from the European Union

Because of the Maastricht Treaty, researchers have devoted considerable effort to fiscal forecasts, beginning in the late 1990s. The fiscal forecasting literature, summarized by Leal et al. (2008), shows that some of the same issues in terms of bias and inefficiency exist in Europe as they do in the United States. However, the EC's oversight of the forecasting process helps to control forecast errors. As Leal et al. note, "Most studies on forecast track records tend to signal that projections by the EC for European countries are the most accurate within international organisations publishing fiscal forecasts, due to its being an independent authority."[2] In contrast, Beetsma, Giuliodori and Wierts (2009) find that fiscal adjustments systematically fall short of forecast adjustments and that this shortfall increases with the forecast horizon. They also present evidence suggesting that as adjustment shortfalls accumulate, governments increasingly resort to creative accounting to mask the problem. Frankel (2011) finds that official forecasts of budget surpluses and overall growth are more (optimistically) biased in the case of Eurozone governments than for other nations he examines.

However, as is the case with the U.S. CBO, the EC is constrained to forecast based on "present policies," so its forecasts are not truly unconditional. Still, Artis and Marcellino (2001) find that there are not statistically significant differences in deficit/GDP forecasts for European countries between the IMF, the OECD, and the EC, where the former two presumably produce unconditional forecasts.[3]

[1] There are several important differences between their work and ours. Most notably, they use only one-quarter ahead forecasts for the growth rates of overall government spending and some of its components. We examine forecasts at multiple horizons for the level of federal government expenditures, receipts and other variables.

[2] See Leal et al. (2008), p. 350.

[3] To some extent, of course, the findings of bias and inefficiency of forecasts may depend on as-

II. Literature on Fiscal Data Revisions and the Cyclicality of Fiscal Policy

As with other components of the National Accounts, official estimates of fiscal variables are typically published with a lag and may be substantially revised after their initial release. Assessing whether such revisions are important for our understanding of expected fiscal policy requires a "real-time" data set, one that carefully matches data vintages across published series.

The cyclical behavior of fiscal policy has also been a subject of perennial interest. Originally, the literature found that fiscal policy was often procyclical, as shown by Lane (2003) and the European Commission (2004). But careful examination of forecasts and realizations by Cimadomo (2008) showed that in many cases governments had planned to have expansionary fiscal policy, as seen in their forecasts, but a change in cyclical conditions caused realized fiscal policy to be contractionary. Understanding when differences between ex-ante plans and ex-post realizations are relevant for understanding fiscal policy requires researchers to be able to match vintages of fiscal data with those for other cyclical variables.

Cimadomo (2011) notes that there are few fiscal variables in the small number of real-time data sets that are continuously updated and available to researchers. Euro area data from 2001 onwards are available in the ECB-EABCN database for the deficit, revenue, and expenditure, while for individual countries only data on government consumption are available. The Bank of England's real-time data set has U.K. data since 1990 on the deficit and expenditures. The OECD's real-time data set has government expenditures data for some countries. The premier U.S. data set (the Real-Time Data Set for Macroeconomists (RTDSM) at the Philadelphia Fed, described in Croushore and Stark (2001)) contains real-time data from 1965 onwards for government expenditures but not the deficit. U.S. deficit data from 1974 onwards are available in the St. Louis Fed's ALFRED database; that database also contains revenue and expenditure data since 1965.

sumptions about the symmetry of the loss function. For example, Elliott, Komunjer and Timmermann (2005) find that IMF and OECD forecasts of G7 budget deficits are not rational under the assumption of symmetric loss but are rational under asymmetric loss.

Some researchers have developed their own data from other sources; for example, Loukoianova, Vahey and Wakerly (2003) use data from the U.S. Economic Report of the President to construct a government deficit series that they use to estimate a fiscal policy rule.

Because of the potential economic importance of anticipated fiscal policy, researchers have become increasingly interested in working with forecasts of fiscal policy. The U.S. Survey of Professional Forecasters (SPF) includes forecasts of government spending but not deficits. With no systematic coverage of relevant fiscal policy, researchers have put together their own data sets for particular projects, using forecasts from the OECD's Economic Outlook or other European Union reports. The OECD Economic Outlook is used by Golinelli and Momigliano (2006) to look at the government primary balance and by Cimadomo (2008) to look at government debt and the cyclically adjusted primary balance. Planning documents for EU member countries have been used to look at real-time fiscal planning in Europe, for example by Beetsma et al. (2011) and Holm-Hadulla, Hauptmeier and Rother (2010).

The data set of the Board's Greenbook forecasts that we present below is an important advance over the above resources in several respects. It provides matched vintages across a variety of fiscal and other cyclical variables and includes both forecasts and data revisions. The data set contains series for both actual and cyclically adjusted deficits. It also covers a much longer time span. This allows us to answer key questions about U.S. fiscal policy, including some that until now researchers have only been able to examine for EU members.

III. Greenbook Forecasts—A New Data Set

To create the data set, we compiled fiscal forecasts from all Greenbooks from July 1966 to December 2006.[4] The Greenbook reports the Federal Reserve Board

[4]The underlying data are available at the websites of the Federal Reserve Bank of Philadelphia and the Federal Reserve Board of Governors. See the Appendix for details.

staff's forecasts before every FOMC meeting (which take place at least twice per quarter).[5] We examine the first and last Greenbook of each quarter to obtain a consistent data set with eight forecasts of quarterly data per year.

In each Greenbook, we gather all the quarterly federal fiscal forecasts and reports of past data that are available for receipts, expenditures, surplus, high-employment budget surplus (HEB), a version of HEB based on a 6.1 percent or 6.0 percent natural rate of unemployment (which we call HEB6), the current and capital account surplus (which was introduced in 1996), the unemployment rate, nominal output, and real output.[6] The HEB variables are designed to measure the cyclically adjusted budget surplus.

The occasional redefinition of some of our data series causes some complications. For example, in 1996, government spending was split into government consumption expenditures and investment, whereas before 1996, the two were combined into one category. Government spending on investment was removed from expenditures, but depreciation of capital was added to expenditures. So, in periods when government investment exceeded depreciation, government expenditures were revised down. This caused both the surplus as well as GDP to be revised up. Another important change came in October 1999, when the BEA began treating government expenditures on software as investment. Again, this caused downward revisions to government expenditures and upward revisions to the surplus. Also, beginning in the early 1980s, HEB was based on a 6 percent natural rate of unemployment, but before that, the assumed natural rate of unemployment varied as it drifted upwards from an initial 4 percent rate.

Our primary data sources were page scans of the Greenbook independently published by the Federal Reserve Board and the Real-Time Data Research Center

[5]Do not confuse the Board staff's Greenbook with that of the U.S. Treasury; the Treasury's "Greenbook" is an annual publication containing the tax proposals in the President's budget proposal. That is not the Greenbook we use; ours is the Federal Reserve Board staff's forecast for the economy, which provides forecasts of federal fiscal variables, including the deficit or surplus, receipts, expenditures, and the high-employment budget balance.

[6]All the fiscal variables are reported on a National Income and Product Accounts (NIPA) basis, rather than a fiscal-year basis.

at the Federal Reserve Bank of Philadelphia.[7] After initial data entry and error-checking by a commercial firm, we compared some series (e.g., unemployment) against known values from other sources and checked the rest against the original PDF files. We believe our data to be at least as accurate as other published sources and our error rate to be less than 0.05%. The Appendix provides more details on the construction of our data set.

Figure 1 shows a sample Greenbook page. Each variable in it can be represented as a string of estimates for past dates (horizons -1, -2, etc.), the current date (horizon 0), and future dates (horizons 1, 2, etc.).

The forecast horizons reported in the Greenbook varied considerably over time as shown in Figure 2. Greenbook forecasts generally go to the end of a calendar year; as the year progresses, we see somewhat fewer quarters of forecasts and somewhat more quarters of historical data. Both then change abruptly once a year when forecasts for the following calendar year are added. The earliest Greenbooks we recorded might contain only two quarters of forecasts and four quarters of current and historical estimates; none contained estimates more than 12 quarters ahead or into the past. As we examine longer forecast horizons (particularly those more than four quarters ahead), our sample is progressively drawn from more recent Greenbooks. For that reason, when comparing results across different forecast horizons, we sometimes restrict the sample period. For forecast horizons up to four, all of our series have at least one forecast per year from the first meeting in 1974Q4 onwards.[8]

After compiling the raw data, we normalized all series by dividing by the real-time data series for nominal output (GNP before 1992, GDP from 1992 on).[9] This makes it easier to compare values across time. One such comparison is given by the string diagram in Figure 3, which shows the budget surplus as a share of

[7]See the Federal Reserve Board website for FOMC Historical Materials and the Philadelphia Fed's Real-Time Data Research Center web site.

[8]Expenditures, receipts, HEB, and HEB6 typically have the shortest forecast horizons.

[9]The exception was the unemployment rate, which was not transformed. Note that our series were recorded in levels, not growth rates.

GDP (or GNP).

String diagrams concisely show how forecasts evolve over time. For example, the early 1990s was a period when projections of steadily improving fiscal balances were met with a steadily deteriorating deficit. By the late 1990s, however, projections of roughly constant deficits and surpluses missed a sustained fiscal improvement.

IV. Evaluating the Forecasts

Forecast evaluation requires a comparison of forecasts with a measure of "outcomes." Of course, as the real-time literature shows (see Croushore (2011)), the revision of published macroeconomic data means that the choice of realized or "actual" value may affect our results.

To evaluate the Greenbook forecasts, we considered five alternative measures of outcomes: (1) the last value published in the Greenbook (*last*); (2) the first officially published estimate (*initial*); (3) the officially reported value as of one year after the initial release (*one year*); (4) the last reported value before a benchmark revision of the National Income and Product Accounts NIPA (*prebenchmark*); and (5) the "current" official estimate (*current vintage*, which was current as of December 2012). The initial release, one-year release, and prebenchmark release of each variable come from the ALFRED database at the Federal Reserve Bank of St. Louis.

The importance of the differences between these alternative measures of outcomes varied considerably. For example, Figure 4 shows the results for government expenditures. Generally speaking, the redefinition of the NIPA federal government accounts in 1996 had an economically large impact on the surplus/deficit, revenues, and expenditures. Other benchmark revisions were sometimes important, as were more regular revisions in some cases. On the other hand, unemployment rates underwent no substantial revisions. No statistical agency publishes estimates for our structural deficit measure, HEB; we therefore just compare its

forecasts with the last reported value (*last*).

The combination of regular and benchmark revisions sometimes causes our current measures of fiscal variables to be very different from the earlier measures, particularly for both expenditures and receipts.[10] Thus, a researcher who was not aware of revision issues would find the forecasts to be persistently biased, but a researcher who is aware of real-time issues would use one of the concepts that is not subject to redefinition issues. In the empirical work that follows in this paper, we are careful to evaluate forecasts only with concepts that are not subject to redefinitions.[11]

The Greenbook forecasts have a reputation for excellence in forecasting macroeconomic variables, as Romer and Romer (2000) show. Are they as good at forecasting fiscal policy variables? To find out, we ran some simple tests for bias and inefficiency.

A. Bias

A basic test of forecast performance is the Mincer-Zarnowitz test, regressing the realized values of a variable on a constant and the forecasts. If the forecasts are unbiased, the constant term should be zero and the coefficient on the forecasts should equal 1. However, Mankiw and Shapiro (1986) show that in small samples (which is the case here), such tests may reject too often because the right-hand side variable is often autocorrelated and thus correlated with lags in the error term. Instead, a zero-mean forecast error test covers the same concept (and is a necessary condition for unbiasedness) without being subject to the small-sample bias.

In our bias (zero-mean) tests, we examine forecasts covering longer horizons than the frequency of the observations, so the tests are subject to the standard

[10] It turns out that the revisions for the current vintage for expenditures and receipts just about offset each other, so there is not a very large difference for the surplus measure between the current vintage value and the other concepts.

[11] This means omitting those forecasts made just before a benchmark change for which official estimates were published only after the change.

overlapping observations problem. We adjust for this by correcting the covariance matrix via Newey-West methods, using the lag length equal to the forecast horizon minus one.

The results of the tests are summarized in Table 1. The table shows p-values for the zero-mean test for three different forecast horizons: zero, two, and four quarters ahead; four different concepts of realizations: last, initial, one year, and prebenchmark; two different meeting times during the quarter: first and last; and six different variables: surplus, expenditures, receipts, HEB, HEB6, and the unemployment rate.[12]

TABLE 1—SUMMARY RESULTS OF BIAS TESTS

		Surplus		Expenditures		Receipts	
Horizon	Concept	First	Last	First	Last	First	Last
0	Last	0.56	0.08	0.02	0.03	0.04	< 0.01
	Initial	0.33	0.94	< 0.01	< 0.01	0.28	0.04
	One Year	0.60	0.71	< 0.01	< 0.01	< 0.01	< 0.01
	Prebenchmark	0.20	0.57	< 0.01	0.01	0.29	0.07
2	Last	0.37	0.40	0.64	0.55	0.18	0.21
	Initial	0.77	0.86	0.77	0.66	0.46	0.54
	One Year	0.63	0.70	0.24	0.17	0.04	0.06
	Prebenchmark	0.84	0.93	0.65	0.55	0.37	0.44
4	Last	0.23	0.22	0.84	0.78	0.03	0.04
	Initial	0.37	0.36	0.75	0.75	0.08	0.09
	One Year	0.31	0.31	0.60	0.51	< 0.01	< 0.01
	Prebenchmark	0.42	0.42	0.89	0.82	0.09	0.10

		HEB		HEB6		Unemployment	
Horizon	Concept	First	Last	First	Last	First	Last
0	Last	< 0.01	< 0.01	0.49	0.39	< 0.01	0.05
	Initial					< 0.01	0.40
	One Year					< 0.01	0.40
2	Last	< 0.01	0.02	0.30	0.50	0.06	0.03
	Initial					0.09	0.06
	One Year					0.09	0.06
4	Last	< 0.01	< 0.01	0.12	0.12	0.13	0.11
	Initial					0.16	0.15
	One Year					0.16	0.15

Note: The figures shown are p-values for tests of the null hypothesis that the mean forecast error is zero. The sample period is 1974Q4 to 2006Q4, except for HEB6, for which the sample begins in 1981Q1.

There is no significant evidence of bias for forecasts of the budget surplus using

[12]We ignore the current vintage realizations here because of the redefinition problem described above.

any of the four outcome measures. Expenditure forecasts are significantly biased at a zero-quarter horizon, but not for longer horizons. The evidence for forecasts of receipts is mixed, with significant bias evident in about half of the cases. The HEB measure can only be evaluated using the last observation in the Greenbook because there is no real-time historical series on the variable; the HEB forecasts are biased for all horizons. However, HEB6 is not biased in any of the horizons or meeting times, perhaps because its sample began later than HEB. Unemployment rate forecasts show bias only for the first meeting of the quarter at the current-quarter horizon but not for most other instances.

To understand why the receipt forecasts might be biased, we plot the four-quarter-ahead forecast against the one-year realized value in Figure 5. It shows that there is some tendency for the forecasted receipts/GDP to exceed the realized value one year later. Such a tendency is not apparent in either the surplus forecasts or the expenditure forecasts, however. A time-series plot (not shown) makes it clear that the forecast errors in receipts were particularly large in the late 1990s and early 2000s, when the Greenbook persistently forecasted a rise in receipts that did not materialize. In this period, the Greenbook (and other forecasters) did not foresee the tax cuts that would be put in place, as well as the slowdown in the tech sector and the economy in 2000 and 2001.

The results suggest that many Greenbook fiscal forecasts show no significant biases, although important exceptions exist, including current-quarter forecasts of expenditures, receipts, and unemployment. This may cast some doubt on the properties of the forecasts; on the other hand, it is likely that the Fed's staff spends much more time and attention on macroeconomic forecasts at longer horizons that may be more relevant to monetary-policy decision-making than on the fiscal "nowcasts."

B. Bias and Election Cycles

There has also been considerable interest in the potential for moral hazard to create forecast bias, particularly around elections. While there is some evidence of systematically optimistic forecasts in advance of elections, we might expect the Greenbook forecasts to be an exception as they are not publically released for at least five years, thereby reducing the direct moral hazard, and the Board is typically portrayed as nonpartisan. We therefore also test for systematic forecast bias related to the U.S. presidential election cycle by adding three dummy variables to the constant in the zero-mean regressions of the previous section. These dummy variables are equal to one only in presidential election years (ELECTION), the year before presidential election years (PRE-ELECTION), and the year after presidential election years (POST-ELECTION).[13] For simplicity, we test only forecast errors using our "best" measure of forecast outcomes; prebenchmark estimates for expenditures and receipts, our current vintage for the unemployment rate, and the last Greenbook value for HEB, HEB6, and the overall surplus/deficit. To allow for sufficient degrees of freedom, we consider only forecast horizons from zero to four quarters ahead and test the period 1974Q4–2006Q4.

We do not report the results here for reasons of space, but they may be summarized as showing little or no evidence of forecast bias related to the election cycle. The joint hypothesis that all three dummy variables were equal to zero was rarely rejected at even the 10% significance level. What limited evidence of bias we could find was concentrated in nowcasts made in preelection years, where some series appeared to have a positive bias on the order of one-half of 1 percent of GDP. However, given the degree of "data snooping" involved in these tests, we found the evidence to be less than compelling.[14]

[13]Standard errors for the estimated coefficients were corrected for serial correlation caused by overlapping forecast horizons using Hansen-Hodrick robust standard errors.

[14]We tested three dummy variables for each of seven series at 10 different forecast horizons for a total of 210 test statistics. The number of rejections of the null hypothesis that we found was roughly what we should have expected under the null hypothesis given the significance level of the test.

C. *Inefficiency*

Another important test of forecast accuracy is the efficiency of forecasts with respect to other variables that are in the information set of forecasters. In principle, a researcher could look for a relationship between forecast errors of any of the budget variables and data in the information set when each Greenbook forecast was produced. Because of the timing requirements, it is crucial that real-time data be used in such an exercise.

TABLE 2—SUMMARY RESULTS OF EFFICIENCY TESTS

		Surplus		Expenditures		Receipts	
Horizon	Concept	First	Last	First	Last	First	Last
0	Last	0.21	0.14	bias	bias	bias	bias
	Initial	0.21	0.09	bias	bias	0.13	0.08
	One Year	0.60	0.56	bias	bias	bias	bias
	Prebenchmark	0.26	0.16	bias	bias	0.08	0.06
2	Last	0.88	0.99	0.19	0.22	0.19	0.35
	Initial	0.95	0.91	0.30	0.35	0.23	0.42
	One Year	0.88	0.75	0.34	0.38	bias	0.59
	Prebenchmark	0.98	0.84	0.17	0.19	0.08	0.17
4	Last	0.59	0.56	0.10	0.13	bias	bias
	Initial	0.66	0.63	0.09	0.10	0.09	0.11
	One Year	0.53	0.51	0.16	0.20	bias	bias
	Prebenchmark	0.54	0.52	0.09	0.12	0.10	0.15
		HEB		HEB6		Unemployment	
Horizon	Concept	First	Last	First	Last	First	Last
0	Last	bias	bias	0.45	0.92	bias	bias
	Initial					bias	0.20
	One Year					bias	0.20
2	Last	bias	bias	0.26	0.57	0.28	bias
	Initial					0.24	0.28
	One Year					0.24	0.28
4	Last	bias	bias	0.18	0.29	0.08	0.11
	Initial					0.08	0.11
	One Year					0.08	0.11

Note: The figures shown are p-values for tests of the null hypothesis that the coefficient on the lagged change in the federal funds rate is zero.

One finding in the literature is that forecasters sometimes do not adjust their forecasts properly for changes in monetary policy. For example, the paper by Ball and Croushore (2003) shows that real output forecast errors from the SPF are correlated with past changes in monetary policy, as measured by the fed funds rate. (The advantage of using the fed funds rate in a test for inefficiency is that

it is not revised.) We therefore examine our Greenbook forecast errors to see if they are inefficient with respect to changes in the fed funds rate. We use the four-quarter change in the fed funds rate ending in the quarter *before* the Greenbook forecast is made so that we are certain that the change in the fed funds rate was in the information set of the forecasters.

Table 2 shows the results of the efficiency tests. Note that we do not test for efficiency in instances in which we found non-zero-mean forecast errors in the test for unbiasedness earlier. (In such cases, the table cells simply read 'bias.') The results show no statistically significant evidence of inefficiency in the forecasts for any of the variables; the past change in monetary policy is not correlated with the forecast errors of these variables.[15] Thus, the Ball and Croushore (2003) results on the inefficiency of the SPF forecasts do not carry over to fiscal forecasts in the Greenbook.

V. Turning Points and Structural Surpluses

Forecasters and policymakers are often particularly concerned about the ability of their forecasts to capture business cycle turning points. One reason for this may be that they feel errors are particularly costly at such times. However, we would expect that even an efficient forecast will appear to be biased around turning points. The reason for this is that turning points are identified only with a (sometimes substantial) delay. This means that they are not part of the information that was available to forecasters. If we pick turning points *ex post*, we should expect forecasts made around peaks to be overly optimistic on average and those around troughs to be similarly too pessimistic on average.

It is less clear that this should be the case for the structural surplus (HEB). In particular, HEB is intended to capture the stance of fiscal policy in the sense that it tries to purge the budget surplus of the "direct effect" of cyclical shocks.

[15] Of course, other information that was available when the forecasts were made might be correlated with the forecast errors.

If successful, this means that we should expect to find turning-point bias only in HEB forecasts to the extent that discretionary fiscal policy responds to such shocks. To see whether this is the case, we investigated the behavior of HEB forecast errors around NBER business cycle turning points.[16] Our sample covers five business cycle peaks (November 1973, January 1980, July 1981, July 1990, and March 2001) and six troughs (November 1970, March 1975, July 1980, November 1982, March 1991, and November 2001). For each date, we took all the FOMC meetings within one month of the turning point and averaged their HEB forecast errors at each forecast horizon. The forecast errors were then averaged across business cycles. Because of the small sample size, we made no attempt to do formal tests for bias. Our results are summarized in Figures 6 and 7.

The colored narrow lines show the average forecast error by forecast horizon for each business cycle, while the thicker black line shows their average across the business cycles. In many respects, the two figures present similar results. Although individual cycles are widely dispersed about the sample average, both peaks and troughs show average forecast errors that are quite small (<0.5% of GDP) at the shortest horizons but increase fairly steadily, exceeding 2.0% of GDP about a year after the turning point. Note that positive errors imply overly optistimic forecasts with structural surpluses forecast initially to be larger than subsequent estimates indicated. The fact that both peaks and troughs produce mean forecast errors of the same sign seems to imply that the ex-post identification of turning points is not responsible for this result. This result seems distinct from any full-sample bias in HEB forecasts (which is typically much less than half the size but is of the same sign). Instead, HEB estimates seem to be sharply revised downwards (i.e., toward larger structural deficits) in the immediate aftermath of business cycle peaks and troughs. Some of this revision, particularly at longer horizons, may reflect the response of discretionary policy as fiscal authorities learn

[16] We are not aware of previous empirical studies that have examined how business cycle turning points affect estimated and forecast structural balances. This may simply reflect the fact that most previous studies either did not include estimates of structural balances or covered too few business cycles to make a meaningful comparison.

about the severity of the recession and shift to a looser fiscal stance. Alternatively, the legislative process may cause fiscal policy to respond to economic news only with a lag of several quarters. Another possiblity is that recessions tend to cause estimates of potential output to be revised downwards *ex post*, which in turn causes the structural surplus to be revised downwards.

VI. Forecast Uncertainty and Learning About the Present

Forecast bias and efficiency are interesting properties, but it is also useful for policymakers to understand how informative forecasts are likely to be. How successful are forecasts in capturing changes four quarters ahead? Two quarters? Zero quarters(!)? To measure this, we simply calculate the variance of the forecast errors as a share of the unconditional variance of the target series. Low values (close to zero) imply that forecasts are useful in the sense that they capture much of the movement in the series they attempt to predict. As values approach one, however, the forecasts capture less and less of the variation in the target variable. (Values greater than one imply a different kind of forecast inefficiency: one in which the user would be better off ignoring the forecast and simply using the unconditional mean of the target variable.) Table 3 shows these ratios by forecast horizon, from the zero-quarter horizon for the last meeting of the quarter to the eight-quarter forecast for the first meeting of the quarter. As the target being forecast recedes into the future, we expect to see a steady rise in the relative variance of the forecast errors.

In all cases, nowcasts performed well, capturing the vast majority of the variation in the series. As forecast horizons lengthened, however, the deterioration in forecast performance varied widely, both across series and across the first and second halves of our sample. In the first half of the sample, forecasts for all series except HEB and HEB6 performed similarly, with forecast error variances consistently rising from less than 10% for the nowcasts to roughly 30% at a four-quarter horizon. HEB stands out as having a considerably higher relative forecast error

Table 3—Forecast Error Variance

Horizon	Expenditures	Receipts	Surplus	C&C Surplus	HEB	HEB6	Unemployment
1974Q4-1990Q4							
0L	0.047	0.075	0.056		0.179	0.141	0.008
0F	0.084	0.129	0.127		0.256	0.146	0.042
1L	0.105	0.189	0.181		0.314	0.152	0.067
1F	0.167	0.194	0.256		0.319	0.139	0.122
2L	0.149	0.330	0.284		0.413	0.117	0.155
2F	0.212	0.328	0.339		0.406	0.111	0.190
3L	0.197	0.173	0.196		0.383	0.143	0.229
3F	0.240	0.214	0.257		0.420	0.144	0.243
4L	0.221	0.207	0.206		0.448	0.093	0.315
4F	0.269	0.250	0.285		0.630	0.137	0.321
1991Q1-2006Q4							
0L	0.049	0.129	0.055	0.091	0.210		0.003
0F	0.059	0.141	0.074	0.114	0.243		0.011
1L	0.067	0.179	0.118	0.161	0.329		0.015
1F	0.069	0.228	0.132	0.159	0.314		0.030
2L	0.101	0.403	0.258	0.273	0.464		0.037
2F	0.118	0.421	0.291	0.288	0.451		0.054
3L	0.169	0.609	0.447	0.415	0.591		0.064
3F	0.195	0.630	0.491	0.450	0.586		0.098
4L	0.260	0.832	0.684	0.605	0.769		0.115
4F	0.304	0.844	0.750	0.667	0.786		0.154

Note: Forecast error variances are shown as a fraction of the unconditional variance of the underlying series over the period 1974Q4-2006Q4. Forecasts are taken from the first FOMC meeting in 1974Q4 until the last meeting in 2006Q4. Outcomes are measured as *last* for HEB, HEB6, and the Current and Capital Account Surplus, as *Prebenchmark* for Expenditures, Receipts, and the Surplus, and as *Current Values* for the unemployment rate. We omit the C&C Surplus in the first period as it is identical to the Surplus, and we omit HEB6 in the second period as it is identical to HEB.

at every horizon, reaching over 60% for the longest forecasts. Curiously, the forecast performance of HEB6 is roughly constant and independent of the forecast horizon.[17] The difference is due to the changing benchmark unemployment rate used to calculate HEB through the 1970s, reflecting changing views of the natural rate of unemployment and of potential output.

In the second half of the sample, the results are quite different. Forecast errors for unemployment are the lowest of any series and are often less than half that of the values in the first half of the sample. All other series show a deterioration in forecast performance, with receipts and the surplus most seriously affected,

[17]HEB6 is not available prior to 1980, so the sample period used for it is substantially different from and shorter than that of the other series.

particularly at the three-quarter and four-quarter horizons. This is particularly puzzling given that this was the period of the "Great Moderation" when the economy was relatively more stable.

An examination of the forecast errors shows that they were particularly large for the surplus in 1992 (about 2.0 percent of GDP) followed by large and sustained errors from 2001Q3 to the end of 2003 (always 2 percent or more of GDP). In both cases, deficits were substantially larger than expected. In large measure, this reflected a shortfall in receipts, which was then exacerbated in the latter period by higher-than-expected expenditures. Both 1992 and the 2001-2003 period also featured similar, unusually large forecast errors in HEB. This suggests that these forecast errors were not primarily due to an unusually weak economy so much as they reflected a failure to anticipate government revenues and expenditures conditional on the state of the economy. That interpretation is also consistent with the relatively good performance in forecasting unemployment and the generally low volatility of the economy during the Great Moderation.

In summary, these results show that, while nowcasts for all variables were very informative, the usefulness of the forecasts varied considerably over time and across variables. In recent decades, forecasts of both actual and structural surpluses have been particularly difficult. These results also suggest that care should be taken in modeling the behavior of policymakers, as their expectations of fiscal policy may be quite different from what is subsequently observed. We return to this point below.

VII. Understanding Forecast Surpluses

A key challenge for fiscal policymakers is to understand the extent to which projected surpluses or deficits reflect purely cyclical (and therefore largely self-correcting) factors and to what extent structural factors (which require a policy adjustment) are at play. This is further complicated by the fact that cyclical and structural factors may not be equally captured by our forecasting models.

For example, our forecast may be dominated by movements in structural factors, while cyclical factors are in practice much more important, or vice versa.

We can shed some light on this issue with a simple decomposition of variance. We can rewrite the government surplus S as

$$S = \tilde{S} + C,$$

where $\tilde{S}$ is the structural surplus and C is the cyclical surplus. Each of these can in turn be decomposed into a forecast and a forecast error, giving

$$S = \tilde{S}^f + \tilde{S}^e + C^f + C^e.$$

We can therefore decompose changes in government surpluses into these four underlying components. Of course, the greater the share of movements that come from $\tilde{S}^f$ and C^f, the better our forecasts.

To understand the relative importance of these cyclical factors, we calculate the *implied* cyclical component of the surplus as simply the difference between the estimated surplus and the estimated structural surplus (HEB.) For simplicity, we refer to this imputed variable C as *Anti-HEB*. This in turn allows us to decompose the variance of S into components due to the variance of each of the four factors listed in the above equation plus their respective covariances. Orthogonalizing these four components requires us to partition the covariances to the respective variables. To do so, we assume that cyclical factors do not cause structural factors and that forecast errors do not cause forecasts, giving us the causal ordering $\{\tilde{S}^f$, C^f, $\tilde{S}^e$, $C^e\}$. The results are summarized in Figure 8, which shows the share of the variance of observed government surpluses that are due to each of the four components. We again found that results varied significantly over the sample period, so we present results for both the pre-1991 and the post-1990 periods.

Not surprisingly, we see that the variance due to forecast errors (HEB_E and $ANTIHEB\_E$) is very small at the shortest horizons and increases thereafter. In the first half of the sample, the opposite is also true; the variance due to each of the forecasts (HEB_F and $ANTIHEB\_F$) is much larger and decreases steadily as the forecast horizon increases. However, in the post-1990 sample, while the

contribution of the structural component HEB_F falls from almost 70% to less than 20%, that of the cyclical component $ANTIHEB\_F$ rises by far more than any other component, accounting for over 60% of the overall sample variance of surpluses at a four-quarter forecast horizon.[18] The great shift in the explanatory power of the forecasts over the two periods is also surprising. While they together accounted for only about 40% of the overall variance at a four-quarter forecast horizon pre-1991, this doubles to roughly 80% after 1990.

These are sobering results for policymakers concerned about structural deficits, as they suggest that their forecasts in recent decades bear little relationship to the observed movements in the deficit except at the very shortest horizons. Rather, the dominant influences are forecasts of cyclical factors and the role played by forecast errors in the structural component.

VIII. A Fiscal Policy-Influenced Taylor Rule

Having analyzed the quality of the Greenbook fiscal forecasts, we now turn to the potential use of such forecasts in policy analysis. We begin by looking at potential interactions between fiscal policy and monetary policy.

Economists have often discussed the interactions between monetary policy and fiscal policy, yet simple rules such as the Taylor rule described in Taylor (1993) do not include a variable representing fiscal policy. Given that the Fed's Greenbook provides a substantial amount of information on fiscal policy, evidently monetary policymakers consider fiscal policy details while determining their policy actions.

So, suppose we estimate a Taylor rule and include a term representing fiscal policy. Would such a term be significant, and would it have an impact on monetary policy? We can use the Greenbook forecasts to form a forward-looking Taylor rule that either excludes or includes forecasts of the cyclical part of the government budget surplus.

[18]This increase is all the more surprising given that HEB_F comes ahead of it in the Cholesky decomposition. Additional analysis, not reported here, showed that this pattern persists at forecast horizons up to eight quarters.

Our generalized Taylor rule to estimate is

$$i_t = \rho i_{t-1} + (1-\rho)[\beta_0 + \beta_1 \pi_{t+k} + \beta_2 y_{t+k} + \beta_3 C_{t+k}] + \epsilon_t.$$

We first estimate the model assuming $\beta_3 = 0$, then reestimate it allowing β_3 to be nonzero. We run the estimation in four different ways (to check robustness), setting $k = 3$ or 4 and using the first or the last meeting of each quarter. The results are shown in Table 4.

Table 4—Taylor Rule Estimates

	k = 3				k = 4			
	First		Last		First		Last	
Constant	0.196	0.476	0.150	0.366	0.107	0.324	0.064	0.189
	(1.83)	(3.50)	(1.31)	(2.58)	(0.97)	(2.11)	(0.56)	(1.16)
i_{t-1}	0.756	0.768	0.804	0.821	0.765	0.786	0.799	0.817
	(20.9)	(22.3)	(22.3)	(23.1)	(21.1)	(21.2)	(22.1)	(20.6)
π_{t+k}	0.441	0.363	0.352	0.279	0.462	0.374	0.402	0.340
	(5.78)	(4.74)	(4.57)	(3.47)	(5.75)	(4.13)	(4.94)	(3.41)
y_{t+k}	0.274	0.512	0.224	0.407	0.268	0.440	0.230	0.322
	(8.25)	(6.17)	(7.08)	(5.03)	(7.85)	(4.72)	(7.03)	(3.50)
C_{t+k}		-59.2		-47.3		-43.4		-24.4
		(3.10)		(2.44)		(1.98)		(1.07)
$\overline{R}^2$	0.975	0.976	0.971	0.973	0.974	0.975	0.971	0.971

Note: Coefficients are shown for each variable in the Taylor rule equation, with t-statistics shown in parentheses below each coefficient.

The results show that the specification works in the sense that all of the terms have the expected sign. The cyclical fiscal term in the estimated Taylor rule is significant for some specifications and shows that a higher cyclical surplus, which translates into tighter fiscal policy, is offset with easier monetary policy through a lower fed funds rate. For one of our specifications, however, the fiscal term is

not statistically significant, though it is in the other specifications. Thus, fiscal policy may have an influence on monetary policy.

How much difference does it make if we include a fiscal policy term in the Taylor rule? If we examine the rules with and without the fiscal policy term (using $k = 3$ and the estimation for the first meeting of the quarter), we can see the difference plotted in Figure 9. Though the differences do not appear to be large (plus or minus 0.3 percentage point, at most), recall that we are using a version of the Taylor rule with a lagged interest rate term that has a coefficient of 0.8 and thus dominates the movement of the federal funds rate. So, the impact of the fiscal term on the Taylor rule is not insignificant.

IX. How Procyclical Is Discretionary Fiscal Policy?

A related literature has examined the degree to which fiscal policy has tended to be procyclical or countercyclical.[19] Several papers in recent years have made use of real-time data (particularly that from the EU's Stability and Growth Pact) to understand the extent to which policymakers tried to follow countercyclical or acyclical policy.[20]

This work is distinct from the Taylor rule studied above that models the behavior of the budget surplus. That surplus is produced as the sum of two distinct mechanisms: so-called "automatic stabilizers," which tend to move the surplus upwards in expansions and downwards in recesssions, and discretionary fiscal policy, which may reinforce or counteract the former. To abstract from the effects of automatic stabilizers, this literature instead examines the behavior of *structural* budget deficits. Surveying the literature, Golinelli and Momigliano (2009) find that the most commonly estimated relationships include such forms as

[19]The issue is a potentially important one, with some authors arguing that political considerations have tended to cause fiscal policy to be procyclical. This in turn has been used to argue that reducing the scope for discretionary fiscal policy would be welfare-improving.

[20]Leading examples include Beetsma et al. (2009), Cimadomo (2011), Golinelli and Momigliano (2006), Golinelli and Momigliano (2009), Giuliodori and Beetsma (2007), and Bernoth, Hughes-Hallett and Lewis (2008).

$$\Delta CAPB_t = \phi_{CAPB} \cdot CAPB_{t-1} + \phi_{debt} \cdot DEBT_{t-1} + \phi_{GAP} \cdot GAP_{t\ or\ t-1} + u_t,$$

where $CAPB_t$ is the cyclically adjusted primary balance, GAP is the output gap, and discretionary policy is said to be countercyclical if and only if $\phi_{GAP} > 0$.

Working with the structural balance introduces a potential complication, however, as estimates may be substantially revised over time and, particularly if policy is forward-looking, forecasts can deviate substantially from realized outcomes. Using current estimates of structural balances could therefore give a distorted view of fiscal policy *intentions*. Numerous authors have therefore re-estimated the discretionary fiscal policy reaction function using real-time data from various sources in recent years. The extent to which this changes the apparent cyclicality of fiscal policy varies widely. We therefore investigate this issue with our Greenbook data.

We begin by estimating a reaction function similar to that above with the form

$$\Delta HEB_t = \phi_0 + \phi_{HEB} \cdot HEB_{t-1} + \phi_U \cdot U_t + u_t,$$

where U is the unemployment rate. Estimation is by OLS with HAC standard errors. The results, presented in Table 5, show that both ϕ_{HEB} and ϕ_U appear to be < 0 and significantly different from zero, both over the full sample as well as over our two subperiods. The full-sample estimate of ϕ_{HEB} implies that, on average, roughly 10 percent of current structural surplus or deficit tends to be reduced each quarter. However, this rate varies over time, with much less persistent deficits after 1990.[21] The negative sign of ϕ_U implies that policy has tended to be countercyclical, with increases in the unemployment rate reducing the structural budget surplus. The ratio ϕ_U/ϕ_{HEB} tells us the long-run impact of a permanent change in the unemployment rate on the structural deficit. By this measure, the aggressiveness of fiscal policy has been relatively constant over time,

[21] These changes in persistence mirror the variation over time in the equation's fit, as shown by its R^2.

despite the much larger impact coefficient on the unemployment rate in recent decades.[22]

TABLE 5—STRUCTURAL DEFICITS: MEASURED EX POST

Sample	1970Q2-2006Q4	1970Q2-1990Q4	1991Q1-2006Q4
ϕ_0	0.004	0.006	0.009
	(2.124)	(1.894)	(2.933)
ϕ_{HEB}	-0.101	-0.099	-0.250
	(-2.913)	(-2.200)	(-4.471)
ϕ_U	-0.096	-0.116	-0.262
	(-3.081)	(-2.462)	(-3.780)
R^2	0.094	0.101	0.180
ϕ_U/ϕ_{HEB}	0.951	1.177	1.050

Note: The coefficients shown above are OLS estimates for the equation
$\Delta HEB_t = \phi_0 + \phi_{HEB} \cdot HEB_{t-1} + \phi_U \cdot U_t + u_t$.
Figures in parentheses are t-ratios based on Newey-West standard errors calculated with four lags.

We then reestimate the same relationship with the addition of Greenbook forecast errors for both the structural deficit and the unemployment rate.[23] We would expect the forecast errors to enter significantly only to the extent that fiscal policy was guided by anticipated rather than realized values of these two variables. Our results are shown in Table 6. First, we note that the R^2 more than doubles, suggesting that these forecast errors appear to play an economically important role in understanding changes in the estimated fiscal policy stance. Second, estimates of ϕ_U are now insignificant in the full sample and the first part of our sample, although its estimate in the latter portion of the sample is significant and not greatly changed from the previous table.

Third, estimates of ψ_{HEB} appear to be significantly less than zero in all three cases. This implies that, for a given level of HEB, higher forecast structural

[22]We investigated a number of alternative specifications as well. HEB and HEB6 gave very similar results when using the same sample period. The data slightly preferred the current unemployment rate to its lag. Results using current CBO estimates of the output gap gave very similar results to those using the unemployment rate; the correlation coefficient of these two series is 0.91. However, results tended to be more sensitive to the inclusion or exclusion of additional lagged values of ΔHEB_t or U_t, particularly over subperiods.

[23]We use the four-quarter-ahead forecasts from the first FOMC meeting of each quarter. Results were similar for forecast errors from one quarter ahead to four quarters ahead.

Table 6—Structural Deficits: Measured Ex Ante

Sample	1970Q2-2006Q4	1970Q2-1990Q4	1991Q1-2006Q4
ϕ_0	-0.001	-0.001	0.009
	(-0.625)	(-0.269)	(1.792)
ϕ_{HEB}	-0.094	-0.054	-0.312
	(-2.747)	(-1.927)	(-3.839)
ϕ_U	-0.001	0.015	-0.260
	(-0.012)	(0.240)	(-2.582)
ψ_U	0.153	0.262	-0.241
	(1.439)	(1.634)	(-2.101)
ψ_{HEB}	-0.204	-0.266	-0.219
	(-3.710)	(-2.550)	(-3.827)
R^2	0.300	0.356	0.404
Multipliers			
ϕ_U/ϕ_{HEB}	0.005	-0.270	0.834
ψ_U/ϕ_{HEB}	-1.628	-4.855	0.772
ψ_{HEB}/ϕ_{HEB}	2.172	4.936	0.704

Note: The coefficients shown above are OLS estimates for the equation
$\Delta HEB_t = \phi_0 + \phi_{HEB} \cdot HEB_{t-1} + \phi_U \cdot U_t + \psi_U \cdot (\hat{U}_t - U_t) + \psi_{HEB} \cdot (\hat{HEB}_t - HEB_t) + u_t$.
$\hat{U}_t - U_t$ and $\hat{HEB}_t - HEB_t$ are the errors of Greenbook forecasts presented at the first FOMC meeting of quarter $t-4$.
Figures in parentheses are t-ratios based on Newey-West standard errors calculated with four lags.

surpluses tended to reduce realized improvements in the surplus. Put another way, this is consistent with higher forecast structural deficits causing further efforts at deficit reduction and higher forecast structural surpluses causing reduced fiscal austerity. Their long-run impact appears to be particularly acute in the first portion of our sample, but even in the latter portion their effect seems to be roughly the same size as that of ex-post estimates of HEB.

Finally, estimates of ψ_U mirror those of ϕ_U; they are significant only in the latter portion of our sample, where their estimated coefficients are similar. The negative estimate of ψ_U in the later sample implies that, for a given level of unemployment, higher *expected* unemployment tends to *decrease* the structural budget surplus. Put another way, this reinforced the countercyclical nature of fiscal policy found in the previous table with ex-post data. However, while the former showed quite similar results across the sample, the use of forecast unemployment

shows a significantly different picture, with acyclical policy (and procyclical intended policy) in the full sample and the first half of the sample, replaced by significantly countercyclical actual and intended policy after 1990.

X. Summary and Conclusions

Our goal was to create a data set containing a complete set of Greenbook fiscal forecasts for use in analyzing U.S. fiscal forecasts with better properties than those that are currently available. We believe that these forecasts may be useful for the study of fiscal policy, both for understanding the nature and sources of fiscal uncertainty as well as understanding the systematic behavior of monetary and fiscal policy.

Regarding fiscal uncertainty, some of the Greenbook forecasts exhibit bias, particularly forecasts of receipts. Those forecasts for the surplus and expenditures that are not biased do not seem to be inefficient with respect to monetary policy, and there was little evidence of forecast bias over the presidential election cycle. A variance decomposition showed that expenditures are easier to forecast than receipts.

We found some evidence that monetary policy may be influenced by expected fiscal policy. We also found some evidence that the apparent cyclicality of fiscal policy has changed significantly over our sample, having become more actually and intentionally countercyclical since 1990. During that period, we found that cyclical factors dominated the behavior of expected budget surpluses. More generally, however, estimates of the structural surplus seem to have an overly optimistic bias around both business cycle peaks and troughs.

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Data Appendix

A1. Sources and Sample

The Greenbook is a summary of economic conditions, trends, and forecasts prepared for every meeting of the FOMC. Our primary data sources are page scans of each Greenbook made available by the Board of Governors of the Federal Reserve System[24] and by the Real-Time Data Research Center at the Federal Reserve Bank of Philadephia.[25]

These two sources provide independently made page scans from different physical copies of the vintage historical materials; this allowed us to independently confirm figures that, on a few very rare occasions, were difficult to distinguish or missing in one of the two sources.[26]

The first data vintage collected was for July 20, 1966, and the last was for December 6, 2006, covering 387 meetings of the FOMC over 40 years. This represented the full set of source materials available when we started. As of late 2013, a further two years of early Greenbooks and one year of recent Greenbooks have been added. However, the earliest versions either lack fiscal variables or contain only very short time series (typically five quarters, most of which are historical estimates). Most of our fiscal variables (Surplus, Revenues, and Expenditures) first appeared in the August 9, 1967, vintage, while the first HEB series vintage was from April 29, 1970. The timing of FOMC meeting dates is slightly irregular, but for most of the period there were exactly two meetings per quarter. Meetings in the early part of the sample were more frequent (12 or more per year, but not necessarily one per month). The release dates of key statistics also vary somewhat over the years. To standardize the forecast horizons that we examine, we

[24] `www.federalreserve.gov/monetarypolicy/fomc_historical.htm`

[25] `www.philadelphiafed.org/research-and-data/real-time-center/greenbook-data`

[26] Note that the Greenbook estimates published in the ALFRED database at the Federal Reserve Bank of St. Louis contain only figures from the main volumes of the Greenbook. This is compiled a few days prior to the meeting of the FOMC; late-breaking developments (such as statistical releases or revisions) are collected and circulated in the form of a supplement to the Greenbook. Our data reflect the estimates presented to the FOMC; these incorporate any additions or revisions contained in supplements to the Greenbook.

restrict our analysis to the vintages from the first and the last FOMC meetings of each quarter. A complete list of data vintage dates is provided below and is summarized in the following table.

TABLE A1—AVAILABLE DATA VINTAGES

Series	First Vintage	Last Vintage
Surplus	Aug. 9, 1967	Dec. 6, 2006
Receipts	Aug. 9, 1967	Dec. 6, 2006
Expenditures	Aug. 9, 1967	Dec. 6, 2006
Unemployment	July 20, 1966	Dec. 6, 2006
GDP (nominal)	July 20, 1966	Dec. 6, 2006
GDP (real)	July 20, 1966	Dec. 6, 2006
HEB	Apr. 29, 1970	Dec. 6, 2006
HEB (6%)	Nov. 12, 1980	Dec. 6, 2006

The number of observations and the forecast horizons included in each series varied considerably over time. Our figures were principally compiled from the *Federal Sector Accounts* and *Main Economic Indicators* tables (whose contents varied somewhat over the years). When series were shown in both tables, we collected data from both to maximize the span of observations available. In some of the earliest vintages, series might not contain more than five quarters of historical estimates and forecasts, whereas later vintages could contain up to 20 quarters. Greenbooks often had slightly more quarters of historical estimates than of forecasts, as can be seen in Table A2, which gives one example of the number of available forecasts for each forecast horizon.

A2. Validation

The data were validated in a number of ways:

1.) A professional data entry firm was employed for the initial key-input of the data with a contracted accuracy rate $\geq 99.95\%$.

2.) Several of its series were then checked against independent sources. This verified the claimed accuracy rate.

Table A2—Number of Observations by Forecast Horizon: Govt. Receipts

Forecast Horizon	First Meeting	Last Meeting	Forecast Horizon	First Meeting	Last Meeting
-12	0	0	**12**	0	0
-11	2	0	**11**	0	0
-10	3	2	**10**	0	0
-9	3	3	**9**	1	6
-8	3	3	**8**	9	17
-7	3	3	**7**	18	26
-6	16	3	**6**	39	52
-5	40	19	**5**	65	74
-4	73	49	**4**	88	101
-3	120	92	**3**	117	128
-2	152	143	**2**	135	137
-1	158	157	**1**	146	150
0	158	158			

Note: A negative forecast horizon represents history (e.g., a forecast horizon of -4 means the data reported for the period four quarters before the date at which the Greenbook forecast was made), also called a backcast; a zero forecast horizon is a nowcast for the current quarter; and a positive forecast horizon refers to a forecast of a future quarter.

2a.) Unemployment rates as well as nominal and real levels of GNP and GDP were checked against estimates published in ALFRED by the FRB St. Louis. We found 10 cases in which the figures in ALFRED did not correspond to the page scans, and one case in which we had missed an entry.[27] We also found a number of cases in which the FOMC and the FRB Philadelphia page scans disagreed. In those cases, the FRB Philadelphia page scans were dated slightly after the original Greenbook estimates, indicating that figures were revised just prior to the FOMC meeting.

2b.) HEB estimates were checked against estimates entered independently.[28] Of approximately 3,000 data points, we found and corrected 10 discrepancies (0.3%); three were due to incorrect or missing meeting dates, five were due to keying errors in the independent estimates, and the remainder were due to illegible page scans.

[27]We communicated our findings to the FRB St. Louis, which verified our figures and corrected the entries in ALFRED. Note that with slightly more than 5,000 data points checked, this implies a precorrection error rate for Greenbook series in ALFRED of $< 0.2\%$ and $< 0.02\%$ for our data entry.

[28]The authors would like to thank Wendy Chan of the Bank of Canada for her research assistance.

3.) There were a small number of cases in which figures shown in the *Federal Sector Accounts* table were not precisely the same as those shown in *Main Economic Indicators* table of the same Greenbook. One possibility is that the two tables may have been prepared by different groups; older Greenbooks were compiled by hand, and slight discrepancies may have arisen in preparation.

4.) We verified that the Surplus/Deficit data were consistent with the data for Receipts and Expenditures.[29]

A3. Forecasts

We recorded all Greenbook estimates for our selected series. This included estimates for future periods (forecasts), current periods (nowcasts), and historical periods (backcasts). In this Appendix, we collectively refer to all of these as *forecasts*, although some prefer the term "projection" to emphasize the conditional nature of these estimates. Forecast horizons varied widely from meeting to meeting. At times, the convention was that the forecast horizon was fixed to the end of a given calendar year then rolled forward once a year. This meant that the length of the forecast horizon varied somewhat throughout the year. There was also a general tendency for forecast and backcast horizons to increase across the decades, although there were some occasions when the horizons were decreased (perhaps because the longest horizons were not felt to be useful). When series were listed in more than one table, different tables might include different forecast horizons. As the content of the tables evolved over time, the available forecast horizons might therefore vary from series to series.

A4. Outcomes

Forecast evaluation requires a measure of observed outcomes. One of the series we collect (HEB) has no officially published value; it is only calculated by Board

[29] Figures in the Greenbook for May 13, 1999, incorrectly reversed the sign on the deficit. We corrected the sign.

staff. While the other series correspond to official statistics, values published for the latter are revised over time. These revisions may reflect the incorporation of new information as preliminary published estimates are refined in the quarters immediately following their initial publication. It may also reflect conceptual changes in the definition of the series, such as the change from GNP to GDP or from a fiscal surplus to a fiscal current account surplus. We refer to the latter as "benchmark" revisions. Each of our series was affected, to greater or lesser degrees, by benchmark changes. This complicates the measurement of forecast outcomes. We therefore use a variety of different "outcome" concepts to provide alternative characterizations of forecast performance. They are as follows:

First Release: This is the initial quarterly estimate published by the responsible official statistical agency (BEA or BLS).

One Year: This is the official quarterly estimate that was available precisely one year after the publication of the First Release. For example, if the First Release was published on September 23, 1998, and revisions were published on August 26, 1999, and September 29, 1999, the August 1999 estimate would be the One Year estimate. This typically incorporates the annual revision common to most official series.

Last Greenbook: This is the last value recorded in the Greenbook, typically one or more years after the quarter to which it refers. This is primarily important as a measure for HEB, which has no counterpart in official statistics.

Prebenchmark: This is the last official estimate reported prior to a benchmark revision of the series. This is intended to capture the most precise available estimate of the same concept that the staff were forecasting and has previously been used in the literature as a measure of data revision.[30] We discuss the identification and importance of benchmark revisions below.

Final: This is a "contemporary" estimate, which in our case was the official estimate as of December 27, 2012.

[30]For example, see Aruoba (2008).

A5. Benchmark Revisions

We use the extent of revision to define those that we treat as *benchmark* revisions. We treat as benchmark revisions those that affect the entire published history of a time series. For example, U.S. Quarterly National Accounts are available starting from 1946Q1. Revisions that do not affect the published estimates for the 1940s are therefore not considered benchmark revisions. Changes in seasonal adjustment factors, although they may occur many years after the fact, are not counted as benchmark revisions. Changes in base years (for real values), the change from fixed-weight to chain-weighted values, and the change from GNP to GDP are all examples of benchmark changes. This definition of benchmark revision has at least two important advantages:

1.) It is a simple, transparent, and objective way to determine which revisions are to be treated as benchmark revisions.

2.) It implicitly relies on the judgment of the statistical agency to determine which methodological or conceptual changes are important enough to be considered benchmark changes. In effect, if the statistical agency judges that historical estimates are sufficiently comparable with current estimates and that no revision to the former is required, no benchmark revision has occurred.

This definition also has at least one important drawback: Since no official series is published for HEB, no long time series are available to identify benchmark changes. As we describe below, we therefore treat HEB estimates somewhat differently.

The economic importance of benchmark revisions varied vastly across our series, as we describe below in greater detail. At one extreme, benchmark revisions in the unemployment rate were rare and trivial. In contrast, the redefinition of the government accounts had an important impact on our fiscal variables. We discuss the economic importance of benchmark revisions in the next subsection. Table A3 shows the dates just before benchmark revisions were first published for each series.

Table A3—Prebenchmark-Revision Dates for Quarterly National Accounts

Last Quarter	Last ALFRED Vintage	Last FOMC Date
1975Q3	19751219	Dec. 10, 1975
1980Q3	19801119	Dec. 12, 1980
1985Q3	19851120	Dec. 11, 1985
1991Q2	19910828	Oct. 30, 1991
1995Q2	19951027	Dec. 14, 1995
1999Q2	19990930	Sep. 29, 1999
2003Q3	20031125	Dec. 3, 2003

Note: This table gives the dates of publication for the last estimates prior to benchmark revisions of the National Accounts. The first column gives the last time period to which those estimates correspond. The second column gives the date at which those estimates were published. The last column gives the date of the last FOMC meeting prior to the publication of the benchmark revision. These dates apply to figures from the Quarterly National Accounts as based on original data vintages from ALFRED and the FRB Philadelphia Real-Time Data Set for Macroeconomists. The 1995 benchmark revision of Expenditures occurred slightly after the revision of the other series; its last prebenchmark-revision quarter was 1995Q3 which was published on October 27, 1995. The last FOMC meeting using this estimate was that of December 14, 1995.

Values forecast prior to a benchmark revision are not comparable with outcomes measured after a benchmark revision. For that reason, whenever a forecast or nowcast is made for an outcome that will be observed only after a benchmark revision has occurred, we drop those forecasts and nowcasts from our data set. For example, the Greenbook for the FOMC meeting on October 15, 1975, contained nowcasts and forecasts for the period 1975Q4-1976Q4. Estimates for most of these outcomes were published only after the benchmark revision, which was first released on January 20, 1976. Therefore, for the series affected by those benchmark changes, those forecasts and nowcasts were replaced by a missing value code.

A6. Variables

GNP and GDP:[31] The BEA published estimates of GNP until December 4, 1991, when it switched to GDP as its main measure of economic activity. The Greenbooks followed suit, focusing on GNP until that date and GDP thereafter. Our primary use of these series is to express various fiscal series as a fraction

[31] Our outcome measures for these series were taken from the ALFRED series *GNP* and *GDP*.

of the overall size of the U.S. economy, for which we need an estimate of the level of the series. After August 2005, Greenbooks no longer listed GDP in levels, giving only growth rate forecasts. For the last 11 FOMC meetings we recorded, we therefore calculated an implied level GDP forecast from the growth rate forecasts by applying the compound growth rate to the second-to-last (and therefore already revised) officially published estimate. For example, the growth rate estimates from the September 14, 2005, Greenbook are applied to the August 31, 2005, vintage BEA estimate of GDP. The last estimate in that vintage is for 2005Q2; we therefore use the 2005Q1 estimate of 12,198.8 as our base.

Receipts, Expenditures and Surplus/Deficit:[32] Receipts (consistent of all revenues accruing to the federal government) have not undergone any major redefinitions. However, the definitions of expenditures and the surplus/deficit changed significantly in 1996 and again in 1999. Prior to 1996, expenditures included all government spending, whether for capital goods or other goods. In 1996, government investment and the government capital stock were introduced into the U.S. national accounts. Expenditures no longer included government spending on capital goods, but instead included their depreciation. In most periods, government investment exceeded depreciation so expenditures were revised down and both the surplus and GDP were revised up. For cash-flow purposes, the government also calculates a current-and-capital-account surplus, which is identical to the overall surplus before 1996, and does not treat government investment differently from other expenditures. A second significant revision to the concepts for expenditures and the surplus came in 1999, when government spending on software was reclassified from expenditures to investment, with subsequent revisions to the expenditure data (revised down for years in which gross investment in software exceeded depreciation of software) and surplus data (revised up for years in which gross investment in software exceeded depreciation of software).

[32]Outcomes for the Surplus/Deficit were measured by the ALFRED series *FGDEF: Net Federal Government Saving*. Outcomes for Receipts were taken from *FGRECPT: Federal Government Current Receipts*, and for Expenditures from *FGEXPND: Federal Government: Current Expenditures*.

HEB: The high-employment budget surplus/deficit (HEB) is the Greenbook's estimate of a cyclically adjusted or "structural" budget deficit. This is the Board staff's counterfactual estimate of what the surplus (or deficit) would be if the unemployment rate were at a constant reference level over the forecast horizon. The budget deficit concept used in HEB always corresponds to that used in the Surplus/Deficit measure; prior to 1996, this was the overall Surplus or Deficit, and this was replaced by the Government Current and Capital Account Surplus/Deficit thereafter.

The reference level of unemployment used to calculate HEB is usually not always explicitly mentioned but drifted upwards from near 4.0% in the earliest part of our sample before major changes were introduced in 1980. From November 12, 1980, until March 23, 1983, two alternative HEB estimates were presented, based on a 6.1% and a 5.1% reference level of unemployment. From May 18, 1983, until August 17, 1983, these were replaced by rates of 6.0% and 5.0%. Thereafter, the reference level was constant at 6.0%. We assume that these changes reflected uncertainty and disagreement within the Board about the equilibrium rate of unemployment. The table design during the "dual-rate" period gave greater prominence to the 6.1% (and then the 6.0%) reference level.

We found that the revision of the reference level of unemployment appeared to have a qualitatively important effect on the HEB estimates. We therefore consider two different sets of HEB estimates: the full series as well as the subset (HEB6), which only considers those estimates based on a 6% or 6.1% reference level. We make no attempt to adjust the HEB6 series for the change from 6.1% to 6.0%. We also calculate the difference between the HEB (and HEB6) estimates and the overall Surplus/Deficit estimates as the Board staff's implied estimate of the cyclical Surplus/Deficit.

Unemployment:[33] Greenbooks only estimate the unemployment rate to 0.1%.

[33]Outcomes for this series were measured by the ALFRED series *UNRATE: Civilian Unemployment Rate.*

Starting with the official estimate published on February 9, 1967, the labor force was redefined to count only those aged 16 and over instead of 14 and over. This never caused revisions of more than 0.1% in absolute value in our data set. There were no benchmark revisions to unemployment after that date. We therefore chose to ignore benchmark revisions in the unemployment rate and do not use a "Prebenchmark" measure of outcomes.

Strictly Confidential (FR)
Class II FOMC

STAFF PROJECTIONS OF FEDERAL SECTOR ACCOUNTS AND RELATED ITEMS
(Billions of dollars except as noted)

January 29, 1997

Item	Fiscal year[5]				1996				1997				1998			
	1995[a]	1996[a]	1997	1998	Q1[a]	Q2[a]	Q3[a]	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
UNIFIED BUDGET					Not seasonally adjusted											
Receipts[1]	1355	1453	1525	1575	322	446	362	346	341	459	380	363	351	469	392	382
Outlays[1]	1519	1560	1634	1692	393	392	395	405	412	408	410	426	419	424	422	471
Surplus/deficit[1]	-164	-107	-109	-117	-72	54	-33	-59	-71	51	-31	-63	-68	45	-30	-89
On-budget	-226	-174	-184	-187	-84	14	-36	-76	-83	11	-36	-72	-81	2	-36	-101
Off-budget	62	67	75	69	12	39	2	18	12	40	5	8	12	43	6	11
Surplus excluding deposit insurance[2]	-182	-116	-118	-120	-75	52	-34	-65	-72	51	-32	-64	-69	44	-31	-90
Means of financing																
Borrowing	171	130	118	146	80	-23	39	49	58	-31	43	54	69	-25	48	73
Cash decrease	-2	-6	4	0	-1	-16	-6	11	13	-16	-4	10	10	-15	-5	10
Other[3]	-5	-16	-13	-29	-7	-14	0	-1	1	-5	-8	0	-11	-5	-13	6
Cash operating balance, end of period	38	44	40	40	22	38	44	33	20	36	40	30	20	35	40	30
NIPA FEDERAL SECTOR					Seasonally adjusted, annual rate											
Receipts	1459	1544	1625	1684	1523	1576	1582	1625	1606	1626	1645	1663	1672	1691	1711	1731
Expenditures	1629	1683	1749	1798	1678	1702	1703	1730	1741	1755	1772	1782	1792	1802	1815	1829
Consumption expend	455	457	462	463	454	464	461	463	460	461	464	463	464	462	464	460
Defense	304	303	303	305	299	307	305	306	301	302	304	305	306	303	305	303
Nondefense	151	155	159	158	155	156	157	157	159	160	160	157	158	159	159	157
Other expenditures	1175	1226	1287	1335	1225	1239	1241	1267	1281	1294	1308	1319	1328	1340	1351	1369
Current account surplus	-171	-139	-124	-114	-155	-127	-121	-105	-135	-129	-127	-119	-120	-112	-104	-98
Gross investment	65	63	62	62	65	66	64	64	61	62	62	63	62	61	61	60
Current and capital account surplus	-236	-202	-186	-176	-220	-193	-185	-169	-196	-190	-189	-182	-182	-172	-166	-159
FISCAL INDICATORS[4]																
High-employment (HEB) surplus/deficit	-263	-237	-245	-249	-247	-233	-231	-222	-251	-251	-254	-253	-253	-247	-244	-241
Change in HEB, percent of potential GDP	0	- 4	1	1	1	- 2	0	- 1	4	0	0	0	0	- 1	0	0
Fiscal impetus (FI), percent, cal year	-5 6	-1 6	-3 5	-5 5	1 3	1 8	- 2	- 8	-2 2	- 5	1	-2 7	-1 8	-1 3	- 3	-2

1 OMB's July 1996 deficit estimates (assuming the enactment of the President's proposals) are $126 billion in FY97 and $94 billion in FY98 CBO's January 1997 baseline deficit estimates are $124 billion in FY97 and $120 billion in FY98 Budget receipts, outlays, and surplus/deficit include corresponding Social Security (OASDI) categories The OASDI surplus is excluded from the on-budget deficit and shown separately as off-budget, as classified under current law The Postal Service deficit is included in off-budget outlays beginning in FY90

2 OMB's July 1996 deficit estimates (assuming the enactment of the President's proposals), excluding deposit insurance spending, are $134 billion in FY97 and $96 billion in FY98 CBO'S January 1997 baseline deficit estimates, excluding deposit insurance, are $136 billion in FY97 and $124 billion in FY98

3 Other means of financing are checks issued less checks paid, accrued items, and changes in other financial assets and liabilities

4 HEB is the NIPA current and capital account surplus in current dollars, with cyclically sensitive receipts and outlays adjusted to the level of potential output generated by 1 8 percent real growth and an associated unemployment rate of 6 percent Quarterly figures for change in HEB and FI are not at annual rates Change in HEB, as a percent of nominal potential GDP, is reversed in sign FI is the weighted difference of discretionary changes in federal spending and taxes (in chained (1992) dollars), scaled by real federal consumption plus investment For change in HEB and FI, negative values indicate restraint

5 Fiscal 1995 data for the unified budget come from OMB,' fiscal 1996 and quarterly data come from the Monthly Treasury Statement and may not sum to OMB fiscal year totals

a--Actual

FIGURE 1. A SAMPLE GREENBOOK PAGE

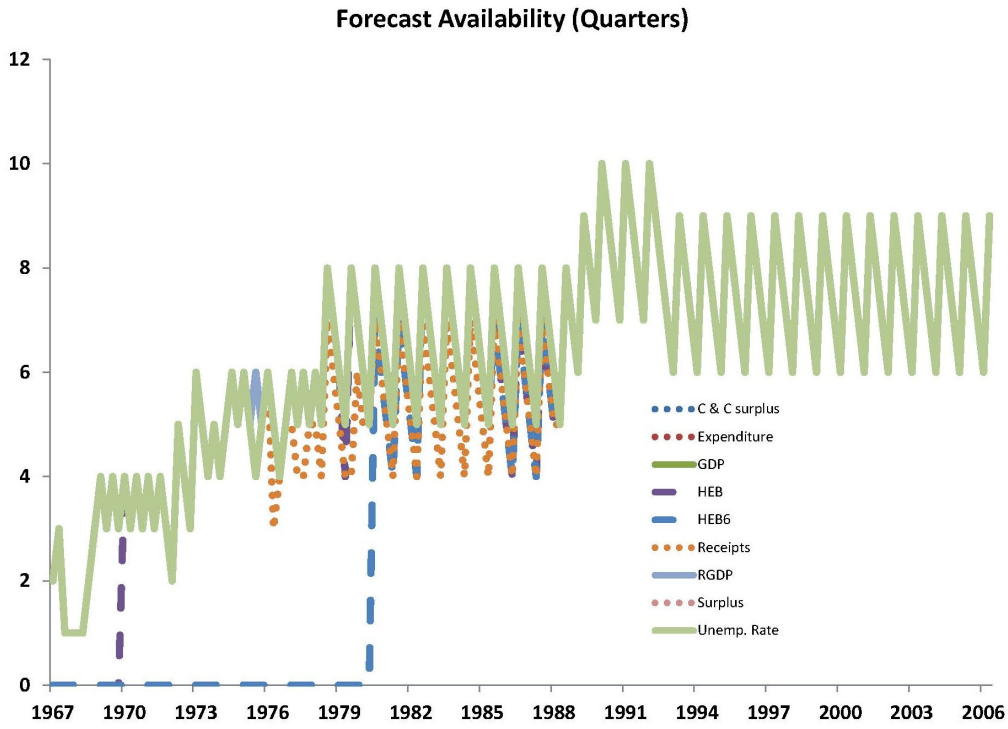

FIGURE 2. GREENBOOK FORECAST HORIZONS BY DATE AND SERIES

Note: Counts are from the first FOMC meeting of each quarter.

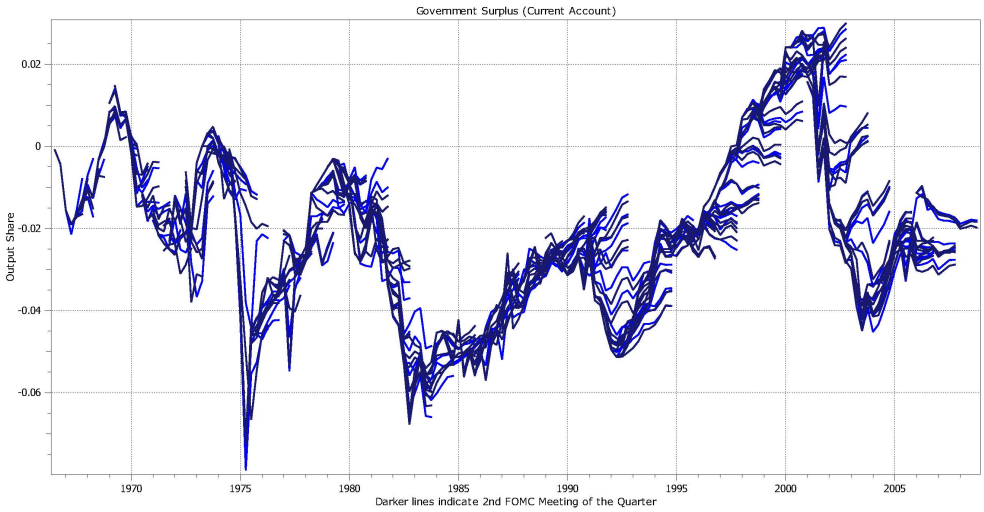

FIGURE 3. THE STRING DIAGRAM OF THE SURPLUS FORECASTS

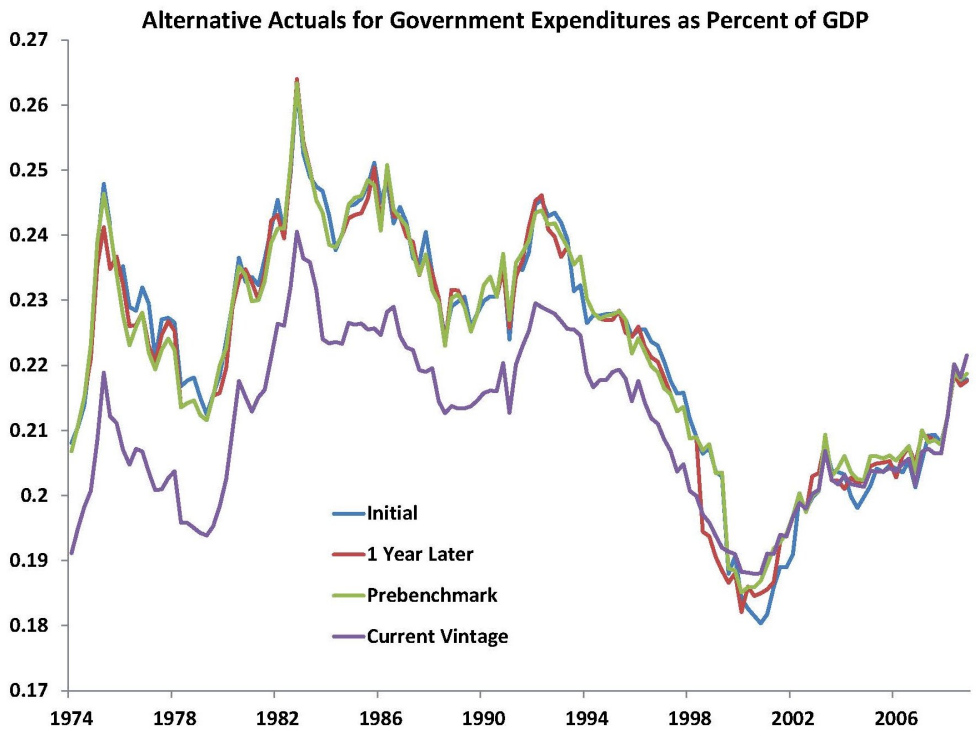

FIGURE 4. REALIZED VALUES OF GOVERNMENT EXPENDITURES BASED ON ALTERNATIVE CONCEPTS

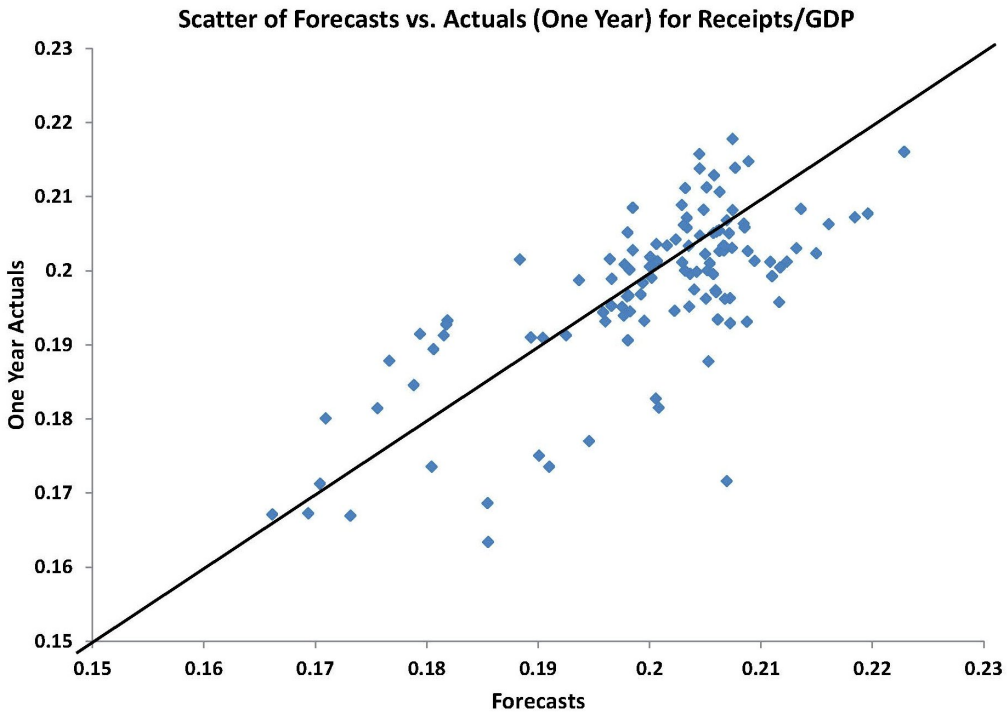

Figure 5. Scatterplot of Four-Quarter-Ahead Receipt Forecasts Against One-Year Realized Values

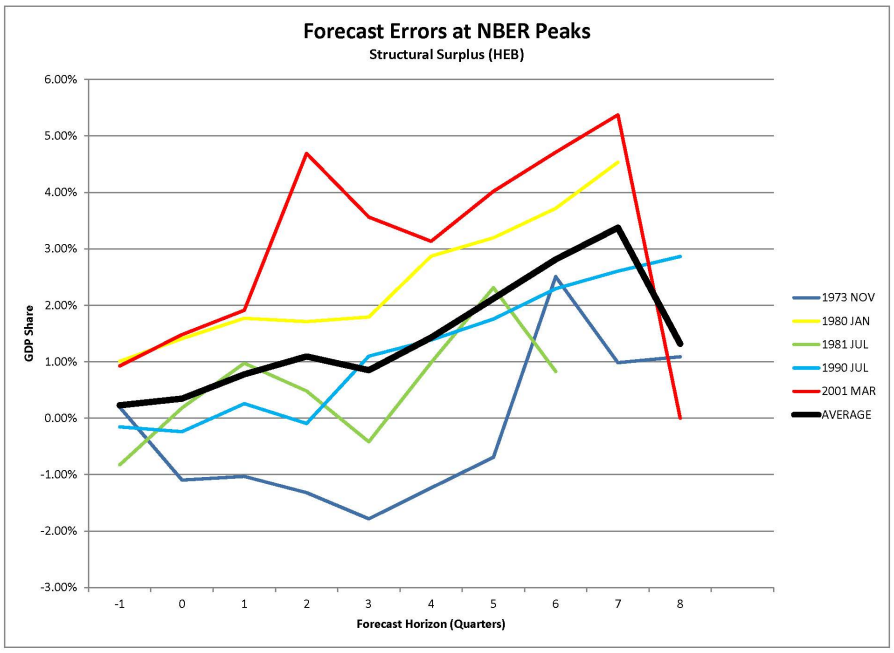

FIGURE 6. HEB - FORECAST ERRORS AT BUSINESS CYCLE PEAKS

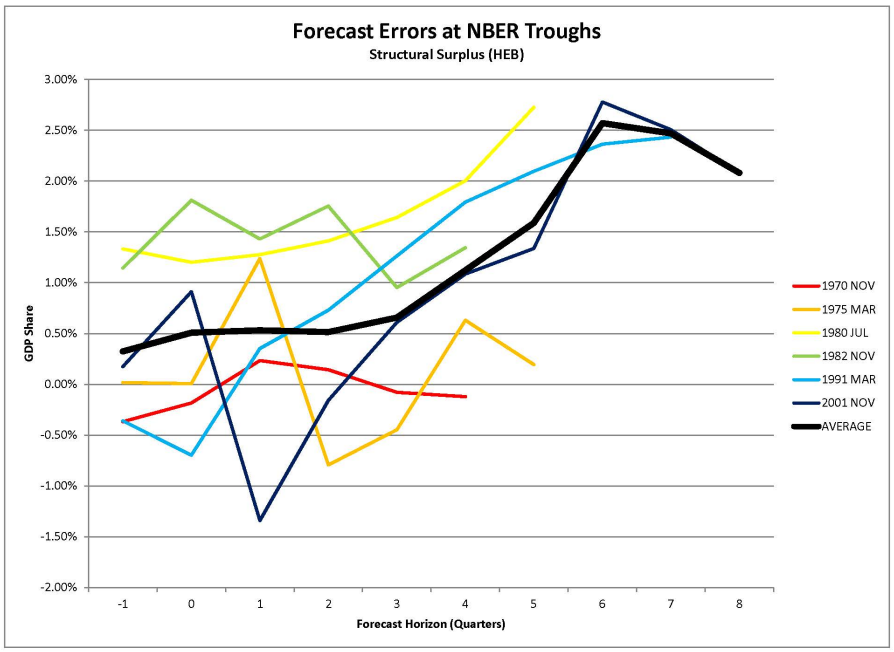

FIGURE 7. HEB - FORECAST ERRORS AT BUSINESS CYCLE TROUGHS

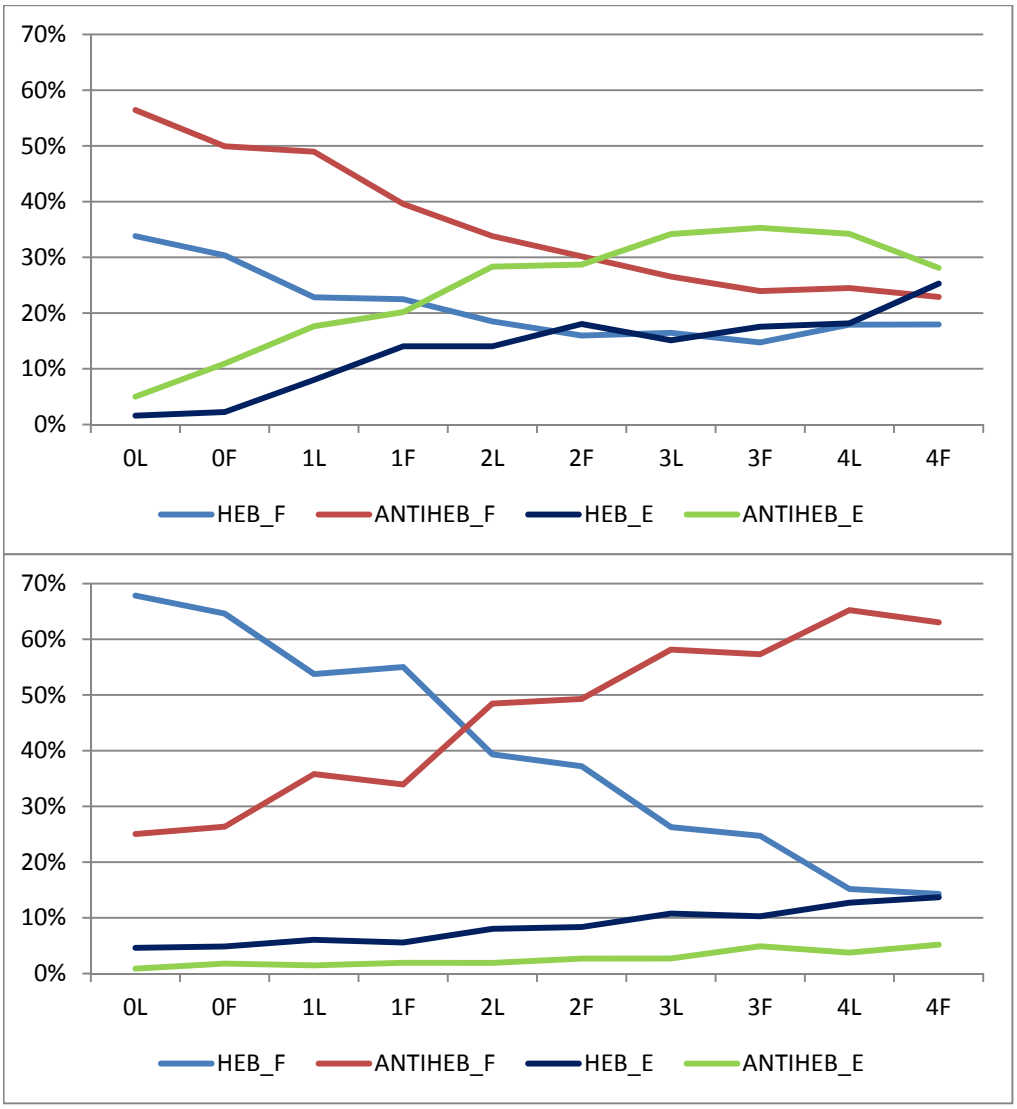

FIGURE 8. BUDGET SURPLUSES: DECOMPOSITION OF VARIANCE

Note: HEB_F is the forecast of structural deficit.
ANTIHEB_F is the forecast of the cyclical deficit.
HEB_E is the forecast error of structural deficit.
ANTIHEB_E is the forecast error of the cyclical deficit.
The upper panel shows the variance decomposition for the period 1974Q4-1990Q4, while the lower is for the period 1991Q4-2006Q4.
The vertical scale is the fraction of the overall variance of the surplus for that period attributed to movements in each of the four indicated components.

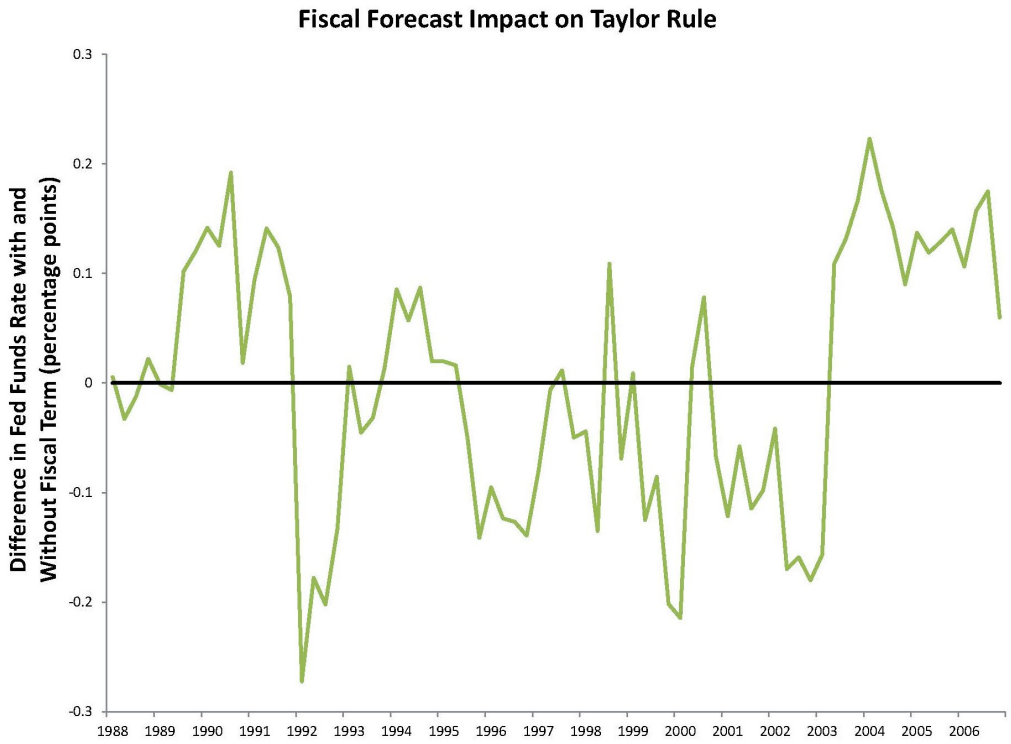

FIGURE 9. FISCAL FORECAST IMPACT ON TAYLOR RULE