Comparing Government Forecasts of the United States' Gross Federal Debt

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Abstract:

This paper compares annual one-step-ahead forecasts from the Congressional Budget Office (CBO) and the Office of Management and Budget (OMB) of the United States' gross federal debt from 1984 to 2010. While comparisons of these agencies' forecasts have been done before, they have not focused on the debt. The paper finds that both agencies do a good job forecasting the debt except during recessions. Each agency's forecast lacks something that the other accounts for and an average of both out performs either individually. However, the Analysis of the President's Budget (APB), which includes information from both agencies, performs best.

I. INTRODUCTION

In the aftermath of the recent financial and economic crisis, rapidly increasing government debt around the world has generated further worries about growth. In 2009, the United States' total federal government debt outstanding was 84 percent of GDP, a share that has not been reached since World War II. Recent projections from the Congressional Budget Office (CBO) and the Office of Management and Budget (OMB) both predict government debt will rise above 100 percent of GDP in the near future. These projections have prompted concerns that the United States' debt burden will become unsustainable.[1] However, upon closer examination there are considerable differences between the available debt forecasts.

The intense focus on the United States' debt makes it increasingly important to understand how well the debt can be forecast. Furthermore, given the differences in forecasts of the debt, it is important to know which forecast more closely matches the trajectory of the United States' debt. This paper aims at answering these questions. Using a time series of the United States' federal debt, it compares how well one-step-ahead debt forecasts from the CBO and the OMB have performed since 1984.

While previous literature has extensively compared CBO and OMB forecasts, this analysis adds to the collection in several ways. First and foremost, it extends forecast comparisons of the CBO and OMB to the federal debt, which has never before been examined. Second, it compares CBO and OMB forecasts against one another individually, against averages of the two agency forecasts, and with a third forecast, the Analysis of the President's Budget (APB). Finally, the analysis utilizes both forecast summary statistics and a variety of forecast encompassing tests to compare the forecasts. This allows for the determination of whether

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[1] For some examples see: Anne Applebaum, "America's debt spiral resembles Greece's crisis", Washington Post, Feb. 17, 2010 and Robert Pozen, "The US Public debt hits its tipping point", Boston Globe, Feb. 23, 2010.

certain forecasts or combination of forecasts can outperform other forecasts. The different forecast comparison tests serve to reinforce or contradict one another, thereby potentially making the findings more robust.

The paper is structured as follows. Section II reviews the previous literature on comparing CBO and OMB forecasts. Section III provides a background to the forecast encompassing tests used in the paper. Section IV describes the data and some initial comparisons of the forecasts. Section V presents the central empirical findings and analysis. Section VI concludes.

II. LITERATURE REVIEW

There is a considerable body of literature that compares CBO and OMB forecasts. These studies can roughly be broken into two different types. The more popular type relies primarily on the mean square forecasting error (MSFE), the mean absolute error (MAE), or the mean absolute percent error (MAPE) to compare forecasts between the two agencies. The second type primarily relies on forecast encompassing tests to compare the forecasts. Both of these types of studies help to compare forecasts from the agencies in different ways.

Using forecast summary statistics, the first group of studies compares forecasts from the two agencies and come up with a variety of findings. Kamlet, Mowery, and Su (1987) compare one-step and multi-step ahead forecasts from CBO, OMB, their ARIMA model, and the ASA/NBER for the real growth rate, inflation rate, and unemployment from 1976 to 1984. They find that for short-term forecasts both agencies are "accurate and unbiased" and that neither of the forecasts "outperforms the other in forecasting accuracy". However, for forecasts extending beyond three years, they find OMB forecasts are "more biased than those of CBO" but are not "less accurate than CBO projections". Plesko (1988) examines the CBO and OMB forecasts of

nominal GNP, current receipts, current outlays, and the deficit from 1974 to 1988 and finds similar results for the short-term forecasts. McNees (1995) compares forecasts from the Federal Reserve Board (FRB), the CBO, the Council of Economic Advisors (CEA)[2], and private forecasters for inflation, GNP, and unemployment from 1976 to 1994. He finds similar results for long term forecasts in that CEA forecasts were more biased compared to private forecasts and to forecasts from CBO and the FRB. Frendreis and Tatalovich (2000) compare the CBO, the OMB, and the FRB one-step-ahead forecasts of GNP growth, inflation, and unemployment from 1979 to 1997. While all three agencies' forecasts tend to be close, they find the CBO forecasts to be the best, followed by the FRB, and then the OMB.

The CBO also conducts a semi-annual comparison of its forecasts with the OMB and private forecasts. The most recent update is CBO (2010), which compares two-year forecasts and five-year forecasts for output, inflation, three month Treasury rates, long-term interest rates, and wage and salary disbursements from 1980 to 2008. Similar to the previous studies, it finds that the CBO's two-year forecasts are as accurate as the OMB and private forecasts. Contrary to previous studies' findings, it finds that the CBO's five-year forecasts have been just as accurate as the other forecasts (rather than better).

The second type of study in the literature uses different types of forecast encompassing tests to compare forecasts and also has somewhat mixed results. Howard (1987) compares the CBO and OMB forecasts of the real GNP growth rate, GNP deflator, consumer price index, unemployment rate, and the three-month Treasury bill rate from 1976 to 1985. By regressing the residuals of the OMB forecasts on a constant and the residuals of the CBO forecasts, Howard finds that while errors for both forecasts are strongly correlated, the OMB forecasts are biased.

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[2]CEA forecasts and OMB forecasts are the same. Thus, studies will either use one or the other to compare against CBO forecasts.

Belongia (1988) compares the Council of Economic Advisors (CEA), the CBO, and private one-step-ahead forecasts of real GNP growth, the GNP deflator, and unemployment from 1976 to 1987. By regressing the actual growth rate for each individual variable on a constant and different pairs of predicted growth rates of two different forecasts, Belongia finds that in general the private forecasts perform better than either the CBO or CEA while neither CBO nor CEA outperform one another. These results suggest that CBO and CEA forecasts may be encompassed by private forecasts of the same variables but do not encompass one another.

Cohen and Follette (2003) compare the CBO, the OMB and the Federal Reserve Board (FRB) one-step-ahead forecasts of the budget from 1977 to 2003. They regress the actual outcomes on OMB and CBO forecasts over different periods and find that for most samples, CBO forecasts encompass OMB forecasts. Douglas and Krause (2005) also compare CBO, OMB and the FRB one-step-ahead forecasts of real and nominal GDP, inflation, unemployment, tax revenues, government outlays, and the budget deficit from 1976 to 2001. They use a variety of encompassing tests, and find that, with the exception of unemployment and tax revenues, the forecasts are not statistically distinguishable from one another. Furthermore they find that the FRB forecasts perform better than either the CBO or OMB in terms of unemployment while the CBO forecasts perform worse than either the OMB or the FRB in terms of tax revenues.

Corder (2005) examines forecasts of GDP, inflation, unemployment, and interest rates from the Social Security Administration (SSA), the CBO, and the OMB between 1976 and 2003. Using two different tests to check for bias and efficiency, he finds that the CBO forecasts encompass OMB forecasts in terms of GDP, OMB forecasts encompass CBO forecasts in terms of unemployment and inflation, and neither encompasses the other for interest rates. As a result,

he concludes that both agencies could improve their forecasts if they incorporated information from the other agency.

Overall both types of studies comparing forecasts from the OMB and CBO have mixed results. While some studies find that CBO forecasts are significantly better than OMB forecasts, others (including the CBO itself) find that OMB forecasts are on par with CBO forecasts and even in a few cases the OMB forecasts perform better than the CBO forecasts. These findings tend to vary depending on the time period examined, the variable being forecast and the forecast horizon. For a summary of the previous studies see **Table 1**.

Both the studies that use standard forecast summary statistics and those that rely on forecast encompassing tests have their limitations. Ericsson (1992) shows that while the MSFE is a necessary condition for ascertaining which forecast is better, it is not sufficient in determining whether one forecast can explain another forecast's errors (i.e., encompass it). On the other hand, CBO (2010) cautions against using statistical tests with such small sample sizes because, "particular errors can have an unduly large influence on the measures". Thus, rather than relying on one test or another, this analysis follows Douglas and Krause's (2005) example and uses several forecast encompassing tests along with the MSFE to compare government forecasts of the debt. By doing so, the risk of choosing a less powerful test is spread over a wider range of tests while allowing for a comparison of the results across tests.

None of the past studies comparing government forecasts have focused on the debt. Instead, all the previous studies comparing government forecasts focus on the budget (or some aspect of it such as outlays or revenues), unemployment, output, inflation, and interest rates. Given the increasing concern surrounding the debt and the lack of attention given to it in previous studies, this paper is an important and timely addition to the literature.

There could be at least two reasons why the literature has not focused on the debt. First of all, forecasts of the federal debt have a much shorter history than other forecasts. The CBO only started publishing forecasts for the federal debt in 1983 while the OMB's started publishing debt forecasts in the late 1950's. By comparison, other CBO forecasts date back to 1976, while OMB forecasts go back to the 1940's.[3] The smaller sample makes comparisons of debt forecasts even more prone to distortions than with other forecasts.

Secondly, forecasts of the federal debt are easily overlooked in that the change in public debt for a given year is usually understood to be equal to the deficit for that year. However, occasionally changes in the debt held by the public also include other revenues and expenditures that are not included in the deficit.[4] Furthermore, the federal debt includes both debt held by the public and debt held by the government. By looking only at forecasts of the deficit, other changes to the total federal debt are missed. Therefore, despite the small sample size it is important to compare forecasts of the federal debt.

III. FORECAST-ENCOMPASSING TESTS

The analysis in this paper relies heavily on the concept of forecast encompassing developed by Chong and Hendry (1986). They lay out a simple forecast encompassing test to see whether one forecast can better explain the dependent variable than another. Their basic framework is:

$$y_t = b_1 * x_t + b_2 * z_t + error, \tag{1}$$

where y_t denotes the actual value of the variable being forecast, x_t denotes the one-step-ahead forecasts from the first agency and z_t denotes the one-step-ahead forecasts from the second

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[3] The CBO was created in 1976 while the OMB (originally known as the Bureau of the Budget) was created in 1921.
[4] A recent example of this is the Troubled Asset Relief Program (TARP).

agency.[5] This approach can test whether either of the forecasts encompasses the other in terms of their explanation of the dependent variable. Ericsson and Marquez (1993) illustrate that this framework has the implicit assumption that the constant term is always equal to zero (i.e., no bias). By including a constant in the equation, additional tests can be performed to test whether the forecasts are biased or not.

Ericsson (1993) illustrates an additional adaptation of the original Chong and Hendry (1986) framework. If both of the forecasts are cointegrated with the dependent variable, then $b_1 + b_2$ equals 1. Then, as Ericsson (1992) illustrates, the forecast encompassing tests have to account for cointegration. As a result the approach changes to:

$$(y_t - x_t) = b_3{}^*(z_t - x_t) + error, \qquad (2)$$

where $(y_t - x_t)$ is the residual from the first agency's forecasts and $(z_t - x_t)$ is the difference between the first agency and the second agency's forecasts. As a result, this approach tests how well the part of agency 2's forecasts that are not the same as agency 1's forecasts is able to explain the component of the actual variable that is not explained by agency 1's forecast errors. Therefore, it examines the variance from agency 2's forecasts that is unexplained by agency 1's forecasts.

There are at least fifteen different varieties of forecast encompassing tests that result from this approach. For a pair of forecasts, five different hypotheses about b_1, b_2, and b_3 can be tested:

(a) $b_1=1$ and $b_2=0$,

(b) $b_2=0$,

(c) $b_1 \equiv 1$ and $b_2=0$,

(d) $b_1+b_2 = 1$, and

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[5] A similar approach was used by Belongia (1988), Cohen and Follette (2003), Douglas and Krause (2005), and Corder (2005).

(e) $b_3 = 0$,

where $b_1 \equiv 1$ indicates that b_1 is constrained to equal unity, whether or not b_2 is constrained to equal zero. Additionally, different treatments of a constant term b_0 generate three variants for each of the five versions of the forecast encompassing test:

(f1) the constant is included but left unrestricted (b_0 unrestricted),

(f2) the constant is included and tested against the null hypothesis that it is zero ($b_0 = 0$),

(f3) the constant is not included in the equation ($b_0 \equiv 0$).

Each of these encompassing tests analyzes a slightly different property of the forecasts and focuses in on how they differ from one another.

IV. DATA SOURCES AND DESCRIPTIONS

This section describes the data used in the analysis and provides some initial visual comparisons of the forecasts. The primary variable of concern is the log of total gross federal debt outstanding held by the public and the government in billions of dollars from 1984 to 2010 (LDEBTB). This data is published by the U.S. Department of Treasury's Financial Management Service and is measured on a fiscal year basis ending on September 30th.[6]

The remaining variables in this analysis span from 1984 to 2010 and come from the annual releases of the CBO's Budget and Economic Outlook, the OMB's Budget of the United States Government, and the CBO's Analysis of the President's Budget. These documents are typically released at the beginning of the year, usually between January and March[7], and contain forecasts through to the end of the fiscal year.[8] In the past 27 years, the Budget and Economic Outlook has on average been released a week before the Budget of the United States

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[6] The face value of the debt is used until 1988 when the Treasury Bulletin started to measure the accrual value of the debt and this practice was also adopted by the CBO and the OMB.

[7] The exception to this was in 1996 when the government shutdown caused the CBO report to be delayed until May.

[8] They also contain multi-step-ahead forecasts, which will be the subject of further research.

Government. Given that the OMB forecasts could be making use of slightly newer data than was available at the time of the CBO's forecast, the OMB forecasts may perform better. On the other hand, in the past 27 years, the CBO's Analysis of the President's Budget (APB) has been released on average a month after the Budget of the United States Government, indicating that the APB forecasts may perform better than the OMB forecasts (**Table 2**).

The first series of interest from these sources are the CBO and OMB estimates of the actual value of the debt from the previous year, on which they then base their forecasts.[9] Due to data revisions and preliminary data releases, these series sometimes contain errors which are then incorporated into the forecasts. In order to visualize any differences, these estimates are subtracted from the actual debt for each year to generate the estimation errors for both agencies (**Figure 1**). Although there have been some differences between the agency estimates and the actual debt, especially from 2004 to 2008, at no point do they ever exceed 1% of the debt and therefore they do not appear to be adding any significant bias.[10]

The primary variables of interest are the log levels of the CBO, OMB, and APB one-step-ahead federal debt forecasts in billions of dollars (LCBODF1, LOMBDF1, and LAPBDF1). A first glimpse of how well the forecasts perform is gained by plotting them together with the actual debt (**Figure 2**). Each forecast is then subtracted from the actual debt in order to generate their forecast errors (**Figure 3**).[11] The largest forecast errors for both agencies were in 1990, 2001, 2002, 2008, and 2009. This is seen more clearly when the actual level of the debt is regressed on each of the forecasts and Impulse Indicator Saturation (IIS) is used with a 1%

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[9] The Analysis of the President's Budget relies on the same estimate that is used in the CBO's original forecast.
[10] The difference between the estimates and the actual debt do indicate that the encompassing tests have to be performed for both the levels and the growth rate of debt since the results will not be invariant to the transformation.
[11] Note that since the forecast is being subtracted from the debt that a value above zero indicates the agency is under predicting the debt while a value below zero indicates that agency is over predicting the debt.

critical value to determine where the structural breaks are in each of the series (**Table 3**). [12] Using IIS is important because structural breaks in the relationship between debt forecasts and the debt are evidence of problems with the forecasts. Because IIS is a way to detect the presence of structural breaks, it is useful in providing a preliminary assessment of the forecasts. Dummy variables for 1990, 2001, 2002, 2008, and 2009 are found to be significant in at least one of the series (2008 is significant in all three). These dummies also make sense given that during each of these years, the United States was either entering or in the midst of a major recession. [13]

The growth of the debt and each agency's ability to forecast the growth of the debt is also examined (**Figure 4**). By examining both forecasts of the growth of the debt and forecasts of the debt itself, it can be seen whether the comparisons remain similar for both agencies. For further comparison, the analysis also includes an average of the CBO and OMB forecasts (Average 1) and an average of the OMB and APB forecasts (Average 2). This provides a test of whether a combination of the forecasts could improve upon the individual agency forecasts. For more information on each of the data series used in this paper and their sources see **Table 4**.

V. ANALYSIS AND RESULTS

The analysis begins with an examination of the CBO and OMB forecasts. Due to the large differences between the forecasts in 2009, the analysis is performed through 2008 and then run again through 2009 and through 2010 to examine how the addition of each year changes the results. Forecasts of both log levels and growth rate are examined because some of the forecast-encompassing tests are not invariant to that transformation. This results from the fact that the growth rate is constructed as a difference between the forecasts and the debt estimates rather than

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[12] For development and discussions of IIS, see: Hendry and Santos (2005), Hendy, Johansen, and Santos (2008), Johansen and Nielson (2009), and Hendry and Santos (2010). For implementation of IIS in Autometrics/OxMetrics, see: Doornik (2008), and Doornik (2009).

[13] For exact recession dates see NBER's Business Cycle Expansions and Contractions: http://www.nber.org/cycles/cyclesmain.html

as a difference between the forecasts and the actual value of the debt. After that, each analysis is rerun using Impulse Indicator Saturation (IIS). IIS is used because calculations of the encompassing test statistics may be affected by outliers or structural breaks. Using IIS helps remove these breaks, which makes calculating the encompassing test statistics more robust. The entire analysis is then performed, using the OMB and APB forecasts. After that, forecast summary statistics are used to compare all of the forecasts against one another and against several benchmark forecast models. Finally, some possible explanations are offered for why there are large differences between the agency forecasts in recent years and why certain forecasts perform better than others. The following chart summarizes which Tables report which results:

Chart. Categorization of forecast-encompassing results, by table number
(table numbers with IIS are in parentheses)

Forecasts Compared	OMB vs. CBO			OMB vs. APB		
Sample end-date	2008	2009	2010	2008	2009	2010
Log levels	5	7	9	17	19	21
	(11)	(13)	(15)	(23)	(25)	(27)
Growth rates	6	8	10	18	20	22
	(12)	(14)	(16)	(24)	(26)	(28)

The forecast encompassing tests for the forecasts of the debt illustrate that through 2008, the OMB forecasts performed better than the CBO forecasts (**Table 5**). Regardless of how the constant is treated in the equation, the null hypothesis that CBO forecasts encompass OMB forecasts is rejected. This can also be expressed by saying that the CBO's forecasts do not forecast-encompass the OMB's forecasts. On the other hand, the OMB forecasts forecast-encompass the CBO forecasts. The average of the OMB and the CBO forecasts also forecast-encompass both the CBO and the OMB forecasts. Given that the null that $b_1+b_2=1$ cannot be rejected, which suggests that the series and their forecasts may be cointegrated, the tests are adapted to account for this property.

The adjusted tests suggest that the average forecast performs better than either of the

agency forecasts individually. The difference between the OMB and the CBO forecasts forecast-encompasses the CBO residuals, regardless of how the constant is treated. On the other hand, the difference between the CBO and the OMB forecasts does not forecast-encompass the OMB residuals. However, the differences between the average and the CBO / OMB forecasts forecast-encompass the CBO / OMB residuals. The results indicate that, while the OMB debt forecasts perform better than the CBO debt forecasts over this sample, averages of the two forecasts outperformed both individual forecasts.

The forecasts of the growth rate of the debt are examined next. The forecast encompassing tests of the growth rate through 2008 have similar findings as the log levels (**Table 6**). The tests continue to indicate that the CBO forecasts do not forecast-encompass the OMB forecasts, albeit at lower confidence levels. Furthermore, the tests illustrate that the OMB forecast-encompasses the CBO and that the average forecast-encompasses both the CBO and the OMB. The difference between the OMB and the CBO forecast-encompasses the CBO residuals. Furthermore, the difference between the CBO and the OMB does not forecast-encompass the OMB residuals while the difference between the average and the CBO / OMB forecasts, forecast-encompasses the CBO / OMB residuals. These results reinforce the conclusions that the OMB forecasts encompass and thus performed better than CBO forecasts, while the average of the two agency's forecasts encompass both the individual agency forecasts through 2008.

These findings change when the analysis is extended beyond 2008. For forecasts of the actual debt level and growth rate through 2009 (**Table 7** and **Table 8**), the CBO does not forecast-encompass the OMB while the OMB also does not forecast-encompass the CBO. However, the average forecast-encompasses both the OMB and CBO regardless of how the constant is treated. For forecasts of the debt through 2010 (**Table 9** and **Table 10**), the results are

similar in that neither CBO or OMB forecast-encompass one another, and the average forecast-encompasses both forecasts individually. Thus, while OMB forecasts of the debt performed better than the CBO forecasts through 2008, neither agency was able to forecast-encompass the other through 2010 (that is, OMB's forecast errors increased significantly, while the CBO's forecast errors remain fairly constant). At the same time, the average forecast performed better than either forecaster individually throughout all three samples.

The same analysis is rerun for the CBO and OMB forecasts, using IIS to include dummies significant at a 1% critical value. The dummy for 2008 is significant in all of the encompassing tests for all of the samples, which illustrates how large the structural break was that year and how poorly all of the forecasts performed. The results through 2008 (actually 2007 since 2008 is dummied out) are similar to the previous analysis (**Table 11** and **Table 12**), but through 2009 none of the forecasts forecast-encompass one another (**Table 13** and **Table 14**). When the analysis is extended through 2010, once again the average forecast-encompasses the individual forecasts (**Table 15** and **Table 16**). However, for all three time periods there is obvious sensitivity in terms of how the constant is treated, which suggests that once the largest outliers are removed there is a significant amount of bias in the forecasts.

When the encompassing tests are performed for the OMB and the APB forecasts, there are very different results. The forecast encompassing tests for the forecasts of the levels of debt and growth rate illustrate that through 2008, the OMB, APB, and the average of those two forecasts all forecast-encompass one another (**Table 17** and **Table 18**). This results from the fact that the OMB and APB forecasts are highly collinear through 2008. Thus, when either one of them is eliminated, there is no significant change in the effectiveness of explaining the debt.

When the analysis of the OMB and APB forecasts is extended through 2009 and 2010,

the results change again. In 2009, the OMB does not forecast-encompass the APB for both the level and the growth rate. On the other hand, the APB forecast-encompasses the OMB (**Table 19** and **Table 20**). At the same time, the average of the APB and OMB forecasts does not forecast-encompass either the APB or the OMB. These results continue to hold when extended through 2010 (**Table 21** and **Table 22**).

Rerunning the OMB and APB analysis using IIS, similar to the OMB and CBO analysis, the dummy for 2008 is found to be significant in every equation for all of the samples. However, the results through 2008 change substantially where the OMB does not forecast-encompass the APB while the APB forecast-encompasses OMB and the average forecast-encompass both OMB and APB (this is especially true for the level of the debt) (**Table 23** and **Table 24**). Through 2009, none of the forecasts forecast-encompass one another, regardless of the test or how the constant is treated (**Table 25** and **Table 26**). The results are similar through 2010, where none of the forecasts are consistently able to forecast-encompass the others[14] (**Table 27** and **Table 28**). This suggests that while the APB performs better than the OMB during structural breaks, it does not perform well enough to encompass the structural breaks (or the OMB forecasts when including structural breaks).

The coefficients in several of the forecast encompassing equations from the analysis highlight these results. From the first part of the analysis, estimates from equations (1) and (2) show that through 2008, the CBO forecasts have coefficients ranging from -0.7 to -0.3 while the OMB forecasts have coefficients ranging from + 1.7 to + 1.3 (**Table 29**). This suggests that the actual debt was higher than what the CBO forecast, while the OMB over forecast the debt. However, looking at the same equations through 2010, the CBO forecasts have coefficients

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[14] The exception to this is null hypothesis (c) where it is tested whether agency 2 does not explain agency 1's forecast error. The tests often fail to reject this null hypothesis given the similarity of the two forecasts being tested.

around 0.7 while the OMB forecasts have coefficients around 0.3. From the second part of the analysis, estimates from equations (1) and (2) show that through 2008, the OMB forecasts have coefficients ranging from -1 to -1.1 while the APB forecasts have coefficients ranging from 2 to 1.1, which does not change considerably when extended through 2010 (**Table 30**). For both parts of the analysis, while the estimated equations through 2010 usually provide a slightly worse explanation of the debt than through 2008 (when looking at the sigma), the fit of the variables, as measured by the standard errors on the coefficients, improves significantly through 2010. This suggests that by extending analysis through 2009 and 2010 a problem of collinearity between the forecasts is reduced.

Additional insight can be gained by numerically comparing the bias, error variance, and the root mean square forecasting errors (RMSFE) for the different forecasts with one another and two benchmark forecasting models (**Table 31**). Through 2008, 2009 or 2010, each of the forecasts and their averages perform better than a random walk model or a double differenced device.[15] When the analysis is restricted to only the CBO, the OMB, and their average, the OMB forecasts have the smallest error variance and RMSFE through 2008, followed by the average forecasts, while the CBO forecasts have the highest bias, error variance, and RMSFE.[16] For the samples through 2009 and also 2010, the average forecasts have the smallest bias, error variance, and RMSFE, followed by the CBO forecasts and then the OMB forecasts. However, when the analysis is extended to include the APB forecasts and the average of the APB and OMB forecasts then the results are different. Regardless of which sample is chosen for the analysis, the APB forecasts outperform all of the other forecasts with the lowest error variance and RMSFE, even though the average of CBO and OMB (Average 1) always has a lower bias. None of these results

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[15] Hendry (2006) shows that a simple double differenced device can outperform much more complicated models.
[16] The average forecast has a bias that is slightly closer to zero than the OMB forecast. In this case negative indicates a tendency to over project the debt while positive indicates a tendency to under project the debt.

change significantly when the growth of the debt is examined.

In general, the average of the CBO and the OMB forecasts is more robust to changes in the economy and as a result is better at forecasting the debt and the change in the debt than the individual agency forecasts. This is supported by Clements and Hendry (2004), who show how pooling forecasts can add value when individual forecasting models are differentially mis-specified. Furthermore, Hendry and Mizon (2005) illustrate that there may be a need to pool across forecasting and policy models when there are structural breaks or policy regime shifts. As a result, individual forecasts' weaknesses can be ameliorated by combining them.

Graphs of the CBO and OMB forecasts clarify their differences. While the two forecasts typically follow one another fairly closely (**Figure 5**), the largest difference between them occurred in 2009, when they differed by over $1.34 trillion. The difference between the two forecasts occurs because, in 2009, the OMB over-predicted debt by $958 billion whereas the CBO under predicted debt by $381 billion. By contrast, the OMB and APB forecasts for 2009 differ by only $0.57 trillion. Both of the agencies' debt forecasts can be dissected into their individual budget components (**Table 32**). In 2009, the CBO and OMB debt forecasts differed in their forecasts of the deficit ($655 billion) and other expenditures and revenues not included within the budget ($684 billion).

A big reason for the differences in these numbers is due to how and when the forecasts were made. In terms of how they are made, the CBO bases its forecasts on the assumption of current policy whereas the OMB forecasts are based on assumed changes in fiscal policy.[17] This important difference means that the CBO has much less flexibility to forecast changes in the debt based on potential policy changes (which during a recession could be very important). It also

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[17] CBO, CBO's Economic Forecasting Record: 2010 Update.

means that the CBO forecasts are grounded in what has already happened instead of being able to speculate on the effects of proposed policy changes.

When the forecasts are made can also play an important role. While on average the OMB releases its forecasts a week after the CBO, in 2009 the OMB released its forecast on February 26th, which was more than a month after the CBO released theirs (January 8th). In this particular year, in the midst of a financial crisis and a major recession, timing was crucial. On February 17th, the president signed into law a $787 billion stimulus package, which more than accounts for differences in the deficit forecasts for the CBO and the OMB.[18] Around the same time, the Treasury Department established several programs to help stabilize the financial system, which account for the differences in the other category. Thus, especially in the midst of structural breaks and regime shifts, the timing of a forecast plays an important role in its forecast performance.

However, how the forecast was generated and when it was released does not account for all of the potential differences between the agencies forecasts. For example, because the OMB releases its forecasts later and takes into account policy changes, it would be expected that that the OMB's forecasts would encompass the CBO's forecasts. However, there are potentially other factors that reduce the OMB's forecast accuracy.[19] Thus, by using a combination of the two forecasts the forecasts are robustified against a variety of potential biases, policy changes as well as against forecast mis-specification, thereby improving forecasts of the debt.

VI. CONCLUSION

This paper compares one-step-ahead debt forecasts from the Congressional Budget Office

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[18] Meckler, Laura, "Obama Signs Stimulus into Law", WSJ, Feb. 18, 2009.
[19] Several articles point to OMB's strategy of intentionally over predicting the deficit / debt so that it can improve its outlook in later revisions. See for example: OMB Watch, "OMB Mid Session Review Gives Limited Picture of Budget Crisis", OMB Watch, July 11, 2006.

and the Office of Management and Budget over the past 27 years. Using several summary statistics and forecast encompassing tests, fairly consistent conclusions are reached. First, the agency forecasts all perform better than the benchmark forecasting models. Second, the OMB outperformed the CBO through 2008 but then deteriorated sharply in 2009 and 2010 due to structural breaks and policy shifts. Furthermore, for all three samples the average of the two forecasts performed better than either of them individually. Third, when the APB forecasts are included in the analysis they perform even better than the average or the individual agency forecasts. Finally, all of these results still hold up (albeit more weakly) when the structural breaks in the analysis are accounted for, despite evidence of increased bias.

In conclusion, while both the Congressional Budget Office and the Office of Management and Budget's forecasts are relatively successful in forecasting the debt, each agency's forecast remains incomplete and could benefit from further information that the other agency takes into account. When only one of the agency's forecasts is used, there is an incomplete and potentially distorted picture of the future levels and changes in government debt.

The Analysis of the President's Budget helps remedy this problem. It effectively acts as a combination of the two forecasts in that it includes information from both agencies in its forecasts. While the analysis in this paper did not directly compare the Analysis of the President's Budget with the average of the CBO and OMB forecasts, the forecast summary statistics suggest that the APB performs best. However, this improved analysis is released up to several months after the CBO and the OMB forecasts, which reduces its effectiveness for policy making despite the improved information content. Therefore, it is important that both agency forecasts of the debt continue to be taken into consideration to better forecast the future trajectories of the United States' gross federal debt.

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VII. REFERENCES

Applebaum, Anne (2010). "America's debt spiral resembles Greece's crisis". *The Washington Post*, Feb. 17, 2010. http://www.washingtonpost.com/wp-dyn/content/article/2010/02/16/AR2010021604549.html (accessed November 30, 2010).

Belongia, Michael (1988). Are economic forecasts by government agencies biased? Accurate? *Federal Reserve Bank of St. Louis Review* 70, 15-23.

Chong, Yock Y., and David F. Hendry (1986). Econometric Evaluation of Linear Macro-Economic Models. *The Review of Economic Studies*, 53, no. 4, Econometrics Special Issue (August), 671-690.

Clements, Michael P., and David F. Hendry (1993). On the Limitations of Comparing Mean Square Forecast Errors. *Journal of Forecasting*, 12, no. 8, 617-637.

_____ (2004). Pooling of forecasts. *Econometrics Journal*, 7, 1-31.

Cohen, Darrel, and Glenn Follette (2003). Forecasting Exogenous Fiscal Variables in the United States. *Federal Reserve Board, Finance and Economics Discussion Series*, 59. http://www.federalreserve.gov/pubs/feds/2003/200359/200359abs.html.

Corder, Kevin J. (2005). Managing Uncertainty: The Bias and Efficiency of Federal Macroeconomic Forecasts. *Journal of Public Administration Research and Theory*, 15, no. 1 (January), 55-70.

Doornik, Jurgen A. (2008). Encompassing and Automatic Model Selection. *Oxford Bulletin of Economics and Statistics*, 70, supplement, 915-925.

Doornik, Jurgen A. (2009). Autometrics, Chapter 4 in J. L. Castle and N. Shephard (eds.) The Methodology and Practice of Econometrics: A Festschrift in Honour of David F. Hendry. Oxford University Press, Oxford, 88-121.

Doornik, Jurgen A., and David F. Hendry (2009). Empirical Econometric Modelling using PcGive: Volume I. 6th, London: Timberlake Consultants Press.

Douglas, James W., and George A. Krause (2005). Institutional Design versus Reputational Effects on Bureaucratic Performance: Evidence from U.S. Government Macroeconomic and Fiscal Projections. *Journal of Public Administration Research and Theory*, 15, no. 2 (April), 281-306.

Engstrom, Erik J., and Samuel Kernell (1999). Serving Competing Principals: The Budget Estimates of OMB and CBO in an Era of Divided Government. *Presidential Studies Quarterly*, 29, no. 4 (December), 820-829.

Ericsson, Neil R. (1992). Parameter Constancy, Mean Square Forecast Errors, and Measuring Forecast Performance: An Exposition, Extensions, and Illustration. *Journal of Policy Modeling* 14, no. 4, 465-495.

Ericsson, Neil R. and Jaime Marquez (1993). Encompassing the Forecasts of U.S. Trade Balance Models. *The Review of Economics and Statistics*, 75, no. 1 (February), 19-31.

Foster, J. D., and James C. Miller III (2000). The Tyranny of Budget Forecasts. *The Journal of Economic Perspectives*, 14, no. 3 (Summer), 205-215.

Frendreis, John, and Rayond Tatlovich (2000). Accuracy and Bias in Macroeconomic Forecasting by the Administration, the CBO, and the Federal Reserve Board. *Polity*, 32, no. 4 (Summer), 623-632.

Hendry, David F. (2006). Robustifying Forecasts from equilibrium-correction systems. *Journal of Econometrics*, 135, 399-426.

Hendry, David F., and Carlos Santos (2005). Regression Models with Data-based Indicator Variables. *Oxford Bulletin of Economics and Statistics*, 67, Issue 5, 571-595.

Hendry, David F., and Carlos Santos (2010). An Automatic Test of Super Exogeneity, Chapter 12 in M. W. Watson, T. Bollerslev, and J. Russell (eds.) Volatility and Time Series Econometrics: Essays in Honor of Robert F. Engle. Oxford University Press, Oxford, 164-193.

Hendry, David F., and Grayham E. Mizon (2001). Forecasting in the Presence of Structural Breaks and Policy Shifts, In, Andrews, Donald W. and Stock, James H. (eds.) Identification and Inference for Econometric Models: Essays in Honor of Thomas Rothenberg. Cambridge, UK, Cambridge University Press, 480-502.

Hendry, David F., Soren Johansen, and Carlos Santos (2008). Automatic selection of indicators in a fully saturated regression. *Computational Statistics*, 32, Issue 2, 317-335.

Howard, James A (1987). Government Economic Projections: A Comparison Between CBO and OMB Forecasts. *Public Budgeting & Finance*, 7, Issue 3, 14-25.

Johansen, Soren, and Bent Nielsen (2009). An Analysis of the Indicator Saturation Estimator as a Robust Regression Estimator, Chapter 1 in J. L. Castle and N. Shephard (eds.) The Methodology and Practice of Econometrics: A Festschrift in Honour of David F. Hendry. Oxford University Press, Oxford, 1-36.

Kamlet, Mark S., David C. Mowery, and Tsai-Tsu Su (1987). Whom Do You Trust? An Analysis of Executive and Congressional Economic Forecasts. *Journal of Policy Analysis and Management*, 6, no. 3 (Spring), 365-384.

McNees, Stephen K. (1995). An assessment of the 'official' economic forecasts. *New England Economic Review* (July/August), 13-24.

Meckler, Laura (2009). "Obama Signs Stimulus into Law". *The Wall Street Journal*, February 18, 2009. http://online.wsj.com/article/NA_WSJ_PUB:SB123487951033799545.html (accessed August 8, 2010).

OMB Watch (2006). "OMB Mid Session Review Gives Limited Picture of Budget Crisis". OMB Watch, July 11, 2006. http://www.ombwatch.org/node/2992 (accessed November 30, 2010).

Plesko, George A. (1988). The Accuracy of Government Forecasts and Budget Projections. *National Tax Journal*, 41, no. 4 (December), 483-501.

Pozen, Robert (2010). "The US Public debt hits its tipping point". *The Boston Globe*, Feb. 23, 2010. http://www.boston.com/bostonglobe/editorial_opinion/oped/articles/2010/02/23/the_us_public_debt_hits_its_tipping_point/ (accessed November 30, 2010).

U.S. Congressional Budget Office (1983-2010). An Analysis of the President's Budgetary Proposals. Washington, DC: Government Printing Office. http://www.cbo.gov/publications/ bysubject.cfm?cat=0 (accessed August 3, 2010).

U.S. Congressional Budget Office (1983-2010). The Economic and Budget Outlook. Washington, DC: Government Printing Office. http://www.cbo.gov/publications/ bysubject.cfm?cat=0 (accessed June 3, 2010).

_____ (2010). CBO's Economic Forecasting Record: 2010 Update. www.cbo.gov/doc.cfm?index=11553 (accessed July 10, 2010).

U.S Department of Treasury, Financial Management Service (1983-2010). Treasury Bulletin. Washington DC: Government Printing Office: http://www.fms.treas.gov/bulletin (accessed November 30, 2010).

U.S. Executive Office of the President, Office of Management and Budget (1983-2010). Budget of the United States Government. Washington DC: Government Printing Office. http://www.gpoaccess.gov/usbudget/browse.html (accessed June 3, 2010).

VIII. TABLES

Table 1. Previous Studies

Study	Forecasts	Variables	Horizon	Time	Summary of Findings
Kamlet, Mowery, and Su (1987)	CBO, OMB, NBER, ARIMA	real GNP growth rate, inflation, unemployment	short / long	1976-1984	OMB more biased than CBO (long)
Howard (1987)	CBO, OMB	real GNP growth rate, GNP deflator, CPI, unemployment, Treasury rates	short	1976-1985	OMB forecasts are biased
Plesko (1988)	CBO, OMB	nominal GDP, revenues, outlays	short	1974-1988	OMB more biased than CBO
Belongia (1988)	CBO, CEA, Private	real GNP growth rate, GNP deflator, unemployment	short	1976-1987	Private best, CBO and CEA equally bad
McNees (1995)	CBO, CEA, FRB, Private	inflation, GNP, unemployment	long	1976-1994	CEA more biased than CBO, FOMC, and Private
Frendreis and Tatalovich (2000)	CBO, OMB, FRB	GNP growth, inflation, unemployment	short	1979-1997	CBO best, followed by FRB and then OMB
Cohen and Follette (2003)	CBO, OMB, FRB	budget	short	1977-2003	CBO encompasses OMB
Douglas and Krause (2005)	CBO, OMB, FRB	real and nominal GDP, inflation, unemployment, revenues, outlays, budget	short	1976-2001	FRB best with unemployment, CBO worst in tax revenues, all else indistinguishable.
Corder (2005)	CBO, OMB, SSA	GDP, Inflation, unemployment, interest rates	short / long	1976-2003	CBO better with GPD, OMB better with unemployment, neither with interest rates (long)
CBO (2010)	CBO, OMB, Private	output, inflation, Treasury rates, long-term interest rates, wage and salary disbursements	short / long	1980-2008	CBO and OMB perform just as good (short and long)

Table 2. Forecast Release Dates, Debt, and Debt Forecasts

Year[a]	Release Dates[b]					Actual Value[d]	Forecasts[d]		
	CBO	OMB	APB	Diff1[c]	Diff2[c]		CBO	OMB	APB
1984	2/07	2/01	2/22	6	-21	1,576.75	1,600.00	1,591.57	1,599.00
1985	2/06	2/04	2/27	2	-23	1,827.47	1,853.00	1,841.08	1,854.00
1986	2/18	2/05	2/26	13	-21	2,129.96	2,114.00	2,112.00	2,110.60
1987	1/27	1/05	2/19	22	-45	2,355.21	2,364.00	2,372.40	2,367.20
1988	2/04	2/18	3/04	-14	-15	2,600.68	2,598.00	2,581.60	2,603.00
1989	1/18	1/09	3/09	9	-59	2,865.66	2,865.00	2,868.80	2,869.00
1990	1/24	1/29	3/08	-5	-38	3,206.26	3,131.00	3,113.30	3,150.00
1991	1/23	2/04	3/01	-12	-25	3,598.92	3,606.00	3,617.84	3,616.00
1992	1/22	1/29	3/01	-7	-32	4,002.82	4,039.00	4,077.50	4,058.00
1993	1/26	2/17	3/01	-22	-12	4,351.15	4,392.00	4,396.70	4,391.00
1994	1/27	2/07	4/01	-11	-53	4,644.00	4,690.00	4,676.00	4,692.00
1995	1/25	2/06	4/01	-12	-54	4,920.95	4,942.00	4,961.50	4,947.00
1996	[e]5/01	2/02	5/01	89	-89	5,181.92	5,191.00	5,207.30	5,193.00
1997	1/28	2/06	3/01	-9	-23	5,369.70	5,436.00	5,453.70	5,431.00
1998	1/28	2/02	3/03	-5	-27	5,478.72	5,540.00	5,543.60	5,524.00
1999	1/29	2/01	3/01	-3	-30	5,606.49	5,579.00	5,614.90	5,578.00
2000	1/26	2/07	3/21	-12	-43	5,629.01	5,665.00	5,686.00	5,674.00
2001	1/31	2/28	5/01	-28	-62	5,770.25	5,603.00	5,625.00	5,627.00
2002	1/23	2/04	3/18	-12	-42	6,198.13	6,043.00	6,137.10	6,117.00
2003	1/30	2/03	3/31	-4	-56	6,758.72	6,620.00	6,752.00	6,706.00
2004	1/27	2/02	2/27	-6	-25	7,352.02	7,459.00	7,486.40	7,453.00
2005	1/25	2/07	3/04	-13	-25	7,902.80	7,975.00	8,031.40	7,991.00
2006	1/26	2/06	3/03	-11	-25	8,448.99	8,515.00	8,611.50	8,556.00
2007	1/25	2/05	3/02	-11	-25	8,948.53	8,915.00	9,007.80	8,968.00
2008	1/23	2/04	3/03	-12	-28	9,983.69	9,432.00	9,654.40	9,606.00
2009	1/08	2/26	3/20	-49	-22	11,873.81	11,529.00	12,867.50	12,303.00
2010	1/27	2/01	3/05	-5	-32	13,526.63	13,260.00	13,786.60	13,684.00
	Average Difference[f]			-8	-31				

Notes:

[a] The year that the forecast was released and the year that is being forecast (ending Sept 30th).

[b] Month/Day. The release date for the CBO and the APB forecasts is the date they are presented to Congress. The release date for the OMB forecasts is the date of the Presidents message.

[c] Difference in days: Calculated for Diff1 by subtracting the OMB release date from the CBO release date. Thus, a negative value means the OMB forecast was released after the CBO forecast whereas a positive value means the OMB forecast was released before the CBO forecast. Calculated for Diff2 by subtracting the APB release date from the OMB release date. Thus, a negative value means the APB forecast was released after the OMB forecast.

[d] Billions of $

[e] The 1996 forecast for CBO is the revised forecast since the original forecast was not published this year.

[f] Does not include 1996.

Table 3. Summary Statistics

```
                        The estimation sample is: 1984 - 2010
```

CBO:

```
                   Coefficient  Std.Error   t-value   t-prob Part.R^2
I:2008                   0.050      0.015      3.40    0.002    0.325
Constant                -0.072      0.043     -1.67    0.108    0.104
LCBODF1                  1.009      0.005    198.00    0.000    0.999

sigma                    0.014 RSS             0.00462880349
R^2                      0.999 F(2,24) =    2.107e+004 [0.000]**
Adj.R^2                  0.999 log-likelihood          78.751
no. of observations         27 no. of parameters            3
mean(LDEBTB)             8.495 se(LDEBTB)                0.559

AR 1-2 test:      F(2,22)   =    1.816 [0.186]
ARCH 1-1 test:    F(1,25)   =    0.231 [0.635]
Normality test:   Chi^2(2)  =    5.134 [0.077]
Hetero test:      F(2,23)   =    0.983 [0.389]
Hetero-X test:    F(2,23)   =    0.983 [0.389]
RESET23 test:     F(2,22)   =    1.750 [0.197]
```

OMB:

```
                   Coefficient  Std.Error   t-value   t-prob Part.R^2
I:1990                   0.035      0.007      4.90    0.000    0.545
I:2001                   0.035      0.007      5.00    0.000    0.556
I:2002                   0.020      0.007      2.87    0.010    0.291
I:2008                   0.047      0.007      6.48    0.000    0.677
I:2009                  -0.065      0.008     -8.55    0.000    0.785
Constant                 0.054      0.023      2.40    0.026    0.224
LOMBDF1                  0.993      0.003    370.00    0.000    0.999

sigma                    0.007 RSS             0.00094246585
R^2                      0.999 F(6,20) =    2.876e+004 [0.000]**
Adj.R^2                  0.999 log-likelihood         100.237
no. of observations         27 no. of parameters            7
mean(LDEBTB)             8.495 se(LDEBTB)                0.559

AR 1-2 test:      F(2,18)   =    0.387 [0.684]
ARCH 1-1 test:    F(1,25)   =    0.525 [0.476]
Normality test:   Chi^2(2)  =    0.999 [0.607]
Hetero test:      F(2,19)   =    0.836 [0.449]
Hetero-X test:    F(2,19)   =    0.836 [0.449]
RESET23 test:     F(2,18)   =    0.721 [0.500]
```

APB:

```
                   Coefficient  Std.Error   t-value   t-prob Part.R^2
I:2001                   0.030      0.010      3.15    0.005    0.311
I:2008                   0.044      0.010      4.51    0.000    0.480
I:2009                  -0.029      0.010     -2.90    0.008    0.276
Constant                 0.011      0.030      0.35    0.731    0.006
LAPBDF1                  0.998      0.004    278.00    0.000    0.999

sigma                    0.009 RSS             0.00189360599
R^2                      0.999 F(4,22) =    2.361e+004 [0.000]**
Adj.R^2                  0.999 log-likelihood         90.8176
no. of observations         27 no. of parameters            5
mean(LDEBTB)             8.495 se(LDEBTB)                0.559

AR 1-2 test:      F(2,20)   =    1.148 [0.337]
ARCH 1-1 test:    F(1,25)   =    0.020 [0.888]
Normality test:   Chi^2(2)  =    6.265 [0.044]*
Hetero test:      F(2,21)   =    0.346 [0.711]
Hetero-X test:    F(2,21)   =    0.346 [0.711]
RESET23 test:     F(2,20)   =    1.235 [0.312]
```

Table 4. Variables

Variable	Description	Units	Periods	Sources
LDEBTB	Annual value of total gross federal debt outstanding (held by public and intra-governmental holdings) in logs.	Billions of Dollars	1983-2010	Financial Management Service (FMS)
LCBODF1	Annual one-step-ahead forecast of Total Gross Federal Debt from the CBO in logs.	Billions of Dollars	1984-2010	Congressional Budget Office
LOMBDF1	Annual one-step-ahead forecast of Total Gross Federal Debt from the OMB in logs.	Billions of Dollars	1984-2010	Office of Management and Budget
LAPBDF1	Annual one-step-ahead forecast of Total Gross Federal Debt from the Analysis of the President's Budget in logs.	Billions of Dollars	1984-2010	Congressional Budget Office
LCBORESID	Annual value of total gross federal debt minus the one-step-ahead forecast of the debt from the CBO in logs.	Billions of Dollars	1984-2010	FMS and CBO
LOMBRESID	Annual value of total gross federal debt minus the one-step-ahead forecast of the debt from the OMB in logs.	Billions of Dollars	1984-2010	FMS and OMB
LAPBRESID	Annual value of total gross federal debt minus the one-step-ahead forecast of the debt from the Analysis of the President's Budget in logs.	Billions of Dollars	1984-2010	FMS and CBO
DLDEBTB	Annual difference of the annual value of total gross federal debt in logs.	Billions of Dollars	1984-2010	Financial Management Service
DLCBODF1	Annual difference between the one-step-ahead CBO forecast of the debt and the CBO estimate of the debt for the previous year.	Billions of Dollars	1984-2010	Congressional Budget Office
DLOMBDF1	Annual difference between the one-step-ahead OMB forecast of the debt and the OMB estimate of the debt for the previous year in logs	Billions of Dollars	1984-2010	Office of Management and Budget
DLAPBDF1	Annual difference between the one-step-ahead APB forecast of the debt and the CBO estimate of the debt for the previous year.	Billions of Dollars	1984-2010	Congressional Budget Office
CBODE	Annual estimate of the total gross federal debt outstanding by the Congressional budget office	Billions of Dollars	1983-2009	Congressional Budget Office
OMBDE	Annual estimate of the total gross federal debt outstanding by the Office of Management and Budget	Billions of Dollars	1983-2009	Office of Management and Budget

Table 5. Forecast-Encompassing Test Statistics for Alternative US Federal Debt Forecasts
One-step-ahead (Log levels, 1984-2008)

Encompassing Forecast (Encompassed Forecast)	Treatment of constant term (f)	Null Hypotheses (a)-(e)				
		$b_1 = 1$, $b_2 = 0$	$b_2=0$	$b_1 \equiv 1$, $b_2=0$	$b_1+b_2=1$	$b_3=0$
CBO (OMB)	b_0 **unrestricted**	5.752**	8.768**	2.128	1.019	10.476**
		[0.010]	[0.007]	[0.158]	[0.324]	[0.004]
		(2,22)	(1,22)	(1,23)	(1,22)	(1,23)
	$b_0 = 0$	3.956*	5.690*	1.201	1.102	5.420*
		[0.021]	[0.010]	[0.319]	[0.350]	[0.012]
		(3,22)	(2,22)	(2,23)	(2,22)	(2,23)
	$b_0 \equiv 0$	5.497*	10.503**	0.354	1.293	9.583**
		[0.011]	[0.004]	[0.557]	[0.267]	[0.005]
		(2,23)	(1,23)	(1,24)	(1,23)	(1,24)
OMB (CBO)	b_0 **unrestricted**	0.744	1.455	0.038	1.019	0.470
		[0.487]	[0.241]	[0.847]	[0.324]	[0.50]
		(2,22)	(1,22)	(1,23)	(1,22)	(1,23)
	$b_0 = 0$	0.744	0.736	0.383	1.102	0.606
		[0.537]	[0.490]	[0.686]	[0.350]	[0.554]
		(3,22)	(2,22)	(2,23)	(2,22)	(2,23)
	$b_0 \equiv 0$	0.660	0.559	0.777	1.293	0.027
		[0.526]	[0.462]	[0.387]	[0.267]	[0.870]
		(2,23)	(1,23)	(1,24)	(1,23)	(1,24)
AVE1 (CBO)	b_0 **unrestricted**	2.434	4.321*	0.463	1.019	3.845
		[0.111]	[0.050]	[0.503]	[0.324]	[0.062]
		(2,22)	(1,22)	(1,23)	(1,22)	(1,23)
	$b_0 = 0$	1.628	2.438	0.239	1.102	1.931
		[0.212]	[0.111]	[0.789]	[0.350]	[0.168]
		(3,22)	(2,22)	(2,23)	(2,22)	(2,23)
	$b_0 \equiv 0$	1.992	3.976	0.007	1.293	2.658
		[0.159]	[0.058]	[0.936]	[0.267]	[0.116]
		(2,23)	(1,23)	(1,24)	(1,23)	(1,24)
AVE1 (OMB)	b_0 **unrestricted**	2.434	4.321*	0.491	1.019	3.845
		[0.111]	[0.050]	[0.490]	[0.324]	[0.062]
		(2,22)	(1,22)	(1,23)	(1,22)	(1,23)
	$b_0 = 0$	1.628	2.438	0.253	1.102	1.931
		[0.212]	[0.111]	[0.779]	[0.350]	[0.168]
		(3,22)	(2,22)	(2,23)	(2,22)	(2,23)
	$b_0 \equiv 0$	1.992	3.976	0.006	1.293	2.658
		[0.159]	[0.058]	[0.937]	[0.267]	[0.116]
		(2,23)	(1,23)	(1,24)	(1,23)	(1,24)

Notes:
1. The three entries within a given block of numbers in the last five columns are: the approximate F statistic for testing the null hypothesis, the tail probability associated with that value of the F statistic (in square brackets), and the degrees of freedom for the F statistic (in parentheses).
2. The regressions for Null Hypothesis tests come from (a) Chong and Hendry (1986), (b) Chong and Hendry (1986), (c) Chong and Hendry (1986), (d) Ericsson (1993), (e) Ericsson (1992), and (f) Ericsson and Marquez (1993).
3. AVE1 is the average of the CBO and the OMB forecasts.
4. b_3 is where b_2-b_1 is constrained to equal b_3 and where b_1 is also constrained to equal unity.
5. Asterisks * and ** denote rejection at the 5% and 1% critical values.

Table 6. Forecast-Encompassing Test Statistics for Alternative US Federal Debt Forecasts
One-step-ahead (Growth rates, 1984-2008)

Encompassing Forecast (Encompassed Forecast)	Treatment of constant term (f)	Null Hypotheses (a)-(e)				
		$b_1 = 1, b_2 = 0$	$b_2=0$	$b_1\equiv1, b_2=0$	$b_1+b_2=1$	$b_3=0$
CBO (OMB)	**b_0 unrestricted**	5.464*	6.802*	1.793	0.545	10.592**
		[0.012]	[0.016]	[0.194]	[0.468]	[0.004]
		(2,22)	(1,22)	(1,23)	(1,22)	(1,23)
	$b_0 = 0$	3.771*	5.573*	1.042	0.814	5.493*
		[0.025]	[0.011]	[0.369]	[0.456]	[0.011]
		(3,22)	(2,22)	(2,23)	(2,22)	(2,23)
	$b_0 \equiv 0$	5.882**	11.588**	0.008	1.657	9.838**
		[0.009]	[0.002]	[0.932]	[0.211]	[0.005]
		(2,23)	(1,23)	(1,24)	(1,23)	(1,24)
OMB (CBO)	**b_0 unrestricted**	0.502	0.216	0.950	0.545	0.469
		[0.612]	[0.647]	[0.340]	[0.468]	[0.50]
		(2,22)	(1,22)	(1,23)	(1,22)	(1,23)
	$b_0 = 0$	0.555	0.210	0.819	0.814	0.571
		[0.650]	[0.812]	[0.453]	[0.456]	[0.573]
		(3,22)	(2,22)	(2,23)	(2,22)	(2,23)
	$b_0 \equiv 0$	0.848	0.397	1.466	1.657	0.037
		[0.441]	[0.535]	[0.238]	[0.211]	[0.849]
		(2,23)	(1,23)	(1,24)	(1,23)	(1,24)
AVE1 (CBO)	**b_0 unrestricted**	2.174	2.487	2.127	0.545	3.880
		[0.138]	[0.129]	[0.158]	[0.468]	[0.061]
		(2,22)	(1,22)	(1,23)	(1,22)	(1,23)
	$b_0 = 0$	1.452	1.935	1.068	0.814	1.944
		[0.255]	[0.168]	[0.360]	[0.456]	[0.166]
		(3,22)	(2,22)	(2,23)	(2,22)	(2,23)
	$b_0 \equiv 0$	2.252	3.995	0.581	1.657	2.772
		[0.128]	[0.058]	[0.454]	[0.211]	[0.109]
		(2,23)	(1,23)	(1,24)	(1,23)	(1,24)
AVE1 (OMB)	**b_0 unrestricted**	2.174	2.487	1.366	0.545	3.880
		[0.138]	[0.129]	[0.254]	[0.468]	[0.061]
		(2,22)	(1,22)	(1,23)	(1,22)	(1,23)
	$b_0 = 0$	1.452	1.935	0.687	0.814	1.944
		[0.255]	[0.168]	[0.513]	[0.456]	[0.166]
		(3,22)	(2,22)	(2,23)	(2,22)	(2,23)
	$b_0 \equiv 0$	2.252	3.995	0.342	1.657	2.772
		[0.128]	[0.058]	[0.564]	[0.211]	[0.109]
		(2,23)	(1,23)	(1,24)	(1,23)	(1,24)

Notes:

See Table 5.

Table 7. Forecast-Encompassing Test Statistics for Alternative US Federal Debt Forecasts
One-step-ahead (Log levels, 1984-2009)

Encompassing Forecast (Encompassed Forecast)	Treatment of constant term (f)	Null Hypotheses (a)-(e)				
		$b_1 = 1$, $b_2 = 0$	$b_2 = 0$	$b_1 \equiv 1$, $b_2 = 0$	$b_1 + b_2 = 1$	$b_3 = 0$
CBO (OMB)	**b_0 unrestricted**	3.514*	3.092	3.872	0.437	6.748*
		[0.047]	[0.092]	[0.061]	[0.515]	[0.016]
		(2,23)	(1,23)	(1,24)	(1,23)	(1,24)
	$b_0 = 0$	2.607	3.401	2.304	0.223	3.780*
		[0.076]	[0.051]	[0.122]	[0.802]	[0.037]
		(3,23)	(2,23)	(2,24)	(2,23)	(2,24)
	$b_0 \equiv 0$	3.777*	6.510*	0.866	0.003	7.863**
		[0.038]	[0.018]	[0.361]	[0.954]	[0.010]
		(2,24)	(1,24)	(1,25)	(1,24)	(1,25)
OMB (CBO)	**b_0 unrestricted**	9.160**	14.526**	2.084	0.437	18.312**
		[0.001]	[0.001]	[0.162]	[0.515]	[0.000]
		(2,23)	(1,23)	(1,24)	(1,23)	(1,24)
	$b_0 = 0$	7.110**	8.949**	1.992	0.223	10.697**
		[0.002]	[0.001]	[0.158]	[0.802]	[0.001]
		(3,23)	(2,23)	(2,24)	(2,23)	(2,24)
	$b_0 \equiv 0$	10.692**	17.870**	2.073	0.003	22.268**
		[0.001]	[0.000]	[0.162]	[0.954]	[0.000]
		(2,24)	(1,24)	(1,25)	(1,24)	(1,25)
AVE1 (CBO)	**b_0 unrestricted**	0.564	1.123	0.007	0.437	0.707
		[0.577]	[0.30]	[0.934]	[0.515]	[0.409]
		(2,23)	(1,23)	(1,24)	(1,23)	(1,24)
	$b_0 = 0$	0.435	0.566	0.092	0.223	0.445
		[0.730]	[0.576]	[0.912]	[0.802]	[0.646]
		(3,23)	(2,23)	(2,24)	(2,23)	(2,24)
	$b_0 \equiv 0$	0.442	0.705	0.180	0.003	0.917
		[0.648]	[0.409]	[0.675]	[0.954]	[0.347]
		(2,24)	(1,24)	(1,25)	(1,24)	(1,25)
AVE1 (OMB)	**b_0 unrestricted**	0.564	1.123	0.002	0.437	0.707
		[0.577]	[0.30]	[0.963]	[0.515]	[0.409]
		(2,23)	(1,23)	(1,24)	(1,23)	(1,24)
	$b_0 = 0$	0.435	0.566	0.090	0.223	0.445
		[0.730]	[0.576]	[0.914]	[0.802]	[0.646]
		(3,23)	(2,23)	(2,24)	(2,23)	(2,24)
	$b_0 \equiv 0$	0.442	0.705	0.181	0.003	0.917
		[0.648]	[0.409]	[0.674]	[0.954]	[0.347]
		(2,24)	(1,24)	(1,25)	(1,24)	(1,25)

Notes:

See Table 5.

Table 8. Forecast-Encompassing Test Statistics for Alternative US Federal Debt Forecasts One-step-ahead (Growth rates, 1984-2009)

Encompassing Forecast (Encompassed Forecast)	Treatment of constant term (f)	Null Hypotheses (a)-(e)				
		$b_1 = 1$, $b_2 = 0$	$b_2=0$	$b_1\equiv1$, $b_2=0$	$b_1+b_2=1$	$b_3=0$
CBO (OMB)	**b_0 unrestricted**	5.219*	8.687**	0.002	3.018	6.844*
		[0.014]	[0.007]	[0.966]	[0.096]	[0.015]
		(2,23)	(1,23)	(1,24)	(1,23)	(1,24)
	$b_0 = 0$	3.789*	5.657*	0.334	1.512	3.850*
		[0.024]	[0.010]	[0.719]	[0.242]	[0.035]
		(3,23)	(2,23)	(2,24)	(2,23)	(2,24)
	$b_0 \equiv 0$	4.403*	8.757**	0.552	0.843	8.014**
		[0.024]	[0.007]	[0.465]	[0.368]	[0.009]
		(2,24)	(1,24)	(1,25)	(1,24)	(1,25)
OMB (CBO)	**b_0 unrestricted**	11.394**	7.584*	3.337	3.018	18.237**
		[0.000]	[0.011]	[0.080]	[0.096]	[0.000]
		(2,23)	(1,23)	(1,24)	(1,23)	(1,24)
	$b_0 = 0$	8.661**	6.908**	2.622	1.512	10.592**
		[0.001]	[0.005]	[0.093]	[0.242]	[0.001]
		(3,23)	(2,23)	(2,24)	(2,23)	(2,24)
	$b_0 \equiv 0$	11.380**	11.146**	4.330*	0.843	22.056**
		[0.000]	[0.003]	[0.048]	[0.368]	[0.000]
		(2,24)	(1,24)	(1,25)	(1,24)	(1,25)
AVE1 (CBO)	**b_0 unrestricted**	1.880	0.022	3.493	3.018	0.684
		[0.175]	[0.883]	[0.074]	[0.096]	[0.416]
		(2,23)	(1,23)	(1,24)	(1,23)	(1,24)
	$b_0 = 0$	1.310	1.144	1.834	1.512	0.420
		[0.295]	[0.336]	[0.182]	[0.242]	[0.662]
		(3,23)	(2,23)	(2,24)	(2,23)	(2,24)
	$b_0 \equiv 0$	0.854	0.139	1.490	0.843	0.870
		[0.438]	[0.712]	[0.234]	[0.368]	[0.360]
		(2,24)	(1,24)	(1,25)	(1,24)	(1,25)
AVE1 (OMB)	**b_0 unrestricted**	1.880	0.022	3.855	3.018	0.684
		[0.175]	[0.883]	[0.061]	[0.096]	[0.416]
		(2,23)	(1,23)	(1,24)	(1,23)	(1,24)
	$b_0 = 0$	1.310	1.144	2.016	1.512	0.420
		[0.295]	[0.336]	[0.155]	[0.242]	[0.662]
		(3,23)	(2,23)	(2,24)	(2,23)	(2,24)
	$b_0 \equiv 0$	0.854	0.139	1.711	0.843	0.870
		[0.438]	[0.712]	[0.203]	[0.368]	[0.360]
		(2,24)	(1,24)	(1,25)	(1,24)	(1,25)

Notes:

See Table 5.

Table 9. Forecast-Encompassing Test Statistics for Alternative US Federal Debt Forecasts
One-step-ahead (Log levels, 1984-2010)

Encompassing Forecast (Encompassed Forecast)	Treatment of constant term (f)	Null Hypotheses (a)-(e)				
		$b_1 = 1$, $b_2 = 0$	$b_2=0$	$b_1 \equiv 1$, $b_2=0$	$b_1+b_2=1$	$b_3=0$
CBO (OMB)	**b_0 unrestricted**	4.213*	3.268	5.013*	0.545	8.027**
		[0.027]	[0.083]	[0.034]	[0.468]	[0.009]
		(2,24)	(1,24)	(1,25)	(1,24)	(1,25)
	$b_0 = 0$	3.237*	4.041*	3.102	0.275	4.668*
		[0.040]	[0.031]	[0.063]	[0.762]	[0.019]
		(3,24)	(2,24)	(2,25)	(2,24)	(2,25)
	$b_0 \equiv 0$	4.665*	7.672*	1.335	0.001	9.703**
		[0.019]	[0.010]	[0.258]	[0.977]	[0.004]
		(2,25)	(1,25)	(1,26)	(1,25)	(1,26)
OMB (CBO)	**b_0 unrestricted**	9.891**	15.130**	2.605	0.545	19.594**
		[0.001]	[0.001]	[0.119]	[0.468]	[0.000]
		(2,24)	(1,24)	(1,25)	(1,24)	(1,25)
	$b_0 = 0$	7.887**	9.613**	2.526	0.275	11.773**
		[0.001]	[0.001]	[0.10]	[0.762]	[0.000]
		(3,24)	(2,24)	(2,25)	(2,24)	(2,25)
	$b_0 \equiv 0$	11.769**	19.021**	2.637	0.001	24.477**
		[0.000]	[0.000]	[0.116]	[0.977]	[0.000]
		(2,25)	(1,25)	(1,26)	(1,25)	(1,26)
AVE1 (CBO)	**b_0 unrestricted**	0.584	1.158	0.014	0.545	0.635
		[0.565]	[0.293]	[0.906]	[0.468]	[0.433]
		(2,24)	(1,24)	(1,25)	(1,24)	(1,25)
	$b_0 = 0$	0.448	0.587	0.094	0.275	0.406
		[0.721]	[0.564]	[0.911]	[0.762]	[0.670]
		(3,24)	(2,24)	(2,25)	(2,24)	(2,25)
	$b_0 \equiv 0$	0.404	0.637	0.173	0.001	0.840
		[0.672]	[0.432]	[0.681]	[0.977]	[0.368]
		(2,25)	(1,25)	(1,26)	(1,25)	(1,26)
AVE1 (OMB)	**b_0 unrestricted**	0.584	1.158	0.007	0.545	0.635
		[0.565]	[0.293]	[0.933]	[0.468]	[0.433]
		(2,24)	(1,24)	(1,25)	(1,24)	(1,25)
	$b_0 = 0$	0.448	0.587	0.090	0.275	0.406
		[0.721]	[0.564]	[0.914]	[0.762]	[0.670]
		(3,24)	(2,24)	(2,25)	(2,24)	(2,25)
	$b_0 \equiv 0$	0.404	0.637	0.175	0.001	0.840
		[0.672]	[0.432]	[0.679]	[0.977]	[0.368]
		(2,25)	(1,25)	(1,26)	(1,25)	(1,26)

Notes:

See Table 5.

Table 10. Forecast-Encompassing Test Statistics for Alternative US Federal Debt Forecasts
One-step-ahead (Growth rates, 1984-2010)

Encompassing Forecast (Encompassed Forecast)	Treatment of constant term (f)	Null Hypotheses (a)-(e)				
		$b_1 = 1,$ $b_2 = 0$	$b_2=0$	$b_1 \equiv 1,$ $b_2=0$	$b_1+b_2=1$	$b_3=0$
CBO (OMB)	**b_0 unrestricted**	5.868**	10.343**	0.063	2.973	8.123**
		[0.008]	[0.004]	[0.803]	[0.098]	[0.009]
		(2,24)	(1,24)	(1,25)	(1,24)	(1,25)
	$b_0 = 0$	4.404*	6.464**	0.549	1.488	4.745*
		[0.013]	[0.006]	[0.585]	[0.246]	[0.018]
		(3,24)	(2,24)	(2,25)	(2,24)	(2,25)
	$b_0 \equiv 0$	5.288*	10.305**	1.057	0.790	9.865**
		[0.012]	[0.004]	[0.313]	[0.383]	[0.004]
		(2,25)	(1,25)	(1,26)	(1,25)	(1,26)
OMB (CBO)	**b_0 unrestricted**	12.015**	7.573*	3.737	2.973	19.517**
		[0.000]	[0.011]	[0.065]	[0.098]	[0.000]
		(2,24)	(1,24)	(1,25)	(1,24)	(1,25)
	$b_0 = 0$	9.373**	7.026**	3.092	1.488	11.653**
		[0.000]	[0.004]	[0.063]	[0.246]	[0.000]
		(3,24)	(2,24)	(2,25)	(2,24)	(2,25)
	$b_0 \equiv 0$	12.414**	11.379**	5.201*	0.790	24.234**
		[0.000]	[0.002]	[0.031]	[0.383]	[0.000]
		(2,25)	(1,25)	(1,26)	(1,25)	(1,26)
AVE1 (CBO)	**b_0 unrestricted**	1.818	0.002	3.490	2.973	0.614
		[0.184]	[0.963]	[0.074]	[0.098]	[0.441]
		(2,24)	(1,24)	(1,25)	(1,24)	(1,25)
	$b_0 = 0$	1.266	1.120	1.829	1.488	0.383
		[0.308]	[0.343]	[0.181]	[0.246]	[0.686]
		(3,24)	(2,24)	(2,25)	(2,24)	(2,25)
	$b_0 \equiv 0$	0.789	0.086	1.440	0.790	0.794
		[0.466]	[0.772]	[0.241]	[0.383]	[0.381]
		(2,25)	(1,25)	(1,26)	(1,25)	(1,26)
AVE1 (OMB)	**b_0 unrestricted**	1.818	0.002	3.657	2.973	0.614
		[0.184]	[0.963]	[0.067]	[0.098]	[0.441]
		(2,24)	(1,24)	(1,25)	(1,24)	(1,25)
	$b_0 = 0$	1.266	1.120	1.913	1.488	0.383
		[0.308]	[0.343]	[0.169]	[0.246]	[0.686]
		(3,24)	(2,24)	(2,25)	(2,24)	(2,25)
	$b_0 \equiv 0$	0.789	0.086	1.608	0.790	0.794
		[0.466]	[0.772]	[0.216]	[0.383]	[0.381]
		(2,25)	(1,25)	(1,26)	(1,25)	(1,26)

Notes:

See Table 5.

Table 11. Forecast-Encompassing Test Statistics for Alternative US Federal Debt Forecasts IIS, One-step-ahead (Log levels, 1984-2008)

Encompassing Forecast (Encompassed Forecast)	Treatment of constant term (f)	Null Hypotheses (a)-(e)				
		$b_1 = 1$, $b_2 = 0$	$b_2=0$	$b_1\equiv1$, $b_2=0$	$b_1+b_2=1$	$b_3=0$
CBO (OMB)	b_0 unrestricted	9.642** [0.001] (2,19) 90 1	18.267** [0.000] (1,19) 90 1	0.021 [0.887] (1,18) 90 1 2 3	5.039* [0.037] (1,19) 90 1	11.851** [0.003] (1,20) 90 1
	$b_0 = 0$	7.503** [0.002] (3,19) 90 1	9.751** [0.001] (2,19) 90 1	6.696** [0.007] (2,18) 90 1 2 3	8.575** [0.002] (2,19) 90 1	7.267** [0.004] (2,20) 90 1
	$b_0 \equiv 0$	7.835** [0.003] (2,20) 90 1	13.086** [0.002] (1,20) 90 1	14.125** [0.001] (1,19) 90 1 2 3	11.066** [0.003] (1,20) 90 1	1.512 [0.232] (1,22) 1
OMB (CBO)	b_0 unrestricted	2.525 [0.107] (2,19) 90 1	2.256 [0.150] (1,19) 90 1	2.678 [0.117] (1,20) 90 1	5.039* [0.037] (1,19) 90 1	0.009 [0.927] (1,20) 90 1
	$b_0 = 0$	7.336** [0.002] (3,19) 90 1	2.145 [0.145] (2,19) 90 1	9.335** [0.001] (2,20) 90 1	8.575** [0.002] (2,19) 90 1	7.059** [0.005] (2,20) 90 1
	$b_0 \equiv 0$	7.620** [0.004] (2,20) 90 1	0.014 [0.909] (1,20) 90 1	15.979** [0.001] (1,21) 90 1	11.066** [0.003] (1,20) 90 1	3.559 [0.073] (1,22) 1
AVE1 (CBO)	b_0 unrestricted	4.205* [0.031] (2,19) 90 1	8.304** [0.010] (1,19) 90 1	2.099 [0.165] (1,18) 90 1 2 3	5.039* [0.037] (1,19) 90 1	2.805 [0.110] (1,20) 90 1
	$b_0 = 0$	5.718** [0.006] (3,19) 90 1	4.164* [0.032] (2,19) 90 1	12.172** [0.001] (2,18) 90 1 2 3	8.575** [0.002] (2,19) 90 1	5.040* [0.017] (2,20) 90 1
	$b_0 \equiv 0$	5.534* [0.012] (2,20) 90 1	3.484 [0.077] (1,20) 90 1	13.714** [0.001] (1,20) 90 1 2	11.066** [0.003] (1,20) 90 1	0.108 [0.746] (1,22) 1
AVE1 (OMB)	b_0 unrestricted	4.205* [0.031] (2,19) 90 1	8.304** [0.010] (1,19) 90 1	2.092 [0.165] (1,18) 90 1 2 3	5.039* [0.037] (1,19) 90 1	2.805 [0.110] (1,20) 90 1
	$b_0 = 0$	5.718** [0.006] (3,19) 90 1	4.164* [0.032] (2,19) 90 1	12.165** [0.001] (2,18) 90 1 2 3	8.575** [0.002] (2,19) 90 1	5.040* [0.017] (2,20) 90 1
	$b_0 \equiv 0$	5.534* [0.012] (2,20) 90 1	3.484 [0.077] (1,20) 90 1	13.705** [0.001] (1,20) 90 1 2	11.066** [0.003] (1,20) 90 1	0.108 [0.746] (1,22) 1

Notes:
1. The four entries within a given block of numbers in the last five columns are: the approximate F statistic for testing the null hypothesis, the tail probability associated with that value of the F statistic (in square brackets), the degrees of freedom for the F statistic (in parentheses), and the dummies that were found significant using IIS at the 1% level (2008 not shown because it occurs in every equation).
2. The regressions for Null Hypothesis tests come from (a) Chong and Hendry (1986), (b) Chong and Hendry (1986), (c) Chong and Hendry (1986), (d) Ericsson (1993), (e) Ericsson (1992), and (f) Ericsson and Marquez (1993).
3. AVE1 is the average of the CBO and the OMB forecasts.
4. b_3 is where b_2-b_1 is constrained to equal b_3 and where b_1 is also constrained to equal unity.
5. Asterisks * and ** denote rejection at the 5% and 1% critical values.

Table 12. Forecast-Encompassing Test Statistics for Alternative US Federal Debt Forecasts IIS, One-step-ahead (Growth rates, 1984-2008)

Encompassing Forecast (Encompassed Forecast)	Treatment of constant term (f)	Null Hypotheses (a)-(e)				
		$b_1 = 1$, $b_2 = 0$	$b_2 = 0$	$b_1 \equiv 1$, $b_2 = 0$	$b_1 + b_2 = 1$	$b_3 = 0$
CBO (OMB)	b_0 unrestricted	5.750* [0.011] (2,19) 90 1	9.454** [0.006] (1,19) 90 1	0.357 [0.557] (1,18) 90 1 2 3	0.031 [0.863] (1,19) 90 1	12.054** [0.002] (1,20) 90 1
	$b_0 = 0$	4.658* [0.013] (3,19) 90 1	4.904* [0.019] (2,19) 90 1	7.008** [0.006] (2,18) 90 1 2 3	4.725* [0.022] (2,19) 90 1	7.327** [0.004] (2,20) 90 1
	$b_0 \equiv 0$	12.208** [0.001] (2,17) 86 90 1 2 3	0.044 [0.836] (1,17) 86 90 1 2 3	25.194** [0.000] (1,18) 86 90 1 2 3	23.452** [0.000] (1,17) 86 90 1 2 3	1.620 [0.216] (1,22) 1
OMB (CBO)	b_0 unrestricted	0.021 [0.979] (2,19) 90 1	0.002 [0.966] (1,19) 90 1	0.044 [0.836] (1,20) 90 1	0.031 [0.863] (1,19) 90 1	0.012 [0.915] (1,20) 90 1
	$b_0 = 0$	4.380* [0.017] (3,19) 90 1	1.328 [0.288] (2,19) 90 1	6.916** [0.005] (2,20) 90 1	4.725* [0.022] (2,19) 90 1	6.889** [0.005] (2,20) 90 1
	$b_0 \equiv 0$	25.679** [0.000] (2,17) 86 90 1 2 3	12.927** [0.002] (1,17) 86 90 1 2 3	7.383* [0.013] (1,22) 90	23.452** [0.000] (1,17) 86 90 1 2 3	3.471 [0.076] (1,22) 1
AVE1 (CBO)	b_0 unrestricted	1.361 [0.280] (2,19) 90 1	2.475 [0.132] (1,19) 90 1	0.012 [0.913] (1,19) 90 1 2	0.031 [0.863] (1,19) 90 1	2.828 [0.108] (1,20) 90 1
	$b_0 = 0$	3.154* [0.049] (3,19) 90 1	1.438 [0.262] (2,19) 90 1	6.205** [0.008] (2,19) 90 1 2	4.725* [0.022] (2,19) 90 1	4.955* [0.018] (2,20) 90 1
	$b_0 \equiv 0$	16.632** [0.000] (2,17) 86 90 1 2 3	2.923 [0.106] (1,17) 86 90 1 2 3	6.554* [0.018] (1,21) 90 1	23.452** [0.000] (1,17) 86 90 1 2 3	0.087 [0.771] (1,22) 1
AVE1 (OMB)	b_0 unrestricted	1.361 [0.280] (2,19) 90 1	2.475 [0.132] (1,19) 90 1	0.000 [1.000] (1,19) 90 1 2	0.031 [0.863] (1,19) 90 1	2.828 [0.108] (1,20) 90 1
	$b_0 = 0$	3.154* [0.049] (3,19) 90 1	1.438 [0.262] (2,19) 90 1	6.195** [0.009] (2,19) 90 1 2	4.725* [0.022] (2,19) 90 1	4.955* [0.018] (2,20) 90 1
	$b_0 \equiv 0$	16.632** [0.000] (2,17) 86 90 1 2 3	2.923 [0.106] (1,17) 86 90 1 2 3	6.075* [0.022] (1,21) 90 1	23.452** [0.000] (1,17) 86 90 1 2 3	0.087 [0.771] (1,22) 1

Notes:

See Table 11.

Table 13. Forecast-Encompassing Test Statistics for Alternative US Federal Debt Forecasts IIS, One-step-ahead (Log levels, 1984-2009)

Encompassing Forecast (Encompassed Forecast)	Treatment of constant term (f)	Null Hypotheses (a)-(e)				
		$b_1 = 1, b_2 = 0$	$b_2=0$	$b_1\equiv1, b_2=0$	$b_1+b_2=1$	$b_3=0$
CBO (OMB)	b_0 unrestricted	9.642** [0.001] (2,19) 90 1 9	18.267** [0.000] (1,19) 90 1 9	1.820 [0.190] (1,23)	5.039* [0.037] (1,19) 90 1 9	27.755** [0.000] (1,19) 90 1 2 3
	$b_0 = 0$	7.503** [0.002] (3,19) 90 1 9	9.751** [0.001] (2,19) 90 1 9	0.939 [0.406] (2,23)	8.575** [0.002] (2,19) 90 1 9	17.641** [0.000] (2,19) 90 1 2 3
	$b_0 \equiv 0$	18.294** [0.000] (2,19) 90 1 2 3	29.581** [0.000] (1,19) 90 1 2 3	0.458 [0.505] (1,22) 97 98	18.876** [0.000] (1,19) 90 1 2 3	8.244** [0.009] (1,23) 1
OMB (CBO)	b_0 unrestricted	2.525 [0.107] (2,19) 90 1 9	2.256 [0.150] (1,19) 90 1 9	2.678 [0.117] (1,20) 90 1 9	5.039* [0.037] (1,19) 90 1 9	121.76** [0.000] (1,19) 90 1 2 3
	$b_0 = 0$	7.336** [0.002] (3,19) 90 1 9	2.145 [0.145] (2,19) 90 1 9	9.335** [0.001] (2,20) 90 1 9	8.575** [0.002] (2,19) 90 1 9	93.340** [0.000] (2,19) 90 1 2 3
	$b_0 \equiv 0$	95.812** [0.000] (2,19) 90 1 2 3	117.66** [0.000] (1,19) 90 1 2 3	15.979** [0.001] (1,21) 90 1 9	18.876** [0.000] (1,19) 90 1 2 3	54.267** [0.000] (1,23) 1
AVE1 (CBO)	b_0 unrestricted	4.205* [0.031] (2,19) 90 1 9	8.304** [0.010] (1,19) 90 1 9	2.099 [0.165] (1,18) 90 1 2 3 9	5.039* [0.037] (1,19) 90 1 9	8.312** [0.010] (1,19) 90 1 2 3
	$b_0 = 0$	5.718** [0.006] (3,19) 90 1 9	4.164* [0.032] (2,19) 90 1 9	12.172** [0.001] (2,18) 90 1 2 3 9	8.575** [0.002] (2,19) 90 1 9	18.738** [0.000] (2,19) 90 1 2 3
	$b_0 \equiv 0$	19.417** [0.000] (2,19) 90 1 2 3	7.334* [0.014] (1,19) 90 1 2 3	15.733** [0.001] (1,21) 90 1 2	18.876** [0.000] (1,19) 90 1 2 3	5.052* [0.035] (1,23) 1
AVE1 (OMB)	b_0 unrestricted	4.205* [0.031] (2,19) 90 1 9	8.304** [0.010] (1,19) 90 1 9	9.587** [0.006] (1,18) 84 90 1 2 3	5.039* [0.037] (1,19) 90 1 9	8.312** [0.010] (1,19) 90 1 2 3
	$b_0 = 0$	5.718** [0.006] (3,19) 90 1 9	4.164* [0.032] (2,19) 90 1 9	18.278** [0.000] (2,18) 84 90 1 2 3	8.575** [0.002] (2,19) 90 1 9	18.738** [0.000] (2,19) 90 1 2 3
	$b_0 \equiv 0$	19.417** [0.000] (2,19) 90 1 2 3	7.334* [0.014] (1,19) 90 1 2 3	15.803** [0.001] (1,21) 90 1 2	18.876** [0.000] (1,19) 90 1 2 3	5.052* [0.035] (1,23) 1

Notes:

See Table 11.

Table 14. Forecast-Encompassing Test Statistics for Alternative US Federal Debt Forecasts IIS, One-step-ahead (Growth rates, 1984-2009)

Encompassing Forecast (Encompassed Forecast)	Treatment of constant term (f)	Null Hypotheses (a)-(e)				
		$b_1 = 1, b_2 = 0$	$b_2 = 0$	$b_1 \equiv 1, b_2 = 0$	$b_1 + b_2 = 1$	$b_3 = 0$
CBO (OMB)	b_0 unrestricted	13.547** [0.000] (2,18) 90 1 2 3	26.238** [0.000] (1,18) 90 1 2 3	2.762 [0.111] (1,22) 9	0.017 [0.897] (1,18) 90 1 2 3	28.554** [0.000] (1,19) 90 1 2 3
	$b_0 = 0$	11.383** [0.000] (3,18) 90 1 2 3	15.087** [0.000] (2,18) 90 1 2 3	1.398 [0.268] (2,22) 9	8.520** [0.003] (2,18) 90 1 2 3	17.997** [0.000] (2,19) 90 1 2 3
	$b_0 \equiv 0$	9.826** [0.001] (2,21) 90 1	18.991** [0.000] (1,21) 90 1	0.545 [0.468] (1,22) 85 1	5.893* [0.024] (1,21) 90 1	8.485** [0.008] (1,23) 1
OMB (CBO)	b_0 unrestricted	58.870** [0.000] (2,18) 90 1 2 3	71.907** [0.000] (1,18) 90 1 2 3	0.044 [0.836] (1,20) 90 1 9	0.017 [0.897] (1,18) 90 1 2 3	124.15** [0.000] (1,19) 90 1 2 3
	$b_0 = 0$	59.717** [0.000] (3,18) 90 1 2 3	38.306** [0.000] (2,18) 90 1 2 3	6.916** [0.005] (2,20) 90 1 9	8.520** [0.003] (2,18) 90 1 2 3	94.453** [0.000] (2,19) 90 1 2 3
	$b_0 \equiv 0$	42.458** [0.000] (2,21) 90 1	34.971** [0.000] (1,21) 90 1	7.383* [0.013] (1,22) 90 9	5.893* [0.024] (1,21) 90 1	54.225** [0.000] (1,23) 1
AVE1 (CBO)	b_0 unrestricted	3.994* [0.037] (2,18) 90 1 2 3	6.123* [0.024] (1,18) 90 1 2 3	4.713* [0.041] (1,22) 90	0.017 [0.897] (1,18) 90 1 2 3	8.405** [0.009] (1,19) 90 1 2 3
	$b_0 = 0$	11.837** [0.000] (3,18) 90 1 2 3	3.705* [0.045] (2,18) 90 1 2 3	4.303* [0.027] (2,22) 90	8.520** [0.003] (2,18) 90 1 2 3	18.715** [0.000] (2,19) 90 1 2 3
	$b_0 \equiv 0$	6.30** [0.007] (2,21) 90 1	1.175 [0.291] (1,21) 90 1	9.972** [0.005] (1,22) 90 1	5.893* [0.024] (1,21) 90 1	4.953* [0.036] (1,23) 1
AVE1 (OMB)	b_0 unrestricted	3.994* [0.037] (2,18) 90 1 2 3	6.123* [0.024] (1,18) 90 1 2 3	6.415* [0.019] (1,22) 90	0.017 [0.897] (1,18) 90 1 2 3	8.405** [0.009] (1,19) 90 1 2 3
	$b_0 = 0$	11.837** [0.000] (3,18) 90 1 2 3	3.705* [0.045] (2,18) 90 1 2 3	5.277* [0.013] (2,22) 90	8.520** [0.003] (2,18) 90 1 2 3	18.715** [0.000] (2,19) 90 1 2 3
	$b_0 \equiv 0$	6.30** [0.007] (2,21) 90 1	1.175 [0.291] (1,21) 90 1	12.304** [0.002] (1,22) 90 1	5.893* [0.024] (1,21) 90 1	4.953* [0.036] (1,23) 1

Notes:

See Table 11.

Table 15. Forecast-Encompassing Test Statistics for Alternative US Federal Debt Forecasts IIS, One-step-ahead (Log levels, 1984-2010)

Encompassing Forecast (Encompassed Forecast)	Treatment of constant term (f)	Null Hypotheses (a)-(e)				
		$b_1 = 1$, $b_2 = 0$	$b_2=0$	$b_1 \equiv 1$, $b_2=0$	$b_1+b_2=1$	$b_3=0$
CBO (OMB)	**b_0 unrestricted**	11.799** [0.000] (2,20) 90 1 9	19.357** [0.000] (1,20) 90 1 9	3.179 [0.087] (1,24)	3.367 [0.081] (1,20) 90 1 9	26.864** [0.000] (1,21) 90 1 2
	$b_0 = 0$	8.336** [0.001] (3,20) 90 1 9	11.946** [0.000] (2,20) 90 1 9	1.724 [0.20] (2,24)	6.960** [0.005] (2,20) 90 1 9	14.024** [0.000] (2,21) 90 1 2
	$b_0 \equiv 0$	14.030** [0.000] (2,21) 90 1 2	27.266** [0.000] (1,21) 90 1 2	0.983 [0.332] (1,23) 84 85	8.791** [0.007] (1,21) 90 1 2	10.984** [0.003] (1,24) 1
OMB (CBO)	**b_0 unrestricted**	2.364 [0.120] (2,20) 90 1 9	0.339 [0.567] (1,20) 90 1 9	7.678* [0.012] (1,20) 90 1 2 9	3.367 [0.081] (1,20) 90 1 9	76.306** [0.000] (1,21) 90 1 2
	$b_0 = 0$	8.007** [0.001] (3,20) 90 1 9	1.811 [0.189] (2,20) 90 1 9	19.509** [0.000] (2,20) 90 1 2 9	6.960** [0.005] (2,20) 90 1 9	61.003** [0.000] (2,21) 90 1 2
	$b_0 \equiv 0$	61.020** [0.000] (2,21) 90 1 2	71.464** [0.000] (1,21) 90 1 2	18.982** [0.000] (1,22) 90 1 9	8.791** [0.007] (1,21) 90 1 2	57.576** [0.000] (1,24) 1
AVE1 (CBO)	**b_0 unrestricted**	3.071 [0.069] (2,20) 90 1 9	6.141* [0.022] (1,20) 90 1 9	1.153 [0.295] (1,21) 90 1 2	3.367 [0.081] (1,20) 90 1 9	3.155 [0.090] (1,21) 90 1 2
	$b_0 = 0$	4.642* [0.013] (3,20) 90 1 9	3.085 [0.068] (2,20) 90 1 9	7.638** [0.003] (2,21) 90 1 2	6.960** [0.005] (2,20) 90 1 9	9.277** [0.001] (2,21) 90 1 2
	$b_0 \equiv 0$	9.282** [0.001] (2,21) 90 1 2	2.625 [0.120] (1,21) 90 1 2	14.814** [0.001] (1,22) 90 1 2	8.791** [0.007] (1,21) 90 1 2	4.566* [0.043] (1,24) 1
AVE1 (OMB)	**b_0 unrestricted**	3.071 [0.069] (2,20) 90 1 9	6.141* [0.022] (1,20) 90 1 9	1.253 [0.276] (1,21) 90 1 2	3.367 [0.081] (1,20) 90 1 9	3.155 [0.090] (1,21) 90 1 2
	$b_0 = 0$	4.642* [0.013] (3,20) 90 1 9	3.085 [0.068] (2,20) 90 1 9	7.720** [0.003] (2,21) 90 1 2	6.960** [0.005] (2,20) 90 1 9	9.277** [0.001] (2,21) 90 1 2
	$b_0 \equiv 0$	9.282** [0.001] (2,21) 90 1 2	2.625 [0.120] (1,21) 90 1 2	14.869** [0.001] (1,22) 90 1 2	8.791** [0.007] (1,21) 90 1 2	4.566* [0.043] (1,24) 1

Notes:

See Table 11.

Table 16. Forecast-Encompassing Test Statistics for Alternative US Federal Debt Forecasts IIS, One-step-ahead (Growth rates, 1984-2010)

Encompassing Forecast (Encompassed Forecast)	Treatment of constant term (f)	Null Hypotheses (a)-(e)				
		$b_1 = 1, b_2 = 0$	$b_2 = 0$	$b_1 \equiv 1, b_2 = 0$	$b_1 + b_2 = 1$	$b_3 = 0$
CBO (OMB)	b_0 unrestricted	13.182** [0.000] (2,20) 90 1 2	25.775** [0.000] (1,20) 90 1 2	0.274 [0.605] (1,24)	0.109 [0.744] (1,20) 90 1 2	27.418** [0.000] (1,21) 90 1 2
	$b_0 = 0$	9.149** [0.001] (3,20) 90 1 2	13.531** [0.000] (2,20) 90 1 2	0.269 [0.766] (2,24)	4.214* [0.030] (2,20) 90 1 2	14.274** [0.000] (2,21) 90 1 2
	$b_0 \equiv 0$	11.336** [0.000] (2,22) 90 1	22.60** [0.000] (1,22) 90 1	25.194** [0.000] (1,18) 86 90 1 2 3 9 10	5.235* [0.032] (1,22) 90 1	11.259** [0.003] (1,24) 1
OMB (CBO)	b_0 unrestricted	37.141** [0.000] (2,20) 90 1 2	42.103** [0.000] (1,20) 90 1 2	0.000 [1.000] (1,21) 90 1 9	0.109 [0.744] (1,20) 90 1 2	77.457** [0.000] (1,21) 90 1 2
	$b_0 = 0$	39.242** [0.000] (3,20) 90 1 2	22.951** [0.000] (2,20) 90 1 2	8.006** [0.003] (2,21) 90 1 9	4.214* [0.030] (2,20) 90 1 2	61.413** [0.000] (2,21) 90 1 2
	$b_0 \equiv 0$	43.216** [0.000] (2,22) 90 1	33.098** [0.000] (1,22) 90 1	9.468** [0.005] (1,23) 90 9	5.235* [0.032] (1,22) 90 1	57.509** [0.000] (1,24) 1
AVE1 (CBO)	b_0 unrestricted	1.576 [0.232] (2,20) 90 1 2	1.962 [0.177] (1,20) 90 1 2	4.465* [0.046] (1,23) 90	0.109 [0.744] (1,20) 90 1 2	3.177 [0.089] (1,21) 90 1 2
	$b_0 = 0$	5.903** [0.005] (3,20) 90 1 2	1.212 [0.319] (2,20) 90 1 2	4.120* [0.030] (2,23) 90	4.214* [0.030] (2,20) 90 1 2	9.190** [0.001] (2,21) 90 1 2
	$b_0 \equiv 0$	5.540* [0.011] (2,22) 90 1	0.712 [0.408] (1,22) 90 1	9.465** [0.005] (1,23) 90 1	5.235* [0.032] (1,22) 90 1	4.469* [0.045] (1,24) 1
AVE1 (OMB)	b_0 unrestricted	1.576 [0.232] (2,20) 90 1 2	1.962 [0.177] (1,20) 90 1 2	5.590* [0.027] (1,23) 90	0.109 [0.744] (1,20) 90 1 2	3.177 [0.089] (1,21) 90 1 2
	$b_0 = 0$	5.903** [0.005] (3,20) 90 1 2	1.212 [0.319] (2,20) 90 1 2	4.760* [0.019] (2,23) 90	4.214* [0.030] (2,20) 90 1 2	9.190** [0.001] (2,21) 90 1 2
	$b_0 \equiv 0$	5.540* [0.011] (2,22) 90 1	0.712 [0.408] (1,22) 90 1	11.157** [0.003] (1,23) 90 1	5.235* [0.032] (1,22) 90 1	4.469* [0.045] (1,24) 1

Notes:

See Table 11.

Table 17. Forecast-Encompassing Test Statistics for Alternative US Federal Debt Forecasts
One-step-ahead (Log levels, 1984-2008)

Encompassing Forecast (Encompassed Forecast)	Treatment of constant term (f)	Null Hypotheses (a)-(e)				
		$b_1 = 1$, $b_2 = 0$	$b_2=0$	$b_1 \equiv 1$, $b_2=0$	$b_1+b_2=1$	$b_3=0$
OMB (APB)	**b_0 unrestricted**	3.247	6.452*	0.028	2.676	3.558
		[0.058]	[0.019]	[0.868]	[0.116]	[0.072]
		(2,22)	(1,22)	(1,23)	(1,22)	(1,23)
	$b_0 = 0$	2.465	3.237	0.378	1.423	2.199
		[0.089]	[0.059]	[0.689]	[0.262]	[0.134]
		(3,22)	(2,22)	(2,23)	(2,22)	(2,23)
	$b_0 \equiv 0$	2.169	3.482	0.774	0.108	4.393*
		[0.137]	[0.075]	[0.388]	[0.746]	[0.047]
		(2,23)	(1,23)	(1,24)	(1,23)	(1,24)
APB (OMB)	**b_0 unrestricted**	1.352	1.581	1.076	2.676	0.025
		[0.280]	[0.222]	[0.310]	[0.116]	[0.875]
		(2,22)	(1,22)	(1,23)	(1,22)	(1,23)
	$b_0 = 0$	0.975	1.379	0.646	1.423	0.116
		[0.422]	[0.273]	[0.533]	[0.262]	[0.891]
		(3,22)	(2,22)	(2,23)	(2,22)	(2,23)
	$b_0 \equiv 0$	0.091	0.026	0.162	0.108	0.076
		[0.914]	[0.874]	[0.691]	[0.746]	[0.785]
		(2,23)	(1,23)	(1,24)	(1,23)	(1,24)
AVE2 (OMB)	**b_0 unrestricted**	1.899	3.613	0.161	2.676	1.046
		[0.173]	[0.070]	[0.692]	[0.116]	[0.317]
		(2,22)	(1,22)	(1,23)	(1,22)	(1,23)
	$b_0 = 0$	1.434	1.918	0.307	1.423	0.758
		[0.260]	[0.171]	[0.739]	[0.262]	[0.480]
		(3,22)	(2,22)	(2,23)	(2,22)	(2,23)
	$b_0 \equiv 0$	0.731	1.027	0.435	0.108	1.406
		[0.492]	[0.321]	[0.516]	[0.746]	[0.247]
		(2,23)	(1,23)	(1,24)	(1,23)	(1,24)
AVE2 (APB)	**b_0 unrestricted**	1.899	3.613	0.171	2.676	1.046
		[0.173]	[0.070]	[0.683]	[0.116]	[0.317]
		(2,22)	(1,22)	(1,23)	(1,22)	(1,23)
	$b_0 = 0$	1.434	1.918	0.312	1.423	0.758
		[0.260]	[0.171]	[0.735]	[0.262]	[0.480]
		(3,22)	(2,22)	(2,23)	(2,22)	(2,23)
	$b_0 \equiv 0$	0.731	1.027	0.434	0.108	1.406
		[0.492]	[0.321]	[0.516]	[0.746]	[0.247]
		(2,23)	(1,23)	(1,24)	(1,23)	(1,24)

Notes:
1. The three entries within a given block of numbers in the last five columns are: the approximate F statistic for testing the null hypothesis, the tail probability associated with that value of the F statistic (in square brackets), and the degrees of freedom for the F statistic (in parentheses).
2. The regressions for Null Hypothesis tests come from (a) Chong and Hendry (1986), (b) Chong and Hendry (1986), (c) Chong and Hendry (1986), (d) Ericsson (1993), (e) Ericsson (1992), and (f) Ericsson and Marquez (1993).
3. AVE2 in is the average of the OMB and the APB forecasts.
4. b_3 is where b_2-b_1 is constrained to equal b_3 and where b_1 is also constrained to equal unity.
5. Asterisks * and ** denote rejection at the 5% and 1% critical values.

Table 18. Forecast-Encompassing Test Statistics for Alternative US Federal Debt Forecasts
One-step-ahead (Growth rates, 1984-2008)

Encompassing Forecast (Encompassed Forecast)	Treatment of constant term (f)	Null Hypotheses (a)-(e)				
		$b_1 = 1,$ $b_2 = 0$	$b_2 = 0$	$b_1 \equiv 1,$ $b_2 = 0$	$b_1 + b_2 = 1$	$b_3 = 0$
OMB (APB)	**b_0 unrestricted**	2.343	3.772	0.454	1.846	2.739
		[0.119]	[0.065]	[0.507]	[0.188]	[0.112]
		(2,22)	(1,22)	(1,23)	(1,22)	(1,23)
	$b_0 = 0$	1.817	2.005	0.563	1.067	1.739
		[0.173]	[0.159]	[0.577]	[0.361]	[0.198]
		(3,22)	(2,22)	(2,23)	(2,22)	(2,23)
	$b_0 \equiv 0$	2.218	2.994	1.115	1.120	3.299
		[0.132]	[0.097]	[0.302]	[0.301]	[0.082]
		(2,23)	(1,23)	(1,24)	(1,23)	(1,24)
APB (OMB)	**b_0 unrestricted**	0.928	0.127	1.897	1.846	0.010
		[0.410]	[0.725]	[0.182]	[0.188]	[0.920]
		(2,22)	(1,22)	(1,23)	(1,22)	(1,23)
	$b_0 = 0$	0.711	0.507	1.094	1.067	0.139
		[0.556]	[0.609]	[0.352]	[0.361]	[0.871]
		(3,22)	(2,22)	(2,23)	(2,22)	(2,23)
	$b_0 \equiv 0$	0.560	0.001	1.161	1.120	0.000
		[0.579]	[0.979]	[0.292]	[0.301]	[0.999]
		(2,23)	(1,23)	(1,24)	(1,23)	(1,24)
AVE2 (OMB)	**b_0 unrestricted**	1.236	1.294	1.319	1.846	0.603
		[0.310]	[0.268]	[0.263]	[0.188]	[0.445]
		(2,22)	(1,22)	(1,23)	(1,22)	(1,23)
	$b_0 = 0$	0.988	0.871	0.904	1.067	0.539
		[0.417]	[0.433]	[0.419]	[0.361]	[0.591]
		(3,22)	(2,22)	(2,23)	(2,22)	(2,23)
	$b_0 \equiv 0$	0.974	0.728	1.290	1.120	0.824
		[0.393]	[0.402]	[0.267]	[0.301]	[0.373]
		(2,23)	(1,23)	(1,24)	(1,23)	(1,24)
AVE2 (APB)	**b_0 unrestricted**	1.236	1.294	1.015	1.846	0.603
		[0.310]	[0.268]	[0.324]	[0.188]	[0.445]
		(2,22)	(1,22)	(1,23)	(1,22)	(1,23)
	$b_0 = 0$	0.988	0.871	0.749	1.067	0.539
		[0.417]	[0.433]	[0.484]	[0.361]	[0.591]
		(3,22)	(2,22)	(2,23)	(2,22)	(2,23)
	$b_0 \equiv 0$	0.974	0.728	1.179	1.120	0.824
		[0.393]	[0.402]	[0.288]	[0.301]	[0.373]
		(2,23)	(1,23)	(1,24)	(1,23)	(1,24)

Notes:

See Table 17.

Table 19. Forecast-Encompassing Test Statistics for Alternative US Federal Debt Forecasts
One-step-ahead (Log levels, 1984-2009)

Encompassing Forecast (Encompassed Forecast)	Treatment of constant term (f)	Null Hypotheses (a)-(e)				
		$b_1 = 1$, $b_2 = 0$	$b_2=0$	$b_1\equiv1$, $b_2=0$	$b_1+b_2=1$	$b_3=0$
OMB (APB)	**b_0 unrestricted**	20.741**	35.564**	2.246	4.013	33.290**
		[0.000]	[0.000]	[0.147]	[0.057]	[0.000]
		(2,23)	(1,23)	(1,24)	(1,23)	(1,24)
	$b_0 = 0$	15.394**	20.412**	2.079	2.045	18.732**
		[0.000]	[0.000]	[0.147]	[0.152]	[0.000]
		(3,23)	(2,23)	(2,24)	(2,23)	(2,24)
	$b_0 \equiv 0$	18.680**	32.609**	2.085	0.027	38.845**
		[0.000]	[0.000]	[0.161]	[0.870]	[0.000]
		(2,24)	(1,24)	(1,25)	(1,24)	(1,25)
APB (OMB)	**b_0 unrestricted**	4.766*	9.529**	0.000	4.013	4.903*
		[0.019]	[0.005]	[0.995]	[0.057]	[0.037]
		(2,23)	(1,23)	(1,24)	(1,23)	(1,24)
	$b_0 = 0$	3.517*	4.771*	0.376	2.045	2.904
		[0.031]	[0.019]	[0.691]	[0.152]	[0.074]
		(3,23)	(2,23)	(2,24)	(2,23)	(2,24)
	$b_0 \equiv 0$	2.879	4.863*	0.780	0.027	5.963*
		[0.076]	[0.037]	[0.386]	[0.870]	[0.022]
		(2,24)	(1,24)	(1,25)	(1,24)	(1,25)
AVE2 (OMB)	**b_0 unrestricted**	10.975**	20.555**	0.812	4.013	15.936**
		[0.001]	[0.000]	[0.377]	[0.057]	[0.001]
		(2,23)	(1,23)	(1,24)	(1,23)	(1,24)
	$b_0 = 0$	8.158**	10.861**	1.102	2.045	9.089**
		[0.001]	[0.001]	[0.348]	[0.152]	[0.001]
		(3,23)	(2,23)	(2,24)	(2,23)	(2,24)
	$b_0 \equiv 0$	9.054**	15.667**	1.542	0.027	18.812**
		[0.001]	[0.001]	[0.226]	[0.870]	[0.000]
		(2,24)	(1,24)	(1,25)	(1,24)	(1,25)
AVE2 (APB)	**b_0 unrestricted**	10.975**	20.555**	0.726	4.013	15.936**
		[0.001]	[0.000]	[0.403]	[0.057]	[0.001]
		(2,23)	(1,23)	(1,24)	(1,23)	(1,24)
	$b_0 = 0$	8.158**	10.861**	1.057	2.045	9.089**
		[0.001]	[0.001]	[0.363]	[0.152]	[0.001]
		(3,23)	(2,23)	(2,24)	(2,23)	(2,24)
	$b_0 \equiv 0$	9.054**	15.667**	1.533	0.027	18.812**
		[0.001]	[0.001]	[0.227]	[0.870]	[0.000]
		(2,24)	(1,24)	(1,25)	(1,24)	(1,25)

Notes:

See Table 17.

Table 20. Forecast-Encompassing Test Statistics for Alternative US Federal Debt Forecasts
One-step-ahead (Growth rates, 1984-2009)

Encompassing Forecast (Encompassed Forecast)	Treatment of constant term (f)	Null Hypotheses (a)-(e)				
		$b_1 = 1, b_2 = 0$	$b_2=0$	$b_1\equiv1, b_2=0$	$b_1+b_2=1$	$b_3=0$
OMB (APB)	b_0 **unrestricted**	18.525**	17.109**	6.775*	3.510	30.364**
		[0.000]	[0.000]	[0.016]	[0.074]	[0.000]
		(2,23)	(1,23)	(1,24)	(1,23)	(1,24)
	$b_0 = 0$	13.746**	12.642**	4.461*	1.858	17.079**
		[0.000]	[0.000]	[0.023]	[0.179]	[0.000]
		(3,23)	(2,23)	(2,24)	(2,23)	(2,24)
	$b_0 \equiv 0$	18.841**	22.362**	6.036*	1.654	35.111**
		[0.000]	[0.000]	[0.021]	[0.211]	[0.000]
		(2,24)	(1,24)	(1,25)	(1,24)	(1,25)
APB (OMB)	b_0 **unrestricted**	3.957*	1.918	7.125*	3.510	3.987
		[0.033]	[0.179]	[0.013]	[0.074]	[0.057]
		(2,23)	(1,23)	(1,24)	(1,23)	(1,24)
	$b_0 = 0$	30.000	2.326	4.109*	1.858	2.485
		[0.051]	[0.120]	[0.029]	[0.179]	[0.105]
		(3,23)	(2,23)	(2,24)	(2,23)	(2,24)
	$b_0 \equiv 0$	3.364	2.552	4.580*	1.654	4.944*
		[0.052]	[0.123]	[0.042]	[0.211]	[0.035]
		(2,24)	(1,24)	(1,25)	(1,24)	(1,25)
AVE2 (OMB)	b_0 **unrestricted**	9.536**	8.002**	10.369**	3.510	14.089**
		[0.001]	[0.010]	[0.004]	[0.074]	[0.001]
		(2,23)	(1,23)	(1,24)	(1,23)	(1,24)
	$b_0 = 0$	7.153**	6.329**	6.159**	1.858	8.125**
		[0.002]	[0.007]	[0.007]	[0.179]	[0.002]
		(3,23)	(2,23)	(2,24)	(2,23)	(2,24)
	$b_0 \equiv 0$	9.345**	10.240**	6.952*	1.654	16.601**
		[0.001]	[0.004]	[0.014]	[0.211]	[0.000]
		(2,24)	(1,24)	(1,25)	(1,24)	(1,25)
AVE2 (APB)	b_0 **unrestricted**	9.536**	8.002**	6.768*	3.510	14.089**
		[0.001]	[0.010]	[0.016]	[0.074]	[0.001]
		(2,23)	(1,23)	(1,24)	(1,23)	(1,24)
	$b_0 = 0$	7.153**	6.329**	4.257*	1.858	8.125**
		[0.002]	[0.007]	[0.026]	[0.179]	[0.002]
		(3,23)	(2,23)	(2,24)	(2,23)	(2,24)
	$b_0 \equiv 0$	9.345**	10.240**	5.399*	1.654	16.601**
		[0.001]	[0.004]	[0.029]	[0.211]	[0.000]
		(2,24)	(1,24)	(1,25)	(1,24)	(1,25)

Notes:

See Table 17.

Table 21. Forecast-Encompassing Test Statistics for Alternative US Federal Debt Forecasts
One-step-ahead (Log levels, 1984-2010)

Encompassing Forecast (Encompassed Forecast)	Treatment of constant term (f)	Null Hypotheses (a)-(e)				
		$b_1 = 1, b_2 = 0$	$b_2=0$	$b_1\equiv1, b_2=0$	$b_1+b_2=1$	$b_3=0$
OMB (APB)	b_0 **unrestricted**	20.096**	33.370**	2.780	2.674	35.164**
		[0.000]	[0.000]	[0.108]	[0.115]	[0.000]
		(2,24)	(1,24)	(1,25)	(1,24)	(1,25)
	$b_0 = 0$	15.293**	19.689**	2.621	1.398	20.248**
		[0.000]	[0.000]	[0.093]	[0.267]	[0.000]
		(3,24)	(2,24)	(2,25)	(2,24)	(2,25)
	$b_0 \equiv 0$	20.181**	34.280**	2.653	0.064	41.804**
		[0.000]	[0.000]	[0.115]	[0.803]	[0.000]
		(2,25)	(1,25)	(1,26)	(1,25)	(1,26)
APB (OMB)	b_0 **unrestricted**	4.161*	8.281**	0.044	2.674	5.293*
		[0.028]	[0.008]	[0.835]	[0.115]	[0.030]
		(2,24)	(1,24)	(1,25)	(1,24)	(1,25)
	$b_0 = 0$	3.215*	4.148*	0.535	1.398	3.267
		[0.041]	[0.028]	[0.592]	[0.267]	[0.055]
		(3,24)	(2,24)	(2,25)	(2,24)	(2,25)
	$b_0 \equiv 0$	3.235	5.209*	1.091	0.064	6.646*
		[0.056]	[0.031]	[0.306]	[0.803]	[0.016]
		(2,25)	(1,25)	(1,26)	(1,25)	(1,26)
AVE2 (OMB)	b_0 **unrestricted**	10.372**	18.793**	1.189	2.674	16.936**
		[0.001]	[0.000]	[0.286]	[0.115]	[0.000]
		(2,24)	(1,24)	(1,25)	(1,24)	(1,25)
	$b_0 = 0$	7.956**	10.214**	1.509	1.398	9.932**
		[0.001]	[0.001]	[0.241]	[0.267]	[0.001]
		(3,24)	(2,24)	(2,25)	(2,24)	(2,25)
	$b_0 \equiv 0$	9.887**	16.557**	2.018	0.064	20.446**
		[0.001]	[0.000]	[0.167]	[0.803]	[0.000]
		(2,25)	(1,25)	(1,26)	(1,25)	(1,26)
AVE2 (APB)	b_0 **unrestricted**	10.372**	18.793**	1.091	2.674	16.936**
		[0.001]	[0.000]	[0.306]	[0.115]	[0.000]
		(2,24)	(1,24)	(1,25)	(1,24)	(1,25)
	$b_0 = 0$	7.956**	10.214**	1.456	1.398	9.932**
		[0.001]	[0.001]	[0.252]	[0.267]	[0.001]
		(3,24)	(2,24)	(2,25)	(2,24)	(2,25)
	$b_0 \equiv 0$	9.887**	16.557**	2.008	0.064	20.446**
		[0.001]	[0.000]	[0.168]	[0.803]	[0.000]
		(2,25)	(1,25)	(1,26)	(1,25)	(1,26)

Notes:

See Table 17.

Table 22. Forecast-Encompassing Test Statistics for Alternative US Federal Debt Forecasts
One-step-ahead (Growth rates, 1984-2010)

Encompassing Forecast (Encompassed Forecast)	Treatment of constant term (f)	Null Hypotheses (a)-(e)				
		$b_1 = 1$, $b_2 = 0$	$b_2=0$	$b_1 \equiv 1$, $b_2=0$	$b_1+b_2=1$	$b_3=0$
OMB (APB)	b_0 **unrestricted**	19.119** [0.000] (2,24)	16.913** [0.000] (1,24)	7.575* [0.011] (1,25)	4.819* [0.038] (1,24)	28.992** [0.000] (1,25)
	$b_0 = 0$	14.512** [0.000] (3,24)	12.654** [0.000] (2,24)	5.174* [0.013] (2,25)	2.685 [0.089] (2,24)	16.794** [0.000] (2,25)
	$b_0 \equiv 0$	19.436** [0.000] (2,25)	21.632** [0.000] (1,25)	7.202* [0.013] (1,26)	2.775 [0.108] (1,25)	33.788** [0.000] (1,26)
APB (OMB)	b_0 **unrestricted**	4.501* [0.022] (2,24)	1.705 [0.204] (1,24)	8.485** [0.007] (1,25)	4.819* [0.038] (1,24)	3.629 [0.068] (1,25)
	$b_0 = 0$	3.573* [0.029] (3,24)	2.401 [0.112] (2,24)	5.114* [0.014] (2,25)	2.685 [0.089] (2,24)	2.560 [0.097] (2,25)
	$b_0 \equiv 0$	3.918* [0.033] (2,25)	2.239 [0.147] (1,25)	6.047* [0.021] (1,26)	2.775 [0.108] (1,25)	4.736* [0.039] (1,26)
AVE2 (OMB)	b_0 **unrestricted**	10.066** [0.001] (2,24)	7.688* [0.011] (1,24)	11.737** [0.002] (1,25)	4.819* [0.038] (1,24)	13.284** [0.001] (1,25)
	$b_0 = 0$	7.798** [0.001] (3,24)	6.323** [0.006] (2,24)	7.226** [0.003] (2,25)	2.685 [0.089] (2,24)	8.057** [0.002] (2,25)
	$b_0 \equiv 0$	9.911** [0.001] (2,25)	9.657** [0.005] (1,25)	8.483** [0.007] (1,26)	2.775 [0.108] (1,25)	15.956** [0.001] (1,26)
AVE2 (APB)	b_0 **unrestricted**	10.066** [0.001] (2,24)	7.688* [0.011] (1,24)	7.884** [0.010] (1,25)	4.819* [0.038] (1,24)	13.284** [0.001] (1,25)
	$b_0 = 0$	7.798** [0.001] (3,24)	6.323** [0.006] (2,24)	5.158* [0.013] (2,25)	2.685 [0.089] (2,24)	8.057** [0.002] (2,25)
	$b_0 \equiv 0$	9.911** [0.001] (2,25)	9.657** [0.005] (1,25)	6.775* [0.015] (1,26)	2.775 [0.108] (1,25)	15.956** [0.001] (1,26)

Notes:

See Table 17.

Table 23. Forecast-Encompassing Test Statistics for Alternative US Federal Debt Forecasts IIS, One-step-ahead (Log levels, 1984-2008)

Encompassing Forecast (Encompassed Forecast)	Treatment of constant term (f)	Null Hypotheses (a)-(e)				
		$b_1 = 1,$ $b_2 = 0$	$b_2 = 0$	$b_1 \equiv 1,$ $b_2 = 0$	$b_1 + b_2 = 1$	$b_3 = 0$
OMB (APB)	b_0 unrestricted	4.847* [0.019] (2,21)	7.842* [0.011] (1,21)	2.618 [0.121] (1,20) 90 1	0.928 [0.346] (1,21)	10.710** [0.004] (1,21) 1
	$b_0 = 0$	4.318* [0.016] (3,21)	4.709* [0.020] (2,21)	9.284** [0.001] (2,20) 90 1	1.057 [0.365] (2,21)	9.098** [0.001] (2,21) 1
	$b_0 \equiv 0$	9.016** [0.002] (2,21) 1	9.970** [0.005] (1,21) 1	15.969** [0.001] (1,21) 1	3.482 [0.076] (1,21)	10.789** [0.003] (1,23)
APB (OMB)	b_0 unrestricted	0.796 [0.464] (2,21)	1.573 [0.224] (1,21)	0.031 [0.862] (1,21)	0.928 [0.346] (1,21)	0.578 [0.456] (1,21) 1
	$b_0 = 0$	1.100 [0.371] (3,21)	0.809 [0.459] (2,21)	2.228 [0.133] (2,21) 1	1.057 [0.365] (2,21)	2.559 [0.101] (2,21) 1
	$b_0 \equiv 0$	2.504 [0.106] (2,21) 1	0.460 [0.505] (1,21) 1	4.664* [0.042] (1,22) 1	3.482 [0.076] (1,21) 1	1.181 [0.288] (1,23)
AVE2 (OMB)	b_0 unrestricted	2.246 [0.131] (2,21)	4.120 [0.055] (1,21)	0.508 [0.484] (1,20) 90 1	0.928 [0.346] (1,21)	4.066 [0.057] (1,21) 1
	$b_0 = 0$	2.305 [0.106] (3,21)	2.195 [0.136] (2,21)	6.371** [0.007] (2,20) 90 1	1.057 [0.365] (2,21)	4.993* [0.017] (2,21) 1
	$b_0 \equiv 0$	4.928* [0.018] (2,21) 1	3.679 [0.069] (1,21) 1	12.945** [0.002] (1,21) 90 1	3.482 [0.076] (1,21) 1	4.777* [0.039] (1,23)
AVE2 (APB)	b_0 unrestricted	2.246 [0.131] (2,21)	4.120 [0.055] (1,21)	0.511 [0.483] (1,20) 90 1	0.928 [0.346] (1,21)	4.066 [0.057] (1,21) 1
	$b_0 = 0$	2.305 [0.106] (3,21)	2.195 [0.136] (2,21)	6.373** [0.007] (2,20) 90 1	1.057 [0.365] (2,21)	4.993* [0.017] (2,21) 1
	$b_0 \equiv 0$	4.928* [0.018] (2,21) 1	3.679 [0.069] (1,21) 1	12.944** [0.002] (1,21) 90 1	3.482 [0.076] (1,21) 86 90 0 1 2 3	4.777* [0.039] (1,23)

Notes:
1. The four entries within a given block of numbers in the last five columns are: the approximate F statistic for testing the null hypothesis, the tail probability associated with that value of the F statistic (in square brackets), the degrees of freedom for the F statistic (in parentheses), and the dummies that were found significant using IIS at the 1% level (2008 not shown because it occurs in every equation).
2. The regressions for Null Hypothesis tests come from (a) Chong and Hendry (1986), (b) Chong and Hendry (1986), (c) Chong and Hendry (1986), (d) Ericsson (1993), (e) Ericsson (1992), and (f) Ericsson and Marquez (1993).
3. AVE2 is the average of the OMB and the APB forecasts.
4. b_3 is where $b_2 - b_1$ is constrained to equal b_3 and where b_1 is also constrained to equal unity.
5. Asterisks * and ** denote rejection at the 5% and 1% critical values.

Table 24. Forecast-Encompassing Test Statistics for Alternative US Federal Debt Forecasts IIS, One-step-ahead (Growth rates, 1984-2008)

Encompassing Forecast (Encompassed Forecast)	Treatment of constant term (f)	Null Hypotheses (a)-(e) $b_1 = 1, b_2 = 0$	$b_2=0$	$b_1\equiv 1, b_2=0$	$b_1+b_2=1$	$b_3=0$
OMB (APB)	b_0 unrestricted	9.518** [0.001] (2,20) 0	16.514** [0.001] (1,20) 0	0.117 [0.736] (1,20) 90 1	7.923* [0.011] (1,20) 0	1.825 [0.192] (1,20) 90 1
	$b_0 = 0$	7.444** [0.002] (3,20) 0	8.509** [0.002] (2,20) 0	6.978** [0.005] (2,20) 90 1	4.578* [0.023] (2,20) 0	8.420** [0.002] (2,20) 90 1
	$b_0 \equiv 0$	40.659** [0.000] (2,16) 86 90 0 1 2 3	25.104** [0.000] (1,16) 86 90 0 1 2 3	7.102* [0.014] (1,22) 90	49.230** [0.000] (1,16) 86 90 0 1 2 3	8.233** [0.009] (1,23)
APB (OMB)	b_0 unrestricted	4.348* [0.027] (2,20) 0	4.030 [0.058] (1,20) 0	2.626 [0.119] (1,22)	7.923* [0.011] (1,20) 0	1.282 [0.271] (1,20) 90 1
	$b_0 = 0$	3.473* [0.035] (3,20) 0	2.981 [0.074] (2,20) 0	2.350 [0.119] (2,22)	4.578* [0.023] (2,20) 0	5.352* [0.014] (2,20) 90 1
	$b_0 \equiv 0$	25.837** [0.000] (2,16) 86 90 0 1 2 3	1.620 [0.221] (1,16) 86 90 0 1 2 3	4.065 [0.056] (1,23)	49.230** [0.000] (1,16) 86 90 0 1 2 3	0.506 [0.484] (1,23)
AVE2 (OMB)	b_0 unrestricted	6.180** [0.008] (2,20) 0	9.097** [0.007] (1,20) 0	0.035 [0.853] (1,20) 90 1	7.923* [0.011] (1,20) 0	0.012 [0.914] (1,20) 90 1
	$b_0 = 0$	4.936* [0.010] (3,20) 0	5.037* [0.017] (2,20) 0	6.053** [0.009] (2,20) 90 1	4.578* [0.023] (2,20) 0	6.034** [0.009] (2,20) 90 1
	$b_0 \equiv 0$	31.146** [0.000] (2,16) 86 90 0 1 2 3	9.895** [0.006] (1,16) 86 90 0 1 2 3	10.390** [0.004] (1,21) 90 1	49.230** [0.000] (1,16) 86 90 0 1 2 3	3.205 [0.087] (1,23)
AVE2 (APB)	b_0 unrestricted	6.180** [0.008] (2,20) 0	9.097** [0.007] (1,20) 0	0.028 [0.869] (1,20) 90 1	7.923* [0.011] (1,20) 0	0.012 [0.914] (1,20) 90 1
	$b_0 = 0$	4.936* [0.010] (3,20) 0	5.037* [0.017] (2,20) 0	6.047** [0.009] (2,20) 90 1	4.578* [0.023] (2,20) 0	6.034** [0.009] (2,20) 90 1
	$b_0 \equiv 0$	31.146** [0.000] (2,16) 86 90 0 1 2 3	9.895** [0.006] (1,16) 86 90 0 1 2 3	10.052** [0.005] (1,21) 90 1	49.230** [0.000] (1,16) 86 90 0 1 2 3	3.205 [0.087] (1,23)

Notes:

See Table 23.

Table 25. Forecast-Encompassing Test Statistics for Alternative US Federal Debt Forecasts IIS, One-step-ahead (Log levels, 1984-2009)

Encompassing Forecast (Encompassed Forecast)	Treatment of constant term (f)	Null Hypotheses (a)-(e)				
		$b_1 = 1,$ $b_2 = 0$	$b_2=0$	$b_1 \equiv 1,$ $b_2=0$	$b_1+b_2=1$	$b_3=0$
OMB (APB)	b_0 unrestricted	29.730** [0.000] (2,22)	42.418** [0.000] (1,22)	2.618 [0.121] (1,20) 90 1 9	1.447 [0.242] (1,22)	72.995** [0.000] (1,22) 1
	$b_0 = 0$	23.492** [0.000] (3,22)	28.882** [0.000] (2,22)	9.284** [0.001] (2,20) 90 1 9	1.270 [0.301] (2,22)	46.447** [0.000] (2,22) 1
	$b_0 \equiv 0$	46.019** [0.000] (2,22) 1	69.483** [0.000] (1,22) 1	15.969** [0.001] (1,21) 90 1 9	3.087 [0.093] (1,22) 1	66.441** [0.000] (1,24)
APB (OMB)	b_0 unrestricted	5.320* [0.013] (2,22)	9.525** [0.005] (1,22)	0.031 [0.862] (1,21) 1 9	1.447 [0.242] (1,22)	10.753** [0.003] (1,22) 1
	$b_0 = 0$	4.849** [0.010] (3,22)	5.199* [0.014] (2,22)	2.228 [0.133] (2,21) 1 9	1.270 [0.301] (2,22)	9.514** [0.001] (2,22) 1
	$b_0 \equiv 0$	9.361** [0.001] (2,22) 1	10.011** [0.005] (1,22) 1	4.664* [0.042] (1,22) 1 9	3.087 [0.093] (1,22) 1	11.743** [0.002] (1,24)
AVE2 (OMB)	b_0 unrestricted	14.897** [0.000] (2,22)	23.139** [0.000] (1,22)	0.508 [0.484] (1,20) 90 1 9	1.447 [0.242] (1,22)	34.945** [0.000] (1,22) 1
	$b_0 = 0$	12.269** [0.000] (3,22)	14.483** [0.000] (2,22)	6.371** [0.007] (2,20) 90 1 9	1.270 [0.301] (2,22)	24.202** [0.000] (2,22) 1
	$b_0 \equiv 0$	23.940** [0.000] (2,22) 1	33.067** [0.000] (1,22) 1	12.945** [0.002] (1,21) 90 1 9	3.087 [0.093] (1,22) 1	33.512** [0.000] (1,24)
AVE2 (APB)	b_0 unrestricted	14.897** [0.000] (2,22)	23.139** [0.000] (1,22)	0.511 [0.483] (1,20) 90 1 9	1.447 [0.242] (1,22)	34.945** [0.000] (1,22) 1
	$b_0 = 0$	12.269** [0.000] (3,22)	14.483** [0.000] (2,22)	6.373** [0.007] (2,20) 90 1 9	1.270 [0.301] (2,22)	24.202** [0.000] (2,22) 1
	$b_0 \equiv 0$	23.940** [0.000] (2,22) 1	33.067** [0.000] (1,22) 1	12.944** [0.002] (1,21) 90 1 9	3.087 [0.093] (1,22) 86 90 0 1 2 3	33.512** [0.000] (1,24)

Notes:

See Table 23.

Table 26. Forecast-Encompassing Test Statistics for Alternative US Federal Debt Forecasts IIS, One-step-ahead (Growth rates, 1984-2009)

Encompassing Forecast (Encompassed Forecast)	Treatment of constant term (f)	Null Hypotheses (a)-(e)				
		$b_1 = 1, b_2 = 0$	$b_2=0$	$b_1 \equiv 1, b_2=0$	$b_1+b_2=1$	$b_3=0$
OMB (APB)	b_0 unrestricted	120.04** [0.000] (2,16) 86 90 0 1 2 3	110.99** [0.000] (1,16) 86 90 0 1 2 3	0.117 [0.736] (1,20) 90 1 9	15.497** [0.001] (1,16) 86 90 0 1 2 3	65.473** [0.000] (1,22) 1
	$b_0 = 0$	125.27** [0.000] (3,16) 86 90 0 1 2 3	66.594** [0.000] (2,16) 86 90 0 1 2 3	6.978** [0.005] (2,20) 90 1 9	26.595** [0.000] (2,16) 86 90 0 1 2 3	41.655** [0.000] (2,22) 1
	$b_0 \equiv 0$	35.894** [0.000] (2,23)	39.948** [0.000] (1,23)	7.102* [0.014] (1,22) 90 9	4.627* [0.042] (1,23)	69.963** [0.000] (1,23) 1
APB (OMB)	b_0 unrestricted	20.871** [0.000] (2,16) 86 90 0 1 2 3	11.364** [0.004] (1,16) 86 90 0 1 2 3	9.881** [0.005] (1,23)	15.497** [0.001] (1,16) 86 90 0 1 2 3	8.784** [0.007] (1,22) 1
	$b_0 = 0$	36.633** [0.000] (3,16) 86 90 0 1 2 3	6.568** [0.008] (2,16) 86 90 0 1 2 3	7.060** [0.004] (2,23)	26.595** [0.000] (2,16) 86 90 0 1 2 3	8.502** [0.002] (2,22) 1
	$b_0 \equiv 0$	7.833** [0.003] (2,23)	5.243* [0.032] (1,23)	10.467** [0.004] (1,24)	4.627* [0.042] (1,23)	11.431** [0.003] (1,23) 1
AVE2 (OMB)	b_0 unrestricted	58.296** [0.000] (2,16) 86 90 0 1 2 3	51.398** [0.000] (1,16) 86 90 0 1 2 3	0.035 [0.853] (1,20) 90 1 9	15.497** [0.001] (1,16) 86 90 0 1 2 3	30.556** [0.000] (1,22) 1
	$b_0 = 0$	71.883** [0.000] (3,16) 86 90 0 1 2 3	29.492** [0.000] (2,16) 86 90 0 1 2 3	6.053** [0.009] (2,20) 90 1 9	26.595** [0.000] (2,16) 86 90 0 1 2 3	21.562** [0.000] (2,22) 1
	$b_0 \equiv 0$	18.895** [0.000] (2,23)	18.942** [0.000] (1,23)	10.390** [0.004] (1,21) 90 1 9	4.627* [0.042] (1,23)	34.488** [0.000] (1,23) 1
AVE2 (APB)	b_0 unrestricted	58.296** [0.000] (2,16) 86 90 0 1 2 3	51.398** [0.000] (1,16) 86 90 0 1 2 3	0.028 [0.869] (1,20) 90 1 9	15.497** [0.001] (1,16) 86 90 0 1 2 3	30.556** [0.000] (1,22) 1
	$b_0 = 0$	71.883** [0.000] (3,16) 86 90 0 1 2 3	29.492** [0.000] (2,16) 86 90 0 1 2 3	6.047** [0.009] (2,20) 90 1 9	26.595** [0.000] (2,16) 86 90 0 1 2 3	21.562** [0.000] (2,22) 1
	$b_0 \equiv 0$	18.895** [0.000] (2,23)	18.942** [0.000] (1,23)	10.052** [0.005] (1,21) 90 1 9	4.627* [0.042] (1,23)	34.488** [0.000] (1,23) 1

Notes:

See Table 23.

Table 27. Forecast-Encompassing Test Statistics for Alternative US Federal Debt Forecasts IIS, One-step-ahead (Log levels, 1984-2010)

Encompassing Forecast (Encompassed Forecast)	Treatment of constant term (f)	Null Hypotheses (a)-(e)				
		$b_1 = 1$, $b_2 = 0$	$b_2=0$	$b_1\equiv1$, $b_2=0$	$b_1+b_2=1$	$b_3=0$
OMB (APB)	b_0 unrestricted	37.802** [0.000] (2,22) 1	49.290** [0.000] (1,22) 1	7.658* [0.012] (1,20) 90 1 2 9	0.434 [0.517] (1,22) 1	77.066** [0.000] (1,23) 1
	$b_0 = 0$	32.930** [0.000] (3,22) 1	36.171** [0.000] (2,22) 1	19.487** [0.000] (2,20) 90 1 2 9	2.035 [0.155] (2,22) 1	50.419** [0.000] (2,23) 1
	$b_0 \equiv 0$	50.027** [0.000] (2,23) 1	73.109** [0.000] (1,23) 1	18.985** [0.000] (1,22) 90 1 9	3.558 [0.072] (1,23) 1	71.185** [0.000] (1,25) 1
APB (OMB)	b_0 unrestricted	5.820** [0.009] (2,22) 1	8.973** [0.007] (1,22) 1	0.251 [0.622] (1,22) 1 9	0.434 [0.517] (1,22) 1	11.488** [0.003] (1,23) 1
	$b_0 = 0$	7.062** [0.002] (3,22) 1	5.506* [0.012] (2,22) 1	2.870 [0.078] (2,22) 1 9	2.035 [0.155] (2,22) 1	10.638** [0.001] (2,23) 1
	$b_0 \equiv 0$	10.497** [0.001] (2,23) 1	10.630** [0.003] (1,23) 1	5.839* [0.024] (1,23) 1 9	3.558 [0.072] (1,23) 1	12.930** [0.001] (1,25) 1
AVE2 (OMB)	b_0 unrestricted	18.269** [0.000] (2,22) 1	25.196** [0.000] (1,22) 1	1.311 [0.265] (1,21) 90 1 9	0.434 [0.517] (1,22) 1	37.016** [0.000] (1,23) 1
	$b_0 = 0$	17.387** [0.000] (3,22) 1	17.408** [0.000] (2,22) 1	8.117** [0.002] (2,21) 90 1 9	2.035 [0.155] (2,22) 1	26.516** [0.000] (2,23) 1
	$b_0 \equiv 0$	26.275** [0.000] (2,23) 1	34.880** [0.000] (1,23) 1	15.567** [0.001] (1,22) 90 1 9	3.558 [0.072] (1,23) 1	36.198** [0.000] (1,25) 1
AVE2 (APB)	b_0 unrestricted	18.269** [0.000] (2,22) 1	25.196** [0.000] (1,22) 1	1.315 [0.264] (1,21) 90 1 9	0.434 [0.517] (1,22) 1	37.016** [0.000] (1,23) 1
	$b_0 = 0$	17.387** [0.000] (3,22) 1	17.408** [0.000] (2,22) 1	8.121** [0.002] (2,21) 90 1 9	2.035 [0.155] (2,22) 1	26.516** [0.000] (2,23) 1
	$b_0 \equiv 0$	26.275** [0.000] (2,23) 1	34.880** [0.000] (1,23) 1	15.564** [0.001] (1,22) 90 1 9	3.558 [0.072] (1,23) 1	36.198** [0.000] (1,25) 1

Notes:

See Table 23.

Table 28. Forecast-Encompassing Test Statistics for Alternative US Federal Debt Forecasts IIS, One-step-ahead (Growth rates, 1984-2010)

Encompassing Forecast (Encompassed Forecast)	Treatment of constant term (f)	Null Hypotheses (a)-(e)				
		$b_1 = 1,$ $b_2 = 0$	$b_2=0$	$b_1 \equiv 1,$ $b_2=0$	$b_1+b_2=1$	$b_3=0$
OMB (APB)	b_0 unrestricted	117.52** [0.000] (2,17) 86 90 0 1 2 3	108.90** [0.000] (1,17) 86 90 0 1 2 3	0.018 [0.894] (1,21) 90 1 9	20.164** [0.000] (1,17) 86 90 0 1 2 3	60.561** [0.000] (1,23) 1
	$b_0 = 0$	127.27** [0.000] (3,17) 86 90 0 1 2 3	64.779** [0.000] (2,17) 86 90 0 1 2 3	8.022** [0.003] (2,21) 90 1 9	33.661** [0.000] (2,17) 86 90 0 1 2 3	39.954** [0.000] (2,23) 1
	$b_0 \equiv 0$	36.676** [0.000] (2,24)	38.539** [0.000] (1,24)	12.769** [0.002] (1,22) 90 1 9	6.825* [0.015] (1,24)	53.955** [0.000] (1,25)
APB (OMB)	b_0 unrestricted	21.953** [0.000] (2,17) 86 90 0 1 2 3	10.057** [0.006] (1,17) 86 90 0 1 2 3	11.644** [0.002] (1,24)	20.164** [0.000] (1,17) 86 90 0 1 2 3	7.809* [0.010] (1,23) 1
	$b_0 = 0$	40.796** [0.000] (3,17) 86 90 0 1 2 3	6.029* [0.011] (2,17) 86 90 0 1 2 3	8.706** [0.001] (2,24)	33.661** [0.000] (2,17) 86 90 0 1 2 3	8.753** [0.002] (2,23) 1
	$b_0 \equiv 0$	8.859** [0.001] (2,24)	4.698* [0.040] (1,24)	52.738** [0.000] (1,21) 86 90 1 2	6.825* [0.015] (1,24)	8.834** [0.007] (1,25)
AVE2 (OMB)	b_0 unrestricted	57.764** [0.000] (2,17) 86 90 0 1 2 3	49.014** [0.000] (1,17) 86 90 0 1 2 3	0.465 [0.502] (1,21) 90 1 9	20.164** [0.000] (1,17) 86 90 0 1 2 3	27.966** [0.000] (1,23) 1
	$b_0 = 0$	75.171** [0.000] (3,17) 86 90 0 1 2 3	28.151** [0.000] (2,17) 86 90 0 1 2 3	7.444** [0.004] (2,21) 90 1 9	33.661** [0.000] (2,17) 86 90 0 1 2 3	21.037** [0.000] (2,23) 1
	$b_0 \equiv 0$	19.820** [0.000] (2,24)	17.90** [0.000] (1,24)	14.201** [0.001] (1,22) 90 1 9	6.825* [0.015] (1,24)	26.613** [0.000] (1,25)
AVE2 (APB)	b_0 unrestricted	57.764** [0.000] (2,17) 86 90 0 1 2 3	49.014** [0.000] (1,17) 86 90 0 1 2 3	0.431 [0.519] (1,21) 90 1 9	20.164** [0.000] (1,17) 86 90 0 1 2 3	27.966** [0.000] (1,23) 1
	$b_0 = 0$	75.171** [0.000] (3,17) 86 90 0 1 2 3	28.151** [0.000] (2,17) 86 90 0 1 2 3	7.415** [0.004] (2,21) 90 1 9	33.661** [0.000] (2,17) 86 90 0 1 2 3	21.037** [0.000] (2,23) 1
	$b_0 \equiv 0$	19.820** [0.000] (2,24)	17.90** [0.000] (1,24)	13.828** [0.001] (1,22) 90 1 9	6.825* [0.015] (1,24)	26.613** [0.000] (1,25)

Notes:

See Table 23.

Table 29. Comparing Forecast Encompassing Equations: OMB vs. CBO

#	Equations (1984-2008)	Sigma
1	`LDEBTB = + 0.0678 - 0.6941*LCBODF1 + 1.685*LOMBDF1` `(SE)      (0.0709) (0.5755)         (0.5692)`	0.0146
2	`LDEBTB = - 0.3001*LCBODF1 + 1.3*LOMBDF1` `(SE)      (0.4012)       (0.4010)`	0.0146
3	`LCBORESID = - 0.0037 + 1.2686*LOMBDF1-LCBODF1` `(SE)        (0.0034) (0.3919)`	0.0146
4	`LCBORESID = + 1.0563*LOMBDF1-LCBODF1` `(SE)        (0.3412)`	0.0147
5	`DLDEBTB = + 0.0015 - 0.1891*DLCBODF1 + 1.1312*DLOMBDF1` `(SE)       (0.0086) (0.4068)          (0.4337)`	0.0147
6	`DLDEBTB = - 0.2252*DLCBODF1 + 1.1813*DLOMBDF1` `(SE)       (0.3574)          (0.3470)`	0.0144
7	`DLCBORESID = - 0.0035 + 1.2665*DLOMBDF1-DLCBODF1` `(SE)         (0.0034) (0.3891)`	0.0146
8	`DLCBORESID = + 1.0656*DLOMBDF1-DLCBODF1` `(SE)         (0.3397)`	0.0146

#	Equations (1984-2010)	Sigma
1	`LDEBTB = - 0.0436 + 0.6916*LCBODF1 + 0.3136*LOMBDF1` `(SE)      (0.0588) (0.1778)         (0.1735)`	0.0159
2	`LDEBTB = + 0.6119*LCBODF1 + 0.3881*LOMBDF1` `(SE)      (0.1403)        (0.1401)`	0.0157
3	`LCBORESID = - 0.0002 + 0.3903*LOMBDF1-LCBODF1` `(SE)        (0.0033) (0.1377)`	0.0157
4	`LCBORESID = + 0.3864*LOMBDF1-LCBODF1` `(SE)        (0.1240)`	0.0154
5	`DLDEBTB = + 0.0093 + 0.4464*DLCBODF1 + 0.4327*DLOMBDF1` `(SE)       (0.0063) (0.1622)          (0.1345)`	0.0151
6	`DLDEBTB = + 0.5267*DLCBODF1 + 0.4413*DLOMBDF1` `(SE)       (0.1562)          (0.1375)`	0.0155
7	`DLCBORESID = - 0.0002 + 0.3921*DLOMBDF1-DLCBODF1` `(SE)         (0.0033) (0.1376)`	0.0157
8	`DLCBORESID = + 0.3895*DLOMBDF1-DLCBODF1` `(SE)         (0.1240)`	0.0154

Table 30. Comparing Forecast Encompassing Equations: OMB vs. APB

#	Equations (1984-2008)	Sigma
1	LDEBTB = - 0.1030 - 0.9791*LOMBDF1 + 1.9913*LAPBDF1 (SE) (0.0623) (0.7787) (0.7839)	0.0133
2	LDEBTB = - 0.0944*LOMBDF1 + 1.0943*LAPBDF1 (SE) (0.5864) (0.5865)	0.0137
3	LOMBRESID = - 0.0011 + 1.0920*LAPBDF1-LOMBDF1 (SE) (0.0028) (0.5789)	0.0137
4	LOMBRESID = + 1.1515*LAPBDF1-LOMBDF1 (SE) (0.5494)	0.0135
5	DLDEBTB = + 0.0067 - 0.2110*DLOMBDF1 + 1.1129*DLAPBDF1 (SE) (0.0066) (0.5930) (0.5730)	0.0137
6	DLDEBTB = + 0.0150*DLOMBDF1 + 0.9529*DLAPBDF1 (SE) (0.5491) (0.5507)	0.0137
7	DLOMBRESID = - 0.0015 + 0.9422*DLAPBDF1-DLOMBDF1 (SE) (0.0028) (0.5693)	0.0139
8	DLOMBRESID = + 0.9996*DLAPBDF1-DLOMBDF1 (SE) (0.5503)	0.0137

#	Equations (1984-2010)	Sigma
1	LDEBTB = - 0.0813 - 0.9810*LOMBDF1 + 1.9906*LAPBDF1 (SE) (0.0492) (0.3409) (0.3446)	0.0131
2	LDEBTB = - 0.6384*LOMBDF1 + 1.6383*LAPBDF1 (SE) (0.2797) (0.2798)	0.0135
3	LOMBRESID = - 0.0009 + 1.6339*LAPBDF1-LOMBDF1 (SE) (0.0027) (0.2755)	0.0135
4	LOMBRESID = + 1.6631*LAPBDF1-LOMBDF1 (SE) (0.2572)	0.0133
5	DLDEBTB = + 0.0085 - 0.3659*DLOMBDF1 + 1.2413*DLAPBDF1 (SE) (0.0055) (0.2802) (0.3018)	0.0133
6	DLDEBTB = - 0.4264*DLOMBDF1 + 1.3798*DLAPBDF1 (SE) (0.2853) (0.2967)	0.0137
7	DLOMBRESID = - 0.0020 + 1.5475*DLAPBDF1-DLOMBDF1 (SE) (0.0028) (0.2874)	0.0143
8	DLOMBRESID = + 1.5985*DLAPBDF1-DLOMBDF1 (SE) (0.2750)	0.0141

Table 31. Comparing One-step-ahead Forecasts (in %)

Forecast	Statistic	Debt			ΔDebt		
		1984-2008	1984-2009	1984-2010	1984-2008	1984-2009	1984-2010
CBO	Bias	0.18	0.28	0.35	0.18	0.29	0.35
	Variance	13.13	13.32	13.31	13.14	13.33	13.31
	RMSFE	1.73	1.80	1.80	1.74	1.80	1.81
OMB	Bias	-0.25	-0.55	-0.60	-0.24	-0.54	-0.59
	Variance	12.01	14.43	14.34	12.01	14.42	14.34
	RMSFE	1.46	2.15	2.14	1.46	2.15	2.14
Average 1	Bias	-0.04	-0.13	-0.13	-0.03	-0.12	-0.12
	Variance	12.42	12.61	12.49	12.42	12.61	12.49
	RMSFE	1.54	1.60	1.56	1.54	1.59	1.56
APB	Bias	-0.12	-0.26	-0.29	-0.14	-0.27	-0.34
	Variance	11.59	12.16	12.08	11.68	12.21	12.23
	RMSFE	1.35	1.50	1.49	1.37	1.52	1.53
Average 2	Bias	-0.19	-0.40	-0.45	-0.19	-0.41	-0.46
	Variance	11.72	13.18	13.11	11.75	13.19	13.15
	RMSFE	1.39	1.78	1.77	1.39	1.79	1.79
RW Model	Bias	-3.50	-3.08	-2.87	-3.50	-3.08	-2.87
	Variance	19.35	20.62	20.77	19.35	20.62	20.77
	RMSFE	5.13	5.25	5.18	5.13	5.25	5.18
DDD Model	Bias	-1.12	-0.83	-0.93	-1.12	-0.83	-0.93
	Variance	15.53	16.72	16.69	15.53	16.72	16.69
	RMSFE	2.66	2.92	2.93	2.66	2.92	2.93

Notes:
1. A negative bias indicates over predicting while a positive bias indicates under predicting
2. Average 1 is the simple average of the CBO and OMB forecasts.
3. Average 2 is the simple average of the OMB and APB forecasts.
4. RW stands for Random Walk and DDD stands for Doubly Differenced Device.

Table 32. Comparing Budget Forecasts from OMB and CBO for 2009 (billions of $)

Budget Item	CBO	OMB	Diff[a]
Change in Debt held by Public[b]	1390.0	2728.7	-1338.7
Deficit	1186.0	1841.2	-655.2
Other	204.0	887.5	-683.5
Change in cash balances	-297.0	-301.6	-4.6
TARP	461.0	166.4	294.6
Other	40.0	1022.7	-982.7
Change in Debt held by Government	153.0	153.1	-0.1
Total Change in Federal Debt[c]	1543.0	2881.8	-1338.8

Notes:
[a] Difference is calculated by subtracting the absolute OMB value from the absolute CBO value.
[b] Total Change in Public Debt is the sum of the Deficit and Other.
[c] Total Change in Federal Debt is the sum of Total Change in Debt held by the Public and Total Change in Debt held by the Government.

IX. FIGURES

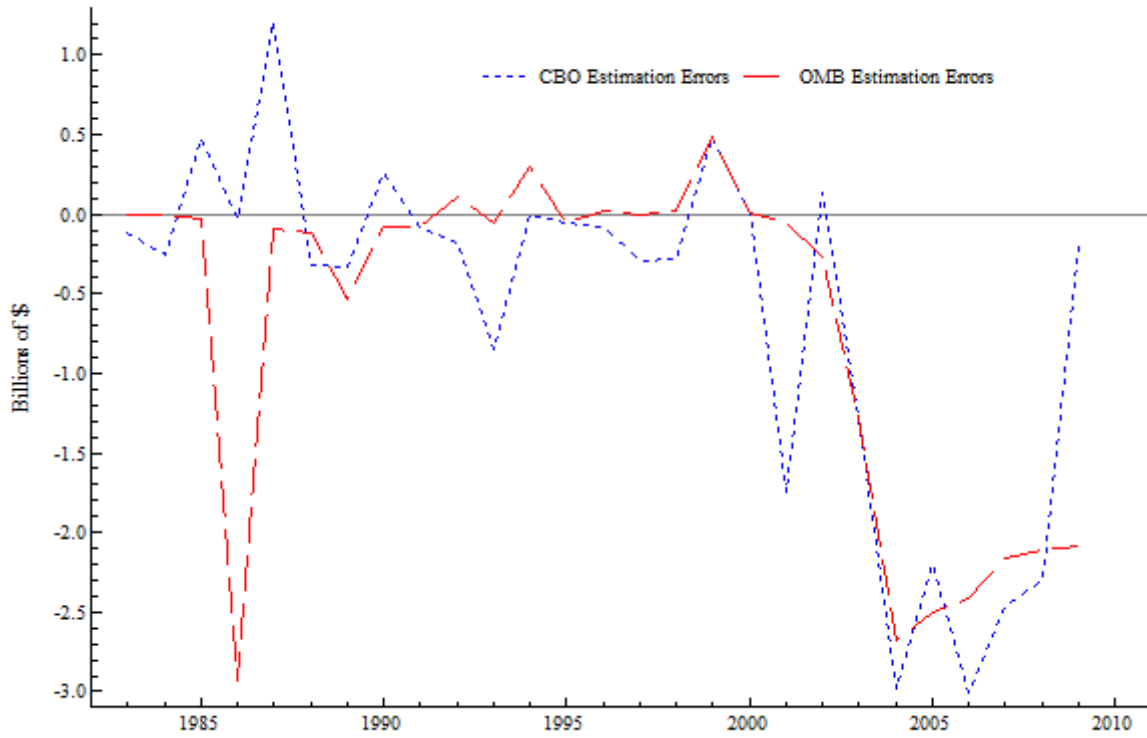Figure 1: CBO and OMB debt estimation errors, 1983-2009

Figure 2: Actual Debt, CBO, OMB, and APB one-step-ahead annual debt forecasts, 1984-2010
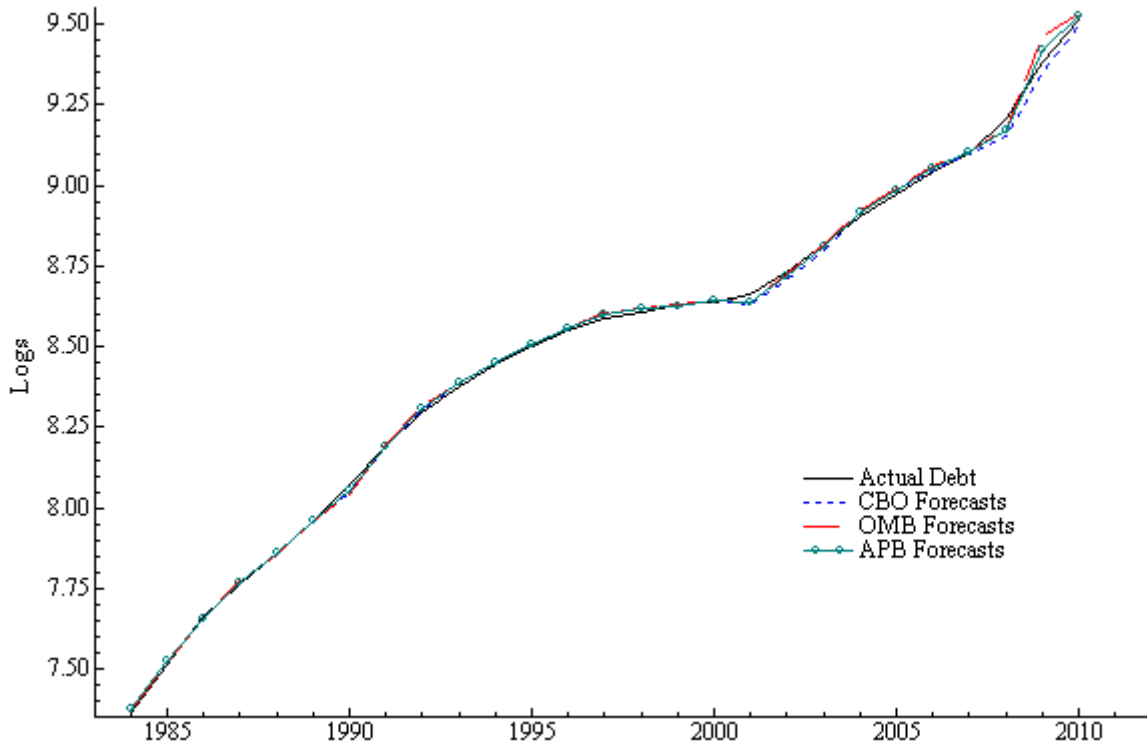
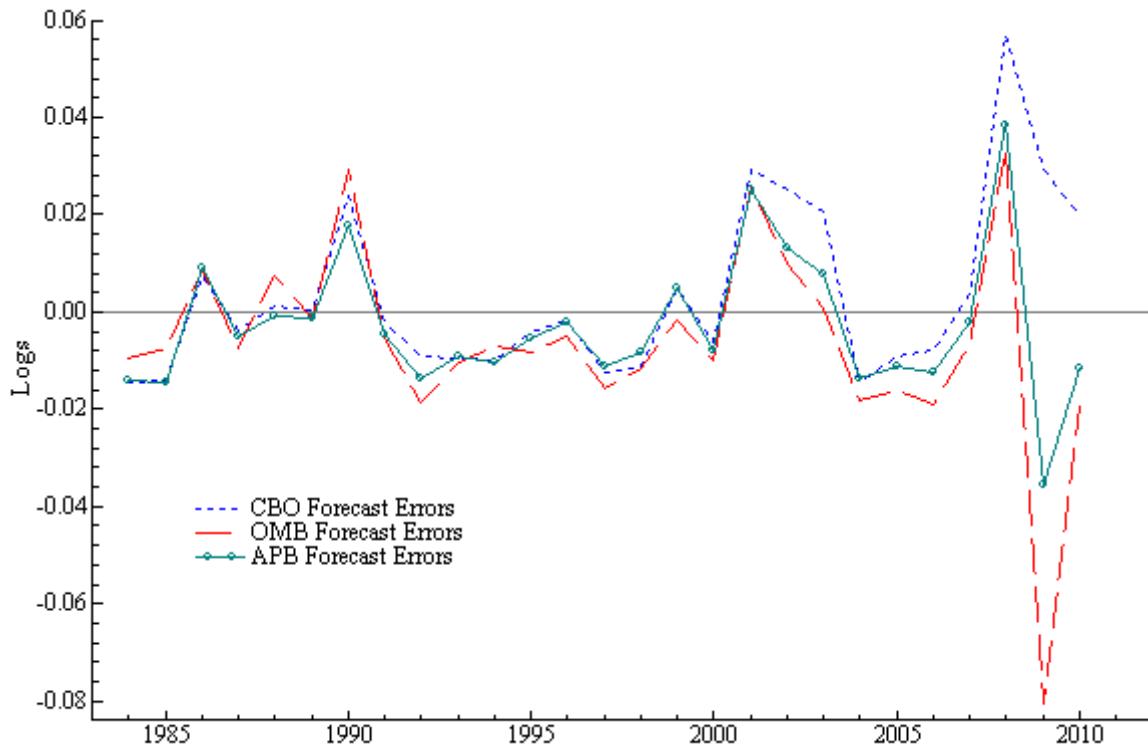Figure 3: CBO, OMB, and APB one-step-ahead annual debt forecast errors, 1984-2010

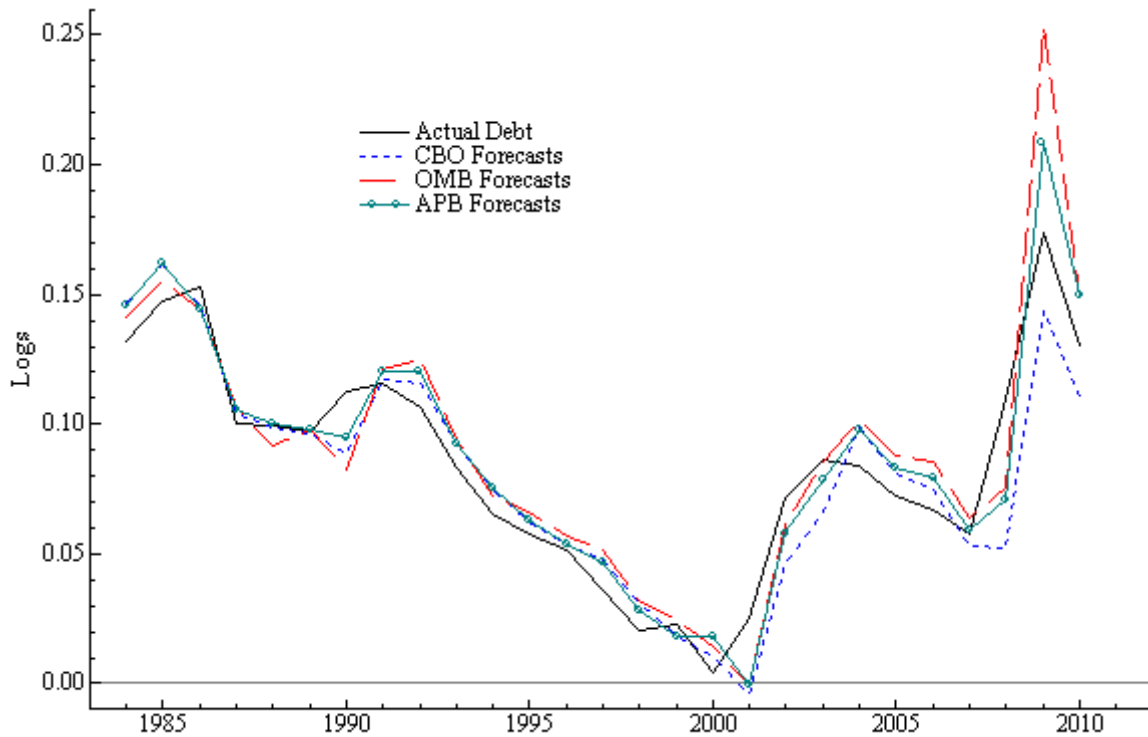Figure 4: Actual debt growth, CBO, OMB, and APB one-step-ahead annual debt growth, 1984-2010

Figure 5: Difference between CBO forecasts and OMB forecasts, and the difference between APB forecasts and OMB forecasts, 1984-2010