**Always in Motion is the Future:**

**The Accuracy of Historical CBO Debt Projections**

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**Abstract:** This paper seeks to the fill the gap in the existing literature in examining the accuracy of long-term Congressional Budget Office (CBO) budget and economic forecasts. Each year, the Congressional Budget Office releases a report titled *The Budget and Economic Outlook* in which it provides 10- and 30-year projections of the economy and the federal budget. This report is closely followed by economists and public policy officials who rely upon it to inform their input on the federal budget. Whereas the existing literature has only assessed the accuracy of short-term CBO forecasts, conversations about policy in both the political sphere and in the media often engage long-term forecasts. I focus therefore, in evaluating and determining the sources of forecast errors made in 10- and 30-year projections published in reports by the CBO from 1996-2008 (for which detailed long-term projection data is available). I find the CBO to have, on average, overestimated the size the cumulative budget balance by 3.9% of cumulative GDP across these reports. Assuming the accuracy of the latest 10-year output forecasts provided by the CBO in its January 2019 *Budget and Economic Outlook*, an error of this size would amount to an overestimate of the cumulative nominal budget balance over the next 10 years of $5.1 trillion.

# Introduction

In *Star Wars: The Empire Strikes Back*, a young Luke Skywalker visits the planet of Dagobah, a remote world of swamps and forests, to train with Jedi Grand Master Yoda. Amidst his training, Luke has a vision of the future, in which his friends, Han, Leia, and Chewie, are in trouble in Cloud City. He worriedly asks Yoda if he should leave and rescue them, to which Yoda replies, "Difficult to see. Always in motion is the future," subsequently urging Luke to remain on the planet and complete his training. We of course know that Luke chooses to defy Yoda only to fall into Darth Vader's trap.

The future, according to Yoda, is subject to tremendous chaos. Even the vision of a young Jedi warrior is as likely to be correct as it is to be catastrophically wrong, due to the sheer quantity of factors that it depends on. In the real world, as institutions and private enterprises seek to predict the future, forecasting outcomes ranging from the winner of the World Series, to the size of the global economy, they make assumptions based on the historical data and short-term consensus projections available to them. Whereas predictions are not subject to manipulation by malicious Jedi Masters, their accuracy is still subject to the bias held by forecasters and to unpredictable shocks.

This paper seeks to examine the accuracy of forecasts published specifically on the federal budget. Each year, the Congressional Budget Office (CBO) publishes its *Budget and Economic Outlook*, providing forecasts on the federal budget deficit and the Debt to GDP ratio on an annual basis for the next 10 and 30 years. Given the agency's non-partisan nature and well-respected economic staff, this report is closely followed by economists and public policy officials who use it to inform their input on the federal budget. Over recent years, there has been an increase in concern over the fiscal position of the United States, expressed by members of both parties. For example, Democrats, campaigning for last year's midterm election, cited the CBO's 2018 forecast of the national debt reaching nearly 100% of GDP by 2028, to criticize their opponents who supported the recently passed *Tax Cuts and Jobs Act of 2017* (CBO, 2018). Members of the Republican Party cited the same report, to instead call for reforms to entitlement programs such as Social Security and Medicare (Dennis, 2018).

Concerns over the federal government's fiscal trajectory are well-founded. Auerbach and Gale (2017) find that sustained deficits and rising federal debt will crowd out future investment, reduce prospects for economic growth, and impose burdens on future generations. They also recommend severe reductions in spending and/or increases in taxes to maintain or reduce federal debt relative to its level in 2017. Concerns among economists over the level of public debt are filtered through policymakers in their enactment of legislation. Hence, it is of critical importance that the reports informing these concerns are accurate. Otherwise, policymakers can unintentionally vote against the interests of their constituents.

As discussed below, there exists literature assessing the accuracy of CBO budget projections. However, most of the work has focussed on quantifying the accuracy of CBO short-term forecasts. However, as we so often hear on the campaign trail, among media pundits, and public policy analysts, long-term projections tend to drive political and economic conversations on public policy. This paper exists solely to start a conversation on the accuracy of the CBO's long-term 10- and 30-year forecasts given their sheer importance among decision makers in Congress.

I begin by discussing the first CBO report published with detailed 10- and 30-year projections – that published in May of 1996 (hereafter referred to as the May 1996 Budget Report). In this report, the CBO estimated projected federal debt to grow to 124% of GDP by 2025. However, in the latest report published by the CBO (January 2019), the CBO forecasted federal debt to grow to 87.7% of GDP by 2025. Hence, I dedicate the first section of this paper to understanding why the CBO, in its May 1996 Budget Report, severely misestimated the budget at the 10-year level. In the second section, I further examine the CBO's 30-year projection in comparison to forecasts of budget outcomes in 2025 released in subsequent reports, given how crucial it is that future projections never reach this level of inaccuracy.

In the second section, I also examine the 10-year budget forecast accuracy of reports published from 1997-2008. Based on this analysis, the following conclusions can be drawn:

(i.) In the May 1996 Budget Report, the CBO, on average, *underestimates* the budget balance by 1.7% of GDP. Given the level of output in the United States last year, an underestimate of the federal government's budget balance for 2018 of this magnitude would amount to an error of $344 billion. In other words, the CBO would have overestimated the size of the federal deficit run in 2018 by over $300 billion. This is roughly the equivalent of what the federal government spent on Medicaid in 2018.

(ii.) In the May 1996 Budget Report, the CBO *overestimates* the amount of Debt Held by the Public in 2006 by $1.9 trillion (or by 14% of 2006 GDP). If the CBO made an error this large in its most recently released budget report (January 2019), and assuming that its projections of output are accurate, then it would have overestimated the amount of Debt Held by the Public in 2029 by $4.4 trillion.

(iii.) In reports published from 1996 to 2008, on average, the CBO *overestimates* the cumulative budget balance by 3.9% of cumulative GDP. Without taking into account the effects of the Great Recession, the CBO overestimates the cumulative budget balance by 1.8% of cumulative GDP. Assuming the accuracy of the latest 10-year output forecasts provided by the CBO in its January 2019 *Budget and Economic Outlook*, an error of this size would amount to an overestimate of the cumulative nominal budget balance over the next 10 years of $5.1 trillion. Errors with respect to budget balance forecasts have not improved since 1996.

(iv.) In reports published from 1996 to 2008, on average, the CBO *underestimates* Debt Held by the Public in the final year of the forecast horizon, on average by 39% of GDP. Debt projections have not improved over time.

(v.) Across reports which provide budget forecasts for the year 2025, on average the CBO projects Debt Held by the Public at the end of 2025 to be 76.8% of projected GDP, compared to that of the May 1996 Budget Report of 124% of projected GDP.

# Previous Work

The analytical literature on historical CBO forecasting accuracy speaks to the following topics: the CBO's ability over time to provide an accurate deficit outlook, their potential bias in specifically predicting revenue and/or outlays, their capacity to accurately forecast economic variables such as real output and inflation, and potential sources for both temporary and systematic error. These articles have primarily focussed on the CBO's short-term budget forecasts and have neglected to assess the accuracy of their long-term predictions.

Plesko (1988) was among the first to assess the accuracy of deficit forecasts provided by federal agencies. Comparing the projected values of nominal GNP, revenues, and outlays to their historical values, in CBO and OMB reports published from 1976 to 1988, he finds there to have been statistically significant downward errors in GNP forecasts in the short-run (the projection year) and statistically significant upward projection errors in the short- to medium-run (3-5 years). In contrast, he finds the CBO to have been statistically unbiased in their forecasting of outlays, underestimating government expenditure over the forecast period on the margin. Furthermore, he finds that projections of receipts and deficits tended to err on the side of optimism. Kliesen and Thornton (2012) replicate Plesko's work for more recent CBO reports, coming to similar conclusions. They find that in forecasts published from 1976 to 2007, the CBO tended to underestimate the size of budget deficits moving forward both one and five years. The authors also find that random walk projections would have, on average, fared better in both the short and medium run than those published by the CBO.

The literature also delves further into errors that the CBO has historically made in its projections of revenues and outlays. Booth et al. (2015) assess the statistical bias and overall accuracy of both the two-year and six-year forecasts of revenue in reports published from 1982 to 2014. They find, on average, the CBO to have overestimated two-year revenue by 1.1%, excluding the impact of legislation passed in the year that each forecast was produced. Overall, exactly half of the forecasts were overestimated and half were underestimated, but the overestimates, most notably for years marked by recessions, tended to be larger. The size of the average error was even larger for the six-year revenue forecasts, at 5.3%. Excluding the projections published from 2009 to 2014 – the overestimates for those years averaged 17.5% - the CBO still, on average, overestimated revenues by 2%. The authors note the lack of improvement in forecast accuracy over time.

Sources of revenue forecast errors can be broken down by category (income taxes, corporate taxes, and so on) as well as into errors attributable to misestimates of macroeconomic variables and technical forecast errors. By category, Booth et al. (2015) find misestimates of corporate taxes to have been the largest, though overestimates of income tax revenues contributed the most to the CBO's two-year forecast errors. Kliesen and Thornton (2012) come to a similar conclusion, running a multivariate regression of historical revenue forecast errors on errors made in projecting revenue components. They find that 98% of the average error made over their assessment period can be explained by errors made in forecasting income, corporate, and payroll taxes.

The divergence in forecasting outcomes by revenue source is largely attributable to the fact that the tax base for revenue sources have varying degrees of predictability. Whereas the base for income taxes (wages and salaries) tends to increase at a more stable rate, corporate profits – the base for corporate taxes – fluctuate significantly over the business cycle. With respect to errors attributable to misestimates of macroeconomic variables, Booth et al. (2015) find that misestimates of GDP tended to move together with misestimates of revenues as a percentage of GDP. While errors associated with the latter tended to be larger over a two-year horizon, they followed closely with errors of the former over the medium term.

Anthony et al. (2017) provide a similar analysis on the accuracy of historical CBO expenditure forecasts. They find that the CBO's budget-year projections tended to overestimate actual outlays, on average, by 1.7%. Of the 32 budget-year projections from 1984 to 2015, 25 exceeded actual spending. The CBO's sixth-year projections also tended to be too high. Both the average error (3%) and the mean absolute error (5.9%) of the sixth-year projections made between 1984 and 2011 were larger than those of the budget-year projections. Broken down by expenditure category, sources of errors included significant overestimates of net interest outlays, without which the mean error for the sixth-year projections would fall by half. Sixth-year projections of Medicare and Medicaid were less accurate than those of other categories in part because it took the CBO several years to fully incorporate into its forecasts the slowing growth in spending for those programs that occurred between 1996 and 2002 (Anthony et al., 2017).

As briefly noted above, given the importance of macroeconomic variables as inputs in the forecasts of key budget items, the CBO's ability to project indicators such as real output and inflation is critical to the accuracy of their reports. Gamber et al. (2017), in examining CBO outlook reports published between 1980 to 2014, find that the agency tended to underestimate two-year real output growth while overestimating inflation, interest rates, and wages. In its five-year forecasts, the CBO tended to overestimate all key macroeconomic inputs. Two key economic developments, according to the authors, are to blame for these errors: turning points in the business cycle and changes in productivity trends. With respect to those errors associated with turning points in the business cycle, recessions that fell in the period of those reports analyzed were prompted by events that forecasters would not have been able to predict. For instance, the Iraqi invasion of Kuwait in August 1990 led to a spike in oil prices and caused a drop in consumer confidence, leading to a recession. The forecast errors of reports published during this period are particularly large due to the unpredictability of this event.

Forecasts of productivity growth play a crucial role in projecting potential output, the variable that determines the trajectory of the agency's ten-year budget forecasts. Hence, errors associated with misestimates of capital accumulation and technological innovation can lead to significant long-term deficit forecast errors. For example, in 1996, growth in labor productivity in the nonfarm business sector accelerated, averaging over 3% for nearly a decade (Gamber et al., 2017). For several years, forecasters underestimated the trend of productivity growth, which partly explains why their projections of the economy's growth rate were too low. The acceleration of labor productivity stemmed from a pickup in technological progress, especially in information technology.

Given the analytical work that has already been done in assessing the CBO's forecast record, I believe that there exists a key area for further exploration. Namely, I draw upon the work of the authors listed above to methodically quantify and identify sources of 10-year forecast errors made in the CBO's May 1996 Budget Report.  I then generalize and apply this methodology to subsequent reports, and conclude by briefly examining the CBO's historical 30-year forecasts.

# Section I

## Overview

In May 1996, the CBO released its first *Economic and Budget Outlook* containing detailed 10-year projections of the economy and the budget and less detailed 30-year forecasts. In addition to forecasting macroeconomic variables such as output, inflation, unemployment, and interest rates, it provides a detailed breakdown of its budget forecast into various spending and revenue categories. I specifically focus here on the CBO's baseline budget projections, which assume the continuation of current revenue and spending policies. I follow this dataset as opposed to those projections based on the presumption of a balanced budget in 2002, as those forecasts are produced solely to provide policymakers a clear path forward toward a balanced budget in six years. The CBO's baseline projections have historically been used in the literature on this topic, and are typically the most widely reported in the media.

This section has three objectives. Firstly, I seek to quantify the budget balance projection errors made by this report and examine the accuracy of its projection of nominal Debt Held by the Public in 2006. By "budget balance," I simply refer to the amount of projected nominal spending substracted from projected nominal revenue for each forecast year. I use these figures to determine whether the CBO forecast improves over the 10-year forecast horizon.

Secondly, I disaggregate budget balance forecast errors by those attributable to spending and revenue forecast errors. I also break down spending and revenue forecast errors by line item. Using these figures, I determine whether the CBO's spending and revenue forecasts improve over the 10-year forecast horizon. Thirdly, I break down spending and revenue forecast errors into those errors that are technical/legislative in nature vs. those attributable to misestimates of macroeconomic variables such as output and inflation.

# Quantifying and Disaggregating Yearly Forecast Errors

## Data

Given that the first section of this paper is dedicated toward discussing forecast errors made in the May 1996 Budget Report, I use data solely provided by the CBO in order to preserve, over time, their methodology in calculating budget and economic figures. This section breaks down the sources used to obtain projection and historical data on revenues, expenditures, and key macroeconomic variables such as output and inflation.

### 10-Year Projection Data

The 10-year projection data used reflects the CBO's baseline projections in its May 1996 Budget Report. This baseline shows the outlook for federal revenues, outlays, and budget balances under the assumption that current laws and spending policies remain in place. The CBO posits that its forecasts are useful for sketching the consequences of policies in place as a benchmark for weighing proposed changes (CBO, 1996).

**Revenues:**

10-year revenue projection data is sourced from Table 2-3 in Chapter 2 of the May 1996 Budget Report. The table breaks down revenue sources into seven categories: Individual Income Taxes, Corporate Income Taxes, Social Insurance Taxes, Excise Taxes, Estate and Gift Taxes, Customs Duties, and Miscellaneous. The data is provided in nominal dollar terms and as percentages of GDP.

**Discretionary Spending and Net Interest Payments:**

10-year discretionary spending and net interest payment projection data is sourced from Table 2-5 in Chapter 2 of the May 1996 Budget Report. The projection data provided assumes that discretionary spending grows from the 1996 level at the rate of inflation, subject to the limits or caps in place through 1998. Since the projections suggest that the caps on general-purpose discretionary spending are constraining in 1998, the CBO assumes that general-purpose spending grows with inflation from that 1998 cap level in subsequent years. Discretionary spending projections are broken down into military and non-military spending in both nominal dollar terms and as percentages of GDP.

**Mandatory Spending:**

10-year mandatory spending projection data is sourced from Table 2-6 in Chapter 2 of the May 1996 Budget Report. The table breaks down this spending into two categories: means-tested programs (i.e. Medicaid, Food Stamps, Earned Income Credits, etc.) and non-means-tested programs (i.e. Social Security, Medicare, etc.). These figures are provided in both nominal dollar terms and as percentages of GDP. The CBO projects mandatory spending under a baseline assumption that all current policies remain unchanged throughout the forecast horizon.

**Macroeconomic Variables:**

I source data on the CBO's projections of key macroeconomic variables from Table 1 of Chapter 1 of its May 1996 Budget Report. These variables include nominal GDP, real GDP, inflation (measured by the CPI), unemployment, and three-month and ten-year treasury rates.

## 10-Year Historical Data

**Revenues:**

I obtain historical revenue data for the years 1996-2006 from the CBO's report titled, *The Budget and Economic Outlook: 2019-2029*, published in January 2019. This report provides a breakdown of revenue by the seven categories mentioned above in both nominal dollar terms and as percentages of GDP.

**Discretionary Spending and Net Interest Payments:**

I obtain historical data on discretionary spending and net interest payments for the years 1996-2006 from the same report. The report breaks discretionary spending down into defense and non-defense spending in both nominal dollar terms and as percentages of GDP.

**Mandatory Spending:**

To get a consistent breakdown of mandatory spending over the years 1996-2006 as that provided in the May 1996 Budget Report, I use subsequent reports (i.e. those published from 1997 to 2007). In each report, the CBO provides a table equivalent to the table I use to obtain data on projected mandatory spending. Each table lists the historical figures for each mandatory spending line item from the previous year. For example, I used a table in the 2000 CBO Budget Report to pull historical mandatory spending figures for the year 1999. This process ensures that the historical figures and projected figures used to calculate forecast errors are comparable. For the most part, line items remain the same from one report to the next. In the case where a line item is removed or added, I consolidate it into the "Other" line item, or into an equivalent line item. For significant changes, I add the line item in and set the forecasts of it to zero for years in which it did not exist. For example, when the Children Health Insurance Program (CHIP) was introduced in 1997, CBO projections began including it as part of mandatory spending. Hence, I create a line item for CHIP among the other spending categories within my forecast table and set its forecast value to zero for 1996 and 1997.

**Macroeconomic Variables:**

I source historical data on key macroeconomic variables from the appendix of the CBO's report titled, *The Budget and Economic Outlook: 2019-2029*. These variables include nominal GDP, real GDP, inflation (measured by the CPI), unemployment, and three-month and ten-year treasury rates.

# Methodology

## Measuring and Disaggregating Cumulative Forecasts Errors

In the first section of this paper, I develop a method to decompose budget forecast errors for each layer of the budget report. I decompose the projection errors made on a yearly basis with respect to the budget balance by using an accounting-style approach. I disaggregate the errors made in forecasting the budget balance into those attributable to revenue and spending. I then decompose the errors made at the revenue level into those attributable to each line item. On the spending side, I disaggregate further into mandatory and discretionary spending. With respect to discretionary expenditure, I decompose the forecast errors by each line item. In assessing mandatory spending, I decompose the errors into those attributable to non-means-tested and means-tested spending. Within these two categories, I break down the errors further by line item.

Consider line item $i$ in the May 1996 budget forecast. To calculate the forecast error of this line item in year $t$ where $t \in \{1996, 1997, \ldots, 2006\}$, I use the following measure:

(1) $$E_{it} = \frac{B_{it}^{p}}{Y_t} - \frac{B_{it}^{h}}{Y_t}$$

where:

$E_{it}$ := The projection error of line item $i$ in year $t$
$B_{it}^{p}$ := The nominal dollar projection of line item $i$ in year $t$
$B_{it}^{h}$ := The historical nominal dollar amount of item $i$ in year $t$
$Y_t$ := Historical nominal GDP in year $t$

This measure is typically used in the literature published on this topic, including in reports published by the CBO. Furthermore, it allows us to understand the size of each projection error relative to the size of the economy. For each larger category (i.e. revenues, mandatory spending, discretionary spending, total spending, budget balance), I sum the errors of each line item in a given year, in a given category, to calculate the projection error of that category in that year. Once this process is complete, the drivers of overall forecast errors become easier to ascertain.

## Results

**Budget Balance and Debt Held by the Public:**

As shown in Figure 1, the CBO underestimates the budget balance in 1996-2002 and 2006. In other words, during these years, the actual budget balance was greater than that projected by the CBO in 1996. It, however, overestimates the budget balance for the years 2003 and 2004 by 0.6% and 0.6% of GDP respectively. In each forecast year for which the budget balance is underestimated, underestimates of revenue drive the forecast error. In each forecast period for which the budget balance is overestimated, overestimates of revenues drive the forecast error. On average, the CBO *underestimates* the budget balance by 1.7% of GDP. Given the level of output in the United States last year, an underestimate of the federal government's budget balance for 2018 of this magnitude would amount to an error of $344 billion. In other words, the CBO would have overestimated the size of the federal deficit run in 2018 by over $300 billion. This is roughly the equivalent of what the federal government spent on Medicaid in 2018.

The CBO underestimates the cumulative budget balance, that is, the sum of total nominal budget balance forecast errors, by 1.6% of cumulative GDP, that is the total nominal output produced over the 10-year forecast horizon. Assuming the accuracy of output projections provided by the CBO's latest budget report (January 2019), a cumulative error of this magnitude would lead the CBO to underestimate the cumulative budget balance over the next 10 years by $4.5 trillion.

Consequently, the CBO, in its May 1996 Budget Report, overestimates the amount of Debt Held by the Public in 2006 by $1.9 trillion (or by 14% of 2006 GDP). If the CBO made an error this large in its most recently released budget report (January 2019), then it would have overestimated the amount of Debt Held by the Public in 2029 by $4.4 trillion.

**Revenues:**

As per Figure 2, the CBO underestimates revenue collected for the years 1996-2001 and 2005-2006. In other words, during these years, the CBO projects federal revenue to be lower than what it was during these years. Over the ten-year forecast horizon, this *underestimate* averages 1% of GDP. Given the level of output in the United States last year, an underestimate of the federal revenue for 2018 of this magnitude would amount to an error of approximately $202 billion. In other words, the CBO would have projected federal revenue in 2018 to be $202 billion lower than what was actually collected. This is roughly the equivalent of what the federal government collected in corporate taxes in 2018. The CBO underestimates cumulative revenue, that is, the sum of total nominal revenue collected over the forecast horizon, by 0.9% of cumulative GDP.

Examining the forecast years, 1996-2001, the CBO underestimates revenue on average by 1.9% of GDP. Underestimates of income taxes collected appear to drive the errors. For these years, the CBO underestimates income tax revenue on average by 1.4% of GDP. Furthermore, the error made with respect to income tax revenue grows from 1996 to 2001, reaching a maximum (in magnitude) of -2.3% of GDP in 2000.

To delve deeper into the source of these errors, it is important to note that revenue forecast errors can either be attributed to errors in projections of GDP or to errors in projections of revenues as a percentage of GDP (CBO, 2015). Namely, the CBO projects revenues largely by identifying the macroeconomic variables in its economic forecasts that constitute the bases for federal taxes. Errors related to the size of the economy, and closely related variables such as wages and corporate profits increase the magnitude of misestimates of revenue. Errors related to the share of GDP drawn upon by the various components of revenue also play important roles given that different types of income are taxed at different rates. Income taxes, for example, draw greater revenue per dollar generated compared to corporate taxes.

In order to decompose CBO revenue forecast errors into those attriutable to misestimates of macroeconomic variables and those attributable to misestimates of the share of the economy drawn upon by various taxation schemes, I conduct a similar analysis as that provided in the CBO's own review of its two- and six-year revenue forecast record (CBO, 2015). I measure the average nominal GDP error (as measured by actual nominal GDP subtracted from projected nominal GDP divided by actual nominal GDP) and the average error made with respect to revenue as a percentage of output (that is, actual nominal revenue as a percentage of actual nominal GDP subtracted from projected nominal revenue as a percentage of projected nominal GDP). As per the CBO's analysis, we can identify errors made with respect to the share of GDP drawn upon by various components of revenue as partly legislative/technical in nature. Changes made by Congress, for example, to the rate of corporate taxation, will change the portion of corporate income drawn upon by corporate taxes. We can identify errors made with respect to macroeconomic variables as economic in nature.

I examine revenue forecast errors made for the years 1996-2001 through this lense. Over this forecast period, the CBO underestimates nominal GDP on average by 7.3%. In other words, the CBO underestimates the bases upon which federal taxes are drawn from 1996-2001. Assuming the accuracy of its projections of revenue as a percentage of output, this should result in the CBO underestimating revenue collected over these years. However, the CBO also underestimates the portion drawn upon the tax base on average by 0.6 percentage points. This should also contribute to the CBO's underestimate of revenue collected over this shorter horizon. Hence, the CBO's underestimate of revenue over this horizon can attributed to both legislative and economic forecast errors.

Examining the forecast years, 2003-2004, the CBO overestimates revenue on average by 1.3% of GDP (1.3% in 2003 and 1.2% in 2004) . Overestimates of income and corporate taxes appear to drive these errors. For 2003-2004, overestimates of income and corporate taxes average 1% and 0.3% of GDP respectively. Interestingly, the CBO appears to underestimate nominal GDP on average by 7.1% over these two years. Hence it underestimates the base upon which revenue is drawn. This should result in an underestimation of revenue. However, for these years, the CBO overestimates revenue as a percentage of output on average by 2.6 percentage points. It overestimates income and corporate tax revenue as a percentage of GDP by 1.6 and 0.4 percentage points respectively. Hence, we see that legislative errors with respect to income and corporate tax forecasts appear to drive revenue projection overestimates for forecast years, 2003-2004.

Tax cuts passed by the Bush administration, the largest of which occurred in 2001 and 2003 appear to play the legislation role in driving overestimates of revenue. Coming into effect in 2001 and 2003 respectively in response to a recession following the collapse of the tech bubble, the Economic Growth and Tax Relief Reconciliation Act (EGTRRA) and the Jobs and Growth Tax Relief Reconciliation Act (JGTRRA) reduced the top four marginal tax rates as well as the tax rate on capital gains and dividends (Horton, 2013). The two tax policies also phased out the estate tax, repealing it entirely in 2010 (Horton, 2013). EGTRRA, according to estimates provided by the Department of the Treasury, reduced revenues in 2003 and 2004 by 0.77% and 0.89% of GDP respectively (Tempalski, 2013). JGTRRA, reduced 2003 and 2004 revenues by 0.49% and 1.18% of GDP respectively (Tempalski, 2013). Hence, these two Bush era tax cuts combined account almost entirely for overestimates of revenue for the years 2003 and 2004.

Moving forward, the CBO once again underestimates revenue during the final two years of the forecast horizon. It underestimates the amount of revenue collected in 2005 and 2006 by 0.2% and 1.3% of GDP respectively. Errors are primarily driven by underestimates of corporate tax revenue. For these years, the CBO continues to underestimate nominal GDP, or the base upon which revenues are drawn by 9.5% in 2005 and 10.7% in 2006. On the other hand, the CBO overestimates revenue as a percentage of GDP by 1.5 percentage points in 2005 and 0.7 percentage points in 2006. Hence, given that the CBO underestimates revenue collected for these years, misestimates of macroeconomic variables appear to drive the errors to a greater extent than those that are technical/legislative in nature.

**Spending**

As Figure 3 shows, the CBO overestimates overall spending in every forecast year except 1996 for which it underestimates spending by 0.1% of GDP, and 2006, for which it also underestimates spending by 0.1% of GDP. On average, the CBO *overestimates* overall spending by 0.7% of GDP. The CBO overestimates cumulative spending, that is, the sum of total nominal spending collected over the forecast horizon, by 0.7% of cumulative GDP.

For the forecast years, 1997 – 2002, the CBO's yearly overestimate of spending is visually definitive, as per Figure 3. This overestimate averages 1.1% of GDP. For these years, overestimates of mandatory and net interest expenses drive the errors. However, for subsequent forecast periods, whereas overestimates of net interest spending drive overall spending errors upward, underestimates of discretionary spending play an increasingly important role in mitigating this effect. From 2003 – 2006, the CBO overestimates overall spending on average by 0.4% of GDP.

Aside from breaking down forecast errors into those related to various spending categories, it is also important to decompose these errors into those attributable to economic and technical/legislative errors. Economic errors, as was the case in examining revenue forecast errors, specifically refer to misestimates of macroeconomic variables such as output, inflation, and interest rates. Technical/legislative errors are those related to the effects of legistiation passed during the forecast horizon that the CBO is unable to predict and account for. For example, in forecasting discretionary spending, the CBO often assumes the continuation of spending restrictions imposed on budget line items while allowing other categories within discretionary spending to grow at the rate of inflation. In forecasting unemployment insurance within the mandatory spending category, the CBO relies both on current legislation dictating the rules of the allotment of benefits as well as on its own employment and output projections.

Hence, in the analysis below, I have two objectives. Firstly, I wish to determine the role of misestimates of macroeconomic variables versus those due to technical/legislative misestimates. Secondly, I wish to see which macroeconomic variables play the biggest role in driving misestimates of spending. I accomplish these tasks by estimating the following regression model:

$$S\_Error_t = \alpha + \beta GDP_t + \gamma UR_t + \delta CPI_t + \theta TB_t + \vartheta TN_t + \varepsilon_t \qquad (2)$$

where:

(i.) $S\_Error_t$ := The spending projection error as a percentage of output made for the year $t$. In other words, $S\_Error_{1997}$ refers to the nominal spending projection error made for the year 1997 in the May 1996 Budget Report as a percentage of actual nominal GDP in 1997.

(ii.) $GDP_t$ := The output projection error as a percentage of actual output made for the year $t$. In other words, $GDP_{1997}$ refers to the nominal GDP projection error made for the year 1997 in the May 1996 Budget Report as a percentage of actual nominal GDP in 1997.

(iii.) $UR_t$ := The percentage point projection error of the unemployment rate made for the year $t$. In other words, $UR_{1997}$ refers to the percentage point error made for the year 1997 in the May 1996 Budget Report.

(iv.) $CPI_t$ := The percentage point projection error of the change in the Consumer Price Index for Urban Consumers for the year $t$. In other words, $CPI_{1997}$ refers to the percentage point error made for inflation for the year 1997 in the May 1996 Budget Report.

(v.) $TB_t$ := The percentage point projection error of the three-month treasury rate made for the year $t$. In other words, $TB_{1997}$ refers to the percentage point error made for the three-month treasury rate for the year 1997 in the May 1996 Budget Report.

(vi.) $TN_t$ := The percentage point projection error of the 10-year treasury rate made for the year $t$. In other words, $TN_{1997}$ refers to the percentage point error made for the 10-year treasury rate for the year 1997 in the May 1996 Budget Report.

Note that within the May 1996 Budget Report, errors made across forecast years are likely correlated. Hence, running a simple OLS regression will produce inaccurate standard errors. Hence, I estimate the population regression model above using Newey-West standard errors which are accurate under this scenario (Stock and Watson, 2015). I use the rule of thumb provided by Stock and Watson (2015) to determine the value of my lagged variable. The results of estimating this model are reported in Table 1:

Table 1: Disaggregation of Spending Projection Errors (May 1996)

| VARIABLES | (1) Spending Error | (2) Spending Error | (3) Spending Error | (4) Spending Error | (5) Spending Error |
|---|---|---|---|---|---|
| GDP | -0.0289 | -0.119 | 0.00786 | 0.366*** | 0.286*** |
| | (0.157) | (0.108) | (0.109) | (0.0717) | (0.0700) |
| CPI | | 0.427* | 0.395* | -0.123 | -0.100 |
| | | (0.206) | (0.187) | (0.204) | (0.112) |
| Unemployment | | | 0.554* | 1.846*** | 1.899*** |
| | | | (0.242) | (0.223) | (0.191) |
| Treasury Bill | | | | 0.504*** | 0.681** |
| | | | | (0.0734) | (0.195) |
| Treasury Note | | | | | -0.348 |
| | | | | | (0.258) |
| Constant | 0.00523 | -0.00331 | 0.00125 | 0.0127*** | 0.00801 |
| | (0.0110) | (0.00659) | (0.00715) | (0.00308) | (0.00447) |
| Observations | 11 | 11 | 11 | 11 | 11 |
| Adjusted R-Squared | -0.102 | 0.0562 | 0.356 | 0.773 | 0.804 |

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The first objective of disaggregating spending projection errors into technical/legislative and economic forecast errors is provided for in the Adjusted R-Squared values in Table 1. These values allow us to determine the degree to which variation in spending errors is explained by variation in macroeconomic forecast errors. As shown in Column 3 of Table 1, including unemployment projection errors add substantial explanatory power to the model as the Adjusted R-Squared rises from -0.102 to 0.356. Thereafter, however, additions of interest rate forecast errors substiantially improve the model, leading to further increases in the Adjusted R-Squared to 0.804 (Column 5). Hence, we see from this regression that misestimates of economic variables explain approximately 80% of spending projection errors.

The second objective of determining the most important macroeconomic variables in terms of their impact on spending projection errors is provided for in the coefficient point estimates. As shown in Column 5 in Table 1, misestimates of unemployment and the three-month treasury rate appear to have the greatest impact on spending projection errors. A one percentage point increase in the error for unemployments leads the projection error for spending to increase by 1.9 percentage points. A one percentage point increase in the error for the three-month treasury rate leads the projection error for spending to increase by 0.7 percentage points. These figures are economically and statistically signficant at the 1% and 5% level respectively.

**Discretionary Spending**

As shown in Figure 4, discretionary spending projection errors are relatively small for forecast years 1996-2000. Over these years, the CBO underestimates discretionary spending on average by 0.1% of GDP. Errors are primarily driven by underestimates of non-defense spending averaging, 0.1% of GDP. Underestimates in discretionary spending thereafter, however, grow in magnitude. The extent to which underestimates of defense spending drives discretionary spending forecast errors grows as well, as is discussed below. Nonetheless, over the entire forecast horizon, the CBO *underestimates* discretionary spending on average by 1% of GDP. The CBO underestimates cumulative discretionary spending, that is, the sum of total nominal discretionary spending over the forecast horizon, by 1.1% of cumulative GDP.

Importantly, the errors to be examined closer are those made after 2000. From 2001 – 2006, the CBO underestimates discretionary spending on average by 1.7% of GDP. Errors made for the years 2001-2003 are primarily driven by underestimates of non-defense spending. However, errors made for the years 2004-2006 are primarily driven by underestimates of defense spending. From 2001-2006, the CBO underestimates defense spending on average by 0.8% of

GDP, and non-defense spending by 0.9% of GDP. The clear candidate as to why the CBO underestimates defense spending over these years, and why these errors grow, is US military involvement in Afghanistan and Iraq. From 2001 – 2006, the federal government spent $398 billion on Operation Enduring Freedom (Afghanistan), Operation Iraqi Freedom (Iraq), and Operation New Dawn (Iraq), or 0.6% of cumulative output produced over these years (Belasco, 2014). Hence, increased military spending to fund the US invasions in Iraq and Afghanistan account for a significant portion of underestimates of defense spending over this period.

However, to examine the role of economic forecast errors and legislative/technical errors in driving discretionary spending forecast errors over the entire forecast horizon, I conduct a similar analysis as above. I regress discretionary spending errors on errors made with respect to various macroeconomic indicators, attaining the results reported in Table 2.

Table 2: Disaggregation of Discretionary Spending Projection Errors (May 1996)

| VARIABLES | (1) Discretionary Spending Error | (2) Discretionary Spending Error | (3) Discretionary Spending Error | (4) Discretionary Spending Error | (5) Discretionary Spending Error |
|---|---|---|---|---|---|
| GDP | 0.296* | 0.289* | 0.614*** | 0.604*** | 0.501*** |
| | (0.152) | (0.136) | (0.0412) | (0.108) | (0.0603) |
| CPI | | 0.0335 | -0.0477 | -0.0329 | -0.00283 |
| | | (0.332) | (0.148) | (0.261) | (0.127) |
| Unemployment | | | 1.422*** | 1.386*** | 1.453*** |
| | | | (0.100) | (0.303) | (0.190) |
| Treasury Bill | | | | -0.0144 | 0.214 |
| | | | | (0.115) | (0.136) |
| Treasury Note | | | | | -0.448** |
| | | | | | (0.147) |
| Constant | 0.0133 | 0.0126 | 0.0243*** | 0.0240*** | 0.0179*** |
| | (0.0109) | (0.00838) | (0.00263) | (0.00485) | (0.00295) |
| Observations | 11 | 11 | 11 | 11 | 11 |
| Adjusted R-Squared | 0.211 | 0.113 | 0.944 | 0.935 | 0.964 |

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

As shown in Column 3 of Table 2, including unemployment projection errors adds substantial explanatory power to the model as the Adjusted R-Squared rises from 0.211 to 0.944. Additions of interest rate forecast errors do not significantly improve the model, as the Adjusted R-Squared increases to 0.964 (Column 5 in Table 2). Hence, we see from this regression that misestimates of economic variables explain approximately 96% of discretionary spending projection errors. This is significant. Whereas underestimates of defense spending are potentially driven partially by US military involvement in the Middle East for approximately half the forecast horizon, misestimates of macroeconomic variables are far more determininstic in explaining variation in discretionary spending projection errors.

As shown in Column 5 of Table 2, misestimates of output and unemployment appear to have the greatest impact on discretionary spending projection errors. A one percentage point increase in the error for nominal GDP leads the projection error for discretionary spending to increase by 0.5 percentage points. A one percentage point increase in the error for the unemployment rate leads the projection error for discretionary spending to increase by 1.5 percentage points. These figures are economically and statistically signficant at the 1% level.

**Mandatory Spending:**

As shown in Figure 5, mandatory spending is *overestimated* in every forecast year except for 1996. And in each year for which it is overestimated, the error is driven by an overestimate of non-means-tested spending. Further analysis of forecast errors with respect to means- and non-means-tested spending is provided below. Over the entire forecast horizon, the CBO *overestimates* mandatory spending on average by 0.8% of GDP. The CBO overestimates cumulative mandatory spending, that is, the sum of total nominal mandatory spending over the forecast horizon, by 0.8% of cumulative GDP.

As is done above, I disaggregate mandatory spending projection errors into those due to economic and legislative/technical forecast errors, as is shown in Table 3.

Table 3: Disaggregation of Mandatory Spending Projection Errors (May 1996)

| VARIABLES | (1) Mandatory Spending Error | (2) Mandatory Spending Error | (3) Mandatory Spending Error | (4) Mandatory Spending Error | (5) Mandatory Spending Error |
|---|---|---|---|---|---|
| GDP | -0.120 | -0.165*** | -0.145** | 0.0193 | -0.00207 |
| | (0.0655) | (0.0429) | (0.0483) | (0.0188) | (0.0429) |
| CPI | | 0.214* | 0.209* | -0.0286 | -0.0223 |
| | | (0.0942) | (0.0936) | (0.0317) | (0.0411) |
| Unemployment | | | 0.0882 | 0.680*** | 0.694*** |
| | | | (0.101) | (0.0708) | (0.0633) |
| Treasury Bill | | | | 0.231*** | 0.278*** |
| | | | | (0.0228) | (0.0374) |
| Treasury Note | | | | | -0.0931 |
| | | | | | (0.103) |
| Constant | -0.00143 | -0.00572 | -0.00499 | 0.000266 | -0.000995 |
| | (0.00506) | (0.00331) | (0.00363) | (0.00127) | (0.00256) |
| Observations | 11 | 11 | 11 | 11 | 11 |
| Adjusted R-Squared | 0.429 | 0.612 | 0.595 | 0.904 | 0.903 |

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

As shown in Column 4 of Table 3, including three-month treasury rate projection errors adds substantial explanatory power to the model as the Adjusted R-Squared rises from 0.43 to 0.9 Hence, we see from this regression that misestimates of economic variables explain approximately 90% of mandatory spending projection errors. Furthermore, as shown in Column 5, misestimates of unemployment and the three-year treasury rate appear to have the greatest impact on mandatory spending projection errors. A one percentage point increase in the error for unemployment leads the projection error for mandatory spending to increase by 0.7 percentage points. A one percentage point increase in the error for the three-month treasury rate leads the projection error for spending to increase by 0.3 percentage points. These figures are economically and statistically signficant at the 1% level.

**Means-Tested Spending**

As Figure 6 shows, over the course of the entire projection horizon, the CBO *overestimates* means-tested spending by 0.2% of GDP on average. Given the level of output in the United States last year, an overestimate of the means-tested spending for 2018 of this magnitude would amount to an error of approximately $40 billion. In other words, the CBO would have projected means-tested spending in 2018 to be $40 billion higher than what was actually spent. This is approximately what the federal government spent on Child Nutrition and Child Health Insurance in 2018. Errors each year are primarily driven by overestimates of Medicaid spending, which average 0.2% of GDP across the forecast horizon. Furthermore, the CBO overestimates cumulative means-tested spending, that is, the sum of total nominal means-tested spending spent over the forecast horizon, by 0.2% of cumulative GDP

**Non-Means-Tested Spending**

Furthermore, as Figure 7 shows, forecast errors for means-tested spending are compounded by those made for non-means-tested programs. On average, the CBO overestimates the spending for such programs by 0.7% of GDP. These errors are primarily driven by overestimates of Social Security and Medicare spending. Given the level of output in the United States last year, an overestimate of non-means-tested spending for 2018 of this magnitude would amount to an error of approximately $111 billion. In other words, the CBO would have projected non-means-tested spending in 2018 to be $111 billion higher than what was actually spent. This is approximately what the federal government spent on veterens benefits in 2018. Errors are primarily driven by those made with respect to Medicare. Across the forecast horizon, the CBO overestimates Medicare spending, on average, by 0.5% of GDP.

The CBO overestimates cumulative non-means-tested spending, that is, the sum of total nominal non-means-tested spending spent over the forecast horizon, by 0.6% of cumulative GDP.

# Section II

## Overview

Given the findings of Section I, which include the CBO's 10-year *underestimates* of cumulative revenue and of cumulative discretionary spending, and *overestimates* of cumulative manadatory spending and public debt levels, I will now examine the accuracy of subsequent reports published from 1997-2008. The ultimate goal of this section is to determine whether the CBO has improved in its forecasting capabilities since it first began releasing 10-year projections.

This section has four objectives. Firstly, I seek to quantify the 10-year cumulative budget balance and final year public debt level forecast errors of each report. By "cumulative budget balance," I simply refer to the sum of the ten years worth of nominal spending projected by each report subtracted from the sum of ten-years worth of nominal revenue projected by each report. By "final year public debt level," I refer to the nominal projected amount of Debt Held by the Public at the end of the final forecast year of each report. I use these figures to determine whether CBO forecasts have become more accurate over time, and whether the direction of these errors are demonstrative of systematic bias, and have changed since 1996.

Secondly, I disaggregate cumulative budget balance forecast errors by errors made with respect to spending and revenue forecasts. I also break down spending and revenue forecast errors by line item. Using these figures, I determine whether the CBO has improved in forecasting various spending and revenue line items over time, and whether the direction of errors are demonstrative of systematic bias, and have changed since 1996. Thirdly, I break down spending and revenue forecast errors into those errors that are technical/legislative in nature and those made in forecasting macroeconomic variables such as output and inflation. Lastly, I assess the accuracy of the CBO's 30-year projections published in the May 1996 report.

# Quantifying and Disaggregating 10-Year Cumulative Forecast Errors

## Data

### 10-Year Projected Figures:

The 10-year projection data used reflects the CBO's baseline projections in Budget and Economic Outlook reports published from 1997-2008. I follow baseline projections to ensure comparability to the May 1996 Budget Report.

**Revenues:**

10-year revenue projection data is typically provided in the Revenue Outlook section in each report, breaking down estimates into seven categories: Individual Income Taxes, Corporate Income Taxes, Social Insurance Taxes, Excise Taxes, Estate and Gift Taxes, Customs Duties, and Miscellaneous. The data is provided in nominal dollar terms and as percentages of GDP.

**Discretionary Spending and Net Interest Expenses:**

10-year discretionary spending and net interest expense projection data is typically provided in the Spending Outlook section in each report. Discretionary spending is typically broken down into two categories: defense and non-defense spending. The data is provided in nominal dollar terms and as percentages of GDP.

**Mandatory Spending:**

10-year mandatory spending projection data is also typically provided in the Spending Outlook section in each report. In reports published from 1996 to 2003, projections of mandatory spending are explicitly broken down into means- and non-means-tested spending. Thus, in breaking down projections provided beginning in 2004, I determine whether line items fall into means- or non-means-tested spending based on their placement in reports published from 1996 to 2003 and their descriptions in analyses provided in each publication.

**Macroeconomic Variables:**

10-year macroeconomic variable projections are typically provided in the Economic Outlook section of each report where items include nominal GDP, real GDP, inflation (measured by the CPI), unemployment, and three-month and ten-year treasury rates.

### 10-Year Historical Figures:

I pull data on historical figures from the same sources as in my analysis of the May 1996 Budget Report.

## Methodology

### Measuring and Disaggregating Cumulative Forecasts Errors

Each budget report provides 10-year forecasts for each line item within the revenue and spending categories. Consider line item $i$ projected forward 10 years in the report published in year $t$. The cumulative forecast error for this line item in the report published in year $t$, is:

(3) $$E_{it} = \frac{\sum_{k=1}^{11} B_{itk}^{p}}{\sum_{k=1}^{11} Y_{tk}^{h}} - \frac{\sum_{k=1}^{11} B_{itk}^{h}}{\sum_{k=1}^{11} Y_{tk}^{h}}$$

where:

(i.) $B_{itk}^{p} \coloneqq$ The projected nominal value of line item $i$ in the k^th year of the forecast horizon of the report published in year $t$

(ii.) $B_{itk}^{h} \coloneqq$ The historical nominal value of line item $i$ in the k^th year of the forecast horizon of the report published in year $t$

(iii.) $Y_{tk}^{h}$ ≔ The historial nominal value of GDP in the k$^{th}$ year of the forecast horizon of the report published in year $t$

In other words, I determine the total projected nominal dollar value of this line item as a percentage of the total historical output over the forecast horizon and subtract the analogous figure for the historical values. This measurement of error is typically used in the literature on this topic, including reports written by the CBO. I calculate this figure for all line items produced by reports published from 1996-2008, for which historial values are available. The cumulative budget balance projection error for each report is disggragated into those errors made in estimating the spending and revenue categories.

The cumulative revenue forecast error for each report is decomposed into cumulative errors made for seven categories: Individual Income Taxes, Corporate Income Taxes, Social Insurance Taxes, Excise Taxes, Estate and Gift Taxes, Customs Duties, and Miscellaneous. The cumulative spending forecast error for each report is broken down by those made in projecting mandatory and discretionary spending. The cumulative mandatory spending forecast error for each report is disaggregated into errors made in estimating means- and non-means-tested spending. The cumulative discretionary spending forecast error for each report is disaggregated into errors made in estimating military and non-military spending.

In reporting the CBO's overall accuracy in projecting budget line items in its reports published from 1996-2008, I choose two measures. Firstly, I report the mean cumulative forecast error for say, budget line item $i$. To calculate this, I sum the cumulative forecast errors made in projecting this line item across all reports and divide this sum by the number of reports. Note, however, that because large positive cumulative forecast errors may cancel out large negative (in absolute terms) cumulative errors, this first measure does not offer much insight into how accurate the CBO is across reports in projecting line item $i$. It only offers insight for categories for which errors are in the same direction over time. Hence, I also report the mean absolute error for each line item.

## Detecting Systematic Bias

In order to determine whether the CBO has a tendency to cumulatively overestimate or underestimate various revenue and spending line items in its reports published from 1996 to 2008, I specify the following very simple regression model:

$$E_{it} = a_i + \varepsilon_{it} \tag{4}$$

where:

(i.) $E_{it}$ := The cumulative forecast error of line item $i$ in the budget report of year $t$

(ii.) $\alpha_i$ := A constant coefficient for line item $i$

(iii.) $\varepsilon_{it}$ := The residual term for line item $i$ in the budget report of year $t$

The constant coefficient in this regression specification will represent the mean cumulative error for a given line item across the budget reports published from 1996 to 2008. I estimate the population regression model above using Newey-West standard errors. I use the rule of thumb provided by Stock and Watson (2015) to determine the value of my lagged variable.

Note that one disadvantage to this estimation procedure is the lack of data. It becomes more difficult to assume asymptotic normality with only 13 data points. However, this paper seeks to offer insight on long-term forecast errors made by the CBO which the available body of literature on this topic has not done. Therefore, I am constrained to CBO reports that produce 10-year forecasts. Secondly, other studies of CBO forecast errors which use regression models also suffer from limited data availability. Kliesen and Thornton (2012), for example, study 30 CBO reports. While regression models run in this paper possess more power than those in my study, assuming asymptotic normality for the purpose of causal inference is still difficult with such little data. Statistical power with respect to data quantity must therefore be sacrificed if CBO reports are to be scrutinized in this manner.

# Results

### Budget Balance and Debt

As shown in Figure 8, the CBO underestimates the cumulative budget balance as a percentage of cumulative output in 1996 and 1997 and overestimates the cumulative balance as a percentage of cumulative output in reports published from 1998 to 2008. Among forecasts where the cumulative budget balance is overestimated, underestimates of cumulative spending drive errors produced in reports published from 1998 to 2000, whereas overestimates of cumulative revenue drive errors produced in reports published from 2002-2008. On average, as per Column 1 of Table 4, the CBO *overestimates* the cumulative budget balance by 3.9% of cumulative GDP. This point estimate is both economically signficant and statistically signficant at the 1% level, suggestive of systematic bias. The mean absolute error is 4.3% of GDP.

Consequently, as Figure 9 shows, the CBO underestimates the amount of debt held by the public at the end of the forecast horizon of each of its reports published after 1997. This error, as per Column 3 of Table 4, averages -38.5% of GDP across the reports, reaching a maximum (in magnitude) of -60.44% for the report published in 2001. In other words, the CBO underestimates in its 2001 report the amount of Debt Held by the Public in 2011 by 60.44% of 2011 GDP. This figure, as per Column 3 of Table 4, is statistically significant at the 1% level and is suggestive of systematic bias.

Table 4: Cumulative Budget Balance and Final Forecast Year Debt Projection Errors

| VARIABLES | (1) Budget Balance Error | (2) Budget Balance Error (Excl. Recession) | (3) Final Forecast Year Debt Error |
|---|---|---|---|
| Constant | 0.0389*** | 0.0179* | -0.385*** |
| | (0.0107) | (0.00948) | (0.0968) |
| Observations | 13 | 13 | 13 |

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

It is also important to note what the cumulative budget balance projection errors are without taking into account the effects of the Great Recession. If the CBO's historical inaccuracy can solely be attrbuted to a single economic shock, then there is not much the institution can do to improve its forecasting capability. In order to retrieve this information, I exclude forecasts for 2009 and subsequent years. 2009 appears to be the first year during which forecast errors grow significantly as a result of the recession. I choose not to exclude the year 2008 so as to preserve the data stemming from the 2008 report. Furthermore, while Kliesen and Thornton (2012) attempt to exclude the effects of the recession in their assessment of CBO forecast accuracy by just excluding the years 2008-2009, they do not take into account the compounded effect of errors made for those years on subsequent forecast periods. In other words, even if I were to exclude the years 2008 and 2009 from the forecast of the 2003 CBO Budget Report, the forecast errors for the years 2012 and 2013 will still reflect errors made in projecting budget outcomes in 2008 and 2009.

Figure 10 shows, without taking into account the effects of the Great Recession, that the CBO still overestimates the cumulative budget balance as a percentage of cumulative output in reports published from 1998 to 2003. These errors are almost entirely driven by underestimates of cumulative spending. In reports published from 2004 to 2008, the CBO's accuracy improves though it still overestimates the cumulative budget balance in the 2007 and 2008 reports. As shown in Column 2 of Table 4, without taking into account the effects of the Great Recession, the CBO *overestimates* the cumulative budget balance on average by 1.8% of cumulative GDP. This point estimate is both economically and statistically signficant at the 10% level, suggestive of systematic bias. The mean absolute error improves to 2.2% of cumulative GDP.

**Revenues**

As shown in Figure 11, the CBO overestimates 10-year cumulative revenue in each of its reports beginning in 1999. On average, it *overestimates* cumulative revenue by 2.2% of cumulative GDP. This, as per Column 1 of Table 5 is statistically signficant at the 5% level and is therefore suggestive of systematic bias. The mean absolute error is 2.5% of cumulative GDP. Note in Figure 11, that cumulative revenue projection errors are larger in magnitude in reports published after 1996 and are in the opposite direction. The errors grow particularly large in the early 2000s as 10-year projections begin accounting for those years of the Great Recession.

Figures 12 and 13 depict the forecast accuracy of revenue projections published in 2002 and 2003. As shown, and as is characteristic of every forecast produced after 1998, the overestimation of revenue spikes in 2009 and remains relatively high in subsequent periods. Reports published after 1998, as shown in Figure 11, have larger cumulative revenue errors than those produced before. Furthermore, cumulative revenue overestimates appear to be driven by overestimates of cumulative income taxes, which average 1.6% percent of cumulative GDP as per Column 3 of Table 5. This figure is statistically significant at the 1% level.

Table 5: Cumulative Revenue Projection Errors

| VARIABLES | (1)<br>Revenue Error | (2)<br>Revenue Error (Excl. Recession) | (3)<br>Income Tax Error | (4)<br>Income Tax Error (Excl. Recession) |
| --- | --- | --- | --- | --- |
| Constant | 0.0220** | 0.00323 | 0.0162*** | 0.00415 |
| | (0.00772) | (0.00428) | (0.00505) | (0.00322) |
| Observations | 13 | 13 | 13 | 13 |

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

As explained in Section I, revenue forecast errors can either be attributed to errors in projections of GDP or to errors in projections of revenues as a percentage of GDP.
In order to decompose CBO revenue forecast errors into those attriutable to misestimates of macroeconomic variables and those attributable to misestimates of the share of the economy drawn upon by various taxation schemes, I conduct a similar analysis as that provided above. I measure the average cumulative nominal GDP error (as measured by actual cumulative GDP subtracted from projected cumulative GDP divided by actual cumulative GDP) and the average error made with respect to revenue as a percentage of output (that is, actual cumulative revenue as a percentage of actual cumulative GDP subtracted from projected cumulative revenue as a percentage of projected cumulative GDP). The results of this analysis are shown in Table 6:

Table 6: Disaggregation of Cumulative Revenue Projection Errors

| VARIABLES | (1)<br>Nominal GDP Error | (2)<br>Revenue Error (Proportion of Output) | (3)<br>Revenue Error |
| --- | --- | --- | --- |
| Constant | -0.00957 | 0.0238*** | 0.0220** |
| | (0.0269) | (0.00358) | (0.00772) |
| Observations | 13 | 13 | 13 |

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

As shown in Table 6, whereas the CBO underestimates cumulative outuput on average by 0.9% (Column 1 of Table 6), it overestimates the proportion of the economy drawn upon by taxation by 2.4 percentage points (Column 2 of Table 6). In other words, the CBO underestimates the base upon which revenue is drawn but overestimates the proportion of that base that revenue comprises. Hence, the CBO's average overestimate of cumulative revenue of 2.2% of cumulative GDP appears to be driven by its average misestimate of cumulative revenue as a percentage of cumulative output.

Figure 14 depicts cumulative forecast errors of revenue for budget reports published from 1996 to 2008 excluding the effects of the Great Recession. As per Column 2 of Table 5, the mean error is 0.3% of cumulative GDP and the mean absolute error is 0.9%. The errors are on average smaller than those that include years after 2008, as Table 5 shows, and the CBO seems to no longer systematically overestimate revenue. Errors with respect to cumulative revenue, excluding post-recession years, are also driven by overestimes of cumulative income taxes, averaging 0.4% of cumulative GDP, as per Column 4 of Table 5. As shown in Table 7, I conduct the same analysis as above in disaggregating cumulative revenue forecast errors into those related to forecasts of the size of the economy and those related to misestimates of revenue as a percentage of the size of the economy.

Table 7: Disaggregation of Cumulative Revenue Projection Errors (Excl. Great Recession)

| VARIABLES | (1)<br>Nominal GDP Error | (2)<br>Revenue as a Percentage of Output Error | (3)<br>Overall Revenue Error |
|---|---|---|---|
| Constant | -0.0543***<br>(0.0110) | 0.0134***<br>(0.00393) | 0.00323<br>(0.00428) |

| Observations | 13 | 13 | 13 |
|---|---|---|---|

Standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

As shown in Column 1 of Table 7, the CBO still, on average, underestimates cumulative nominal GDP by 5.4%, and overestimates the proportion drawn upon that base by cumulative revenue by 1.3 perentage points. Hence, the CBO's average overestimate of cumulative revenue of 0.3% of cumulative GDP appears to be driven by its average misestimate of cumulative revenue as a percentage of cumulative output.

**Spending**

As shown in Figure 15, the CBO underestimates cumulative spending in its reports published after 1997. As per Column 1 of Table 8, on average, the CBO *underestimates* cumulative spending by 1.7% of cumulative GDP, a result that is statistically significant at the 5% level and suggestive of systematic bias. The mean absolute error is 1.8% of cumulative GDP. These errors, as per Figure 15, are primarily driven by underestimates of discretionary spending, particularly in reports published during the early 2000s. In 2007 and 2008, cumulative discretionary spending projection errors appear to play less of role compared to that played by cumulative mandatory spending errors. Further analysis of errors made with respect to these two spending categories is provided below. Interestingly, errors made with respect to net interest expenses appear to play less of a role. Across all budget reports analyzed, the CBO overestimates cumulative net interest expenses by 0.1% of cumulative GDP, a relatively small portion of the total average error. We see overall, that the CBO's ability to accurately forecast spending has not improved since 1996, and the direction of the errors for reports published after 1996 is the opposite of that for the 1996 report.

Table 8: Cumulative Spending Projection Errors

| VARIABLES | (1) Spending Error | (2) Spending Error (Excl. Recession) |
|---|---|---|
| Constant | -0.0169** | -0.0147** |
| | (0.00586) | (0.00584) |
| Observations | 13 | 13 |

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Aside from breaking down forecast errors into those related to various spending categories, it is also important to decompose these errors into those attributable to economic and technical/legislative errors. Firstly, I wish to determine the role of misestimates of macroeconomic variables versus those of technical/legislative misestimates Secondly, I wish to see which macroeconomic variables play the largest role in driving misestimates of spending. I accomplish these tasks by estimating the following regression model:

(5) $$S\_Error_{it_i} = \alpha + \beta GDP_{it_i} + \gamma UR_{it_i} + \delta CPI_{it_i} + \theta TB_{it_i} + \vartheta TN_{it_i} + \varepsilon_{it_i}$$

where:

(i.) $S\_Error_{it_i}$ := The spending projection error as a percentage of output made for the $t_i$-th year in budget report $i$. In other words, $S\_Error_{1996,1997}$ refers to the nominal spending projection error made for the year 1997 in the 1996 report as a percentage of actual nominal GDP in 1997.

(ii.) $GDP_{it_i}$ := The output projection error as a percentage of actual output made for the $t_i$-th year in budget report $i$. In other words, $GDP_{1996,1997}$ refers to the nominal GDP projection error made for the year 1997 in the 1996 report as a percentage of actual nominal GDP in 1997.

(iii.) $UR_{it_i}$ := The percentage point projection error of the unemployment rate made for the $t_i$-th year in budget report $i$. In other words, $UR_{1996,1997}$ refers to the percentage point error made for the unemployment rate for the year 1997 in the 1996 report.

(iv.) $CPI_{it_i}$ := The percentage point projection error of the change in the Consumer Price Index for Urban Consumers for the $t_i$-th year in budget report $i$. In other words, $CPI_{1996,1997}$ refers to the percentage point error made for inflation for the year 1997 in the 1996 report.

(v.) $TB_{it_i}$ := The percentage point projection error of the three-month treasury rate made for the $t_i$-th year in budget report $i$. In other words, $TB_{1996,1997}$ refers to the percentage point error made for the three-month treasury rate for the year 1997 in the 1996 report.

(vi.) $TN_{it_i}$ := The percentage point projection error of the 10-year treasury rate made for the $t_i$-th year in budget report $i$. In other words, $TN_{1996,1997}$ refers to the percentage point error made for the 10-year treasury rate for the year 1997 in the 1996 report.

I estimate the population regression model above using Driscoll and Kray standard errors which are hetero-skedasticity consistent when there potentailly exists auto-correlation between and within reports (Hoechle, 2006). I use the rule of thumb provided by Driscoll and Kray (Hoechle, 2006) to determine the value of my lagged variable. The results of estimating this model are shown in Table 9:

Table 9: Disaggregation of Spending Projection Errors

| VARIABLES | (1) Spending Error | (2) Spending Error | (3) Spending Error | (4) Spending Error | (5) Spending Error |
|---|---|---|---|---|---|
| GDP | -0.0238 | -0.0138 | 0.180*** | 0.194*** | 0.211*** |

| | | | | | |
|---|---|---|---|---|---|
| | (0.0435) | (0.0465) | (0.0211) | (0.0159) | (0.0147) |
| CPI | | -0.190 | 0.00327 | 0.0361 | 0.00963 |
| | | (0.126) | (0.0895) | (0.0972) | (0.0889) |
| Unemployment | | | 1.092*** | 1.031*** | 1.095*** |
| | | | (0.108) | (0.136) | (0.124) |
| Treasury Bill | | | | -0.132 | 0.0661 |
| | | | | (0.217) | (0.162) |
| Treasury Note | | | | | -0.418** |
| | | | | | (0.151) |
| Constant | -0.0163*** | -0.0159*** | -0.00502* | -0.00211 | 0.000726 |
| | (0.00267) | (0.00263) | (0.00245) | (0.00636) | (0.00643) |
| Observations | 143 | 143 | 143 | 143 | 143 |
| Adjusted R-Squared | -0.000410 | 0.00176 | 0.445 | 0.446 | 0.452 |

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The first objective of disaggregating spending projection errors into technical/legislative and economic forecast errors is provided for in the Adjusted R-Squared values. These values allow us to determine the degree to which variation in spending errors is explained by variation in macroeconomic forecast errors. As shown in Column 3 of Table 9, including unemployment projection errors adds substantial explantatory power to the model as the Adjusted R-Squared rises from 0.002 from 0.445. Thereafter, additions of interest rate forecast errors lead to further increases in the Adjusted R-Squared to 0.452 (Column 5 of Table 9). Hence, we see that misestimates of economic variables explain approximately 45% of spending projection errors.

The second objective of determining the most important macroeconomic variables in terms of their impact on spending projection errors is provided for in the coefficient point estimates. As shown by Column 5 of Table 9, misestimates of output and unemployment appear to have the greatest (statistical) impact on spending projection errors. A one percentage point increase in the error for output leads the projection error for spending to increase by 0.2 percentage points.  A one percentage point increase in the error for unemployment leads the projection error for spending to increase by 1.1 percentage points. These figures are economically and statistically signficant at the 1% level.

Importantly, I also analyze CBO spending projection errors without taking into account the effects of the Great Recession. As Figure 16 shows, the CBO underestimates cumulative spending in its reports published from 1998 to 2008. Furthermore, underestimates of cumulative discretionary spending appear to play a much larger role as a proportion of the total error when the Great Recession is not taken into account. As Column 2 of Table 8 shows, the CBO underestimates cumulative spending on average by 1.5% of cumulative GDP. The mean absolute error is 1.6% of cumulative GDP. I also disaggregate spending projection errors into those attributable to technical/legislative forecast errors and economic forecast errors. The results of this estimation are shown in Table 10.

Table 10: Disaggregation of Spending Projection Errors (Excl. Great Recession)

| VARIABLES | (1) Spending Error | (2) Spending Error | (3) Spending Error | (4) Spending Error | (5) Spending Error |
|---|---|---|---|---|---|
| GDP | 0.00721 | 0.0301 | 0.239*** | 0.219*** | 0.214*** |
| | (0.0909) | (0.0870) | (0.0690) | (0.0687) | (0.0638) |
| CPI | | 0.728** | 0.726** | 0.752** | 0.652** |
| | | (0.285) | (0.277) | (0.243) | (0.244) |
| Unemployment | | | 1.364*** | 1.135* | 1.395** |
| | | | (0.204) | (0.547) | (0.530) |
| Treasury Bill | | | | -0.113 | 0.167 |
| | | | | (0.266) | (0.307) |
| Treasury Note | | | | | -0.583* |
| | | | | | (0.315) |
| Constant | -0.0115 | -0.00797 | 5.18e-05 | 0.00120 | 0.00194 |
| | (0.00677) | (0.00625) | (0.00566) | (0.00734) | (0.00593) |
| Observations | 88 | 88 | 88 | 88 | 88 |
| Adjusted R-Squared | -0.0114 | 0.175 | 0.354 | 0.352 | 0.367 |

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

As is the case above, including unemployment forecast errors adds substantial explanatory power to the model, as the Adjusted R-Squared rises from 0.175 to 0.354 (Columns 2 and 3 of Table 10). Thereafter, additions of interest rate forecast errors lead to a further increase in the Adjusted R-Squared to 0.367 (Column 5 of Table 10). Misestimates of economic variables, therefore, explain approximately 37% of spending projection errors, a lower value than that found in accounting for the effects of the Great Recession.

Misestimates of inflation and unemployment appear to have the greatest impact on spending projection errors. A one percentage point increase in the error for inflation leads the projection error for spending to increase by 0.7 percentage points. A one percentage point increase in the error for unemployment leads the projection error for spending to increase by 1.4 percentage points. These figures are economically and statistically signficant at the 5% level.

**Discretionary Spending**

Figure 17 depicts misestimates of cumulative discretionary spending in CBO reports published from 1996-2008. The CBO underestimates cumulative discretionary spending on average, by 1.3% of cumulative GDP, as per Column 1 of Table 11, a statistically significant result. The mean absolute error is 1.3% of cumulative GDP. As shown in Figure 17, CBO forecasts of discretionary spending have not improved since the publication of the May 1996 Budget report, though the errors are in the same direction. For fiscal year 2000, the Balanced Budget and Emergency Deficit Control Act of 1991, which set caps for discretionary spending in subsequent years, combined defense and nondefense spending into an overall discretionary category while retaining separate categories for violent crime reduction, highway, and mass transit spending. Due to this complicated structuring of deficit control measures, the CBO is not able to provide detailed discretionary spending projection data in its budget report published in

1999. Hence, as Figure 17 shows, the cumulative discretionary spending forecast error of the 1999 report is not broken down into defense and nondefense spending.

Table 11: Cumulative Discretionary Spending Projection Errors

| VARIABLES | (1) Discretionary Spending Error | (2) Discretionary Spending Error (Excl. Recession) | (3) Defense Spending Error | (4) Defense Spending Error (Excl. Recession | (5) Non-Defense Spending Error | (6) Non-Defense Spending Error (Excl. Recession) |
|---|---|---|---|---|---|---|
| Constant | -0.0128*** | -0.0103*** | -0.00748*** | -0.00657*** | -0.00533*** | -0.00377** |
| | (0.00246) | (0.00221) | (0.00164) | (0.00102) | (0.00110) | (0.00141) |
| Observations | 13 | 13 | 13 | 13 | 13 | 13 |

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Military spending appears to drive errors particularly for reports published after 2000, which absorb increased military expenditure to finance the invasions of Iraq and Afghanistan. As shown in Column 3 of Table 11, the CBO underestimates cumulative defense spending on average by 0.7% of cumulative GDP. This figure is economically and statistically significant, suggestive of systematic bias across the reports studied. Such underestimation is reconcilable given the unpreditable nature of these invations following 9/11.

Note in Figure 17, that in reports published in 2007 and 2008, errors in cumulative non-defense spending appear to drive cumulative discretionary spending forecast errors. Whereas cumulative defense spending forecast errors average -0.8% compared to -0.5% of cumulative GDP for cumulative non-defense spending for reports published from 1996 to 2005, cumulative defense spending forecast errors average -0.4% compared to -0.5% of cumulative GDP for cumulative non-defense spending for reports published from 2006 to 2008. The effects of the Great Recession appear to be playing more of a role in determining CBO discretionary spending forecast accuracy in later publications. Additional evidence lies in the visualization of discretionary spending forecast errors made in the CBO's 2006 and 2007 reports, shown in Figures 18 and 19. Errors in both reports increase significantly in 2009 (in magnitude), driven primarily by those of non-defense spending. This timing coincides with that of stimulus programs passed to mitigate the effects of the Great Recession.

Completing the same exercise as before, I disaggregate the errors for discretionary spending into those attributable to technical/legislative and economic forecast errors. I then determine which economic variables are most deterministic of discretionary spending projection errors. The results of this regression estimation are below in Table 12.

Table 12: Disaggregation of Discretionary Spending Projection Errors

| VARIABLES | (1) Discretionary Spending Error | (2) Discretionary Spending Error | (3) Discretionary Spending Error | (4) Discretionary Spending Error | (5) Discretionary Spending Error |
|---|---|---|---|---|---|
| GDP | 0.0275 | 0.0304 | 0.128*** | 0.160*** | 0.183*** |
| | (0.0295) | (0.0300) | (0.0175) | (0.0142) | (0.00981) |
| CPI | | -0.0543 | 0.0427 | 0.120** | 0.0859** |
| | | (0.0472) | (0.0327) | (0.0390) | (0.0335) |
| Unemployment | | | 0.548*** | 0.404*** | 0.486*** |
| | | | (0.0357) | (0.0579) | (0.0466) |
| Treasury Bill | | | | -0.310** | -0.0554 |
| | | | | (0.112) | (0.0606) |
| Treasury Note | | | | | -0.538*** |
| | | | | | (0.108) |
| Constant | -0.0122*** | -0.0121*** | -0.00661** | 0.000234 | 0.00388 |
| | (0.00259) | (0.00260) | (0.00272) | (0.00378) | (0.00303) |
| Observations | 143 | 143 | 143 | 143 | 143 |
| Adjusted R-Squared | 0.0284 | 0.0245 | 0.470 | 0.565 | 0.628 |

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Adding unemployment projection errors adds substantial explantatory power to the model, as the Adjusted R-Squared rises from 0.025 to 0.470 (Columns 2 and 3 of Table 12). Thereafter, additions of interest rate forecast errors play a much larger role in explaining discretionary spending projection errors. The addition of these regressors leads the Adjusted R-Squared to increase to 0.63 (Column 5 of Table 12). Hence, misestimates of economic variables explain approximately 63% of spending projection errors, a much higher value compared to that found in examining overall spending.

Errors made with respect to output, unemployment, and the ten-year treasury rate appear to have the greatest impact on discretionary spending projection errors. A one percentage point increase in the error for nominal GDP leads the projection error for discretionary spending to increase by 0.18 percentage points. A one percentage point increase in the error for unemployment leads the projection error for discretionary spending to increase by 0.49 percentage points. And a one percentage point increase in the error for the ten-year treausury rate causes the discretionary spending projection error to decrease by 0.54 percentage points, or by magnitude, increase by 0.54 percentage points. These figures are economically and statistically signficant at the 1% level.

Without including the effects of the Great Recession, as visualized in Figure 20, the CBO underestimates cumulative defense spending on average by 0.7% of cumulative GDP, as per Column 4 of Table 11. Its underestimation of non-defense spending falls (in magnitude) on average to 0.4% of cumulative GDP (Column 6 of Table 11) . These results are statistically significant at the 5% level, and suggest that the CBO systematically underestimates discretionary spending across the budget reports assessed. The relatively larger increase in accuracy in CBO projections of cumulative non-defense spending versus cumulative defense spending is additional evidence of the crucial impact of the Great Recession on forecast accuracy.

I also disaggregate discretionary spending projection errors made without taking into account the impact of the recession into those attributable to technical and economic forecast errors.The results of this regression estimation are below in Table 13:

Table 13: Disaggregation of Discretionary Spending Projection Errors (Excl. Great Recession)

| VARIABLES | (1) Discretionary Spending Error | (2) Discretionary Spending Error | (3) Discretionary Spending Error | (4) Discretionary Spending Error | (5) Discretionary Spending Error |
|---|---|---|---|---|---|
| GDP | 0.118 | 0.124* | 0.259*** | 0.196*** | 0.189*** |
| | (0.0666) | (0.0670) | (0.0526) | (0.0412) | (0.0307) |
| CPI | | 0.211** | 0.210** | 0.292*** | 0.170** |
| | | (0.0883) | (0.0733) | (0.0674) | (0.0596) |
| Unemployment | | | 0.877*** | 0.145 | 0.462** |
| | | | (0.0931) | (0.244) | (0.197) |
| Treasury Bill | | | | -0.359*** | -0.0176 |
| | | | | (0.105) | (0.144) |
| Treasury Note | | | | | -0.711*** |
| | | | | | (0.175) |
| Constant | -0.00489 | -0.00388 | 0.00128 | 0.00493 | 0.00584** |
| | (0.00460) | (0.00461) | (0.00437) | (0.00392) | (0.00236) |
| Observations | 88 | 88 | 88 | 88 | 88 |
| Adjusted R-Squared | 0.165 | 0.200 | 0.403 | 0.555 | 0.641 |

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

We see that forecast errors for inflation and unemployment substantially improve our model's explanatory power over variation in discretionary spending errors. From Columns 1 to 3, the Adjusted R-Squared increases from 0.17 to 0.40. Further additions of interest rate forecast errors to this model improve its explanatory power to 0.64. Hence, misestimates of economic variables explain approximately 64% of the discretionary spending projection errors, roughly the same as that found in the analysis which includes the impact of the Great Recession.

Errors made with respect to unemployment and the ten-year treasury rate appear to have the greatest impact on discretionary spending projection errors. A one percentage point increase in the error for unemployment leads the projection error for discretionary spending to increase by 0.46 percentage points. And a one percentage point increase in the error for the ten-year treausury rate causes the discretionary spending projection error to decrease by 0.71 percentage points, or by magnitude, increase by 0.71 percentage points. These figures are economically and statistically signficant at the 1% level.

**Mandatory Spending**

As discussed previously, the CBO overestimates cumulative mandatory spending in its reports published in 1996 and 1997. However, as per Figure 21, beginning in 1998, the CBO cumulatively underestimates mandatory spending. This *underestimate* averages 0.7% of cumulative GDP over reports published from 1996-2008, a result that is statistically significant and suggestive of systematic bias (Column 1 of Table 14). The mean absolute error is 0.8% of cumulative GDP. Errors are primarily driven by cumulative underestimates of non-means-tested programs averaging 0.4% of cumulative GDP though underestimates of cumulative means-tested programs average 0.2% of GDP, both of which are statistically signficicant (Columns 3 and 5 of Table 14).

Table 14: Mandatory Spending Projection Errors

| VARIABLES | (1) Mandatory Spending Error | (2) Mandatory Spending Error (Excl. Recession) | (3) Means-Tested Spending Error | (4) Means-Tested Spending Error (Excl. Recession | (5) Non-Means-Tested Spending Error | (6) Non-Means-Tested Spending Error (Excl. Recession |
|---|---|---|---|---|---|---|
| Constant | -0.00662** | -0.00291 | -0.00242*** | -0.00130*** | -0.00420* | -0.00161 |
| | (0.00267) | (0.00174) | (0.000618) | (0.000414) | (0.00220) | (0.00134) |
| Observations | 13 | 13 | 13 | 13 | 13 | 13 |

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

I disaggregate mandatory spending errors into those due to technical/legislative and economic forecast errors using the same regression model as above. The results are below:

Table 15: Disaggregation of Mandatory Spending Projection Errors

| VARIABLES | (1) Mandatory Spending Error | (2) Mandatory Spending Error | (3) Mandatory Spending Error | (4) Mandatory Spending Error | (5) Mandatory Spending Error |
|---|---|---|---|---|---|
| GDP | -0.0485* | -0.0340 | 0.0662*** | 0.0632*** | 0.0696*** |
| | (0.0235) | (0.0265) | (0.00558) | (0.00831) | (0.00693) |
| CPI | | -0.275*** | -0.175*** | -0.183** | -0.192*** |
| | | (0.0649) | (0.0511) | (0.0587) | (0.0542) |
| Unemployment | | | 0.565*** | 0.579*** | 0.602*** |
| | | | (0.0331) | (0.0386) | (0.0321) |
| Treasury Bill | | | | 0.0289 | 0.1000 |
| | | | | (0.0855) | (0.0825) |
| Treasury Rate | | | | | -0.150* |
| | | | | | (0.0704) |
| Constant | -0.00696*** | -0.00637*** | -0.000722 | -0.00136 | -0.000340 |
| | (0.000892) | (0.000986) | (0.000428) | (0.00227) | (0.00213) |
| Observations | 143 | 143 | 143 | 143 | 143 |
| Adjusted R-Squared | 0.0915 | 0.155 | 0.579 | 0.577 | 0.578 |

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

We again see that including forecast errors for inflation and unemployment substantially improve our model's explanatory power over variation in mandatory spending errors. From Columns 1 to 3 of Table 15, the Adjusted R-Squared increases from 0.09 to 0.58. Further additions of interest rate forecast errors to this model do not improve its explanatory power as its Adjusted R-Squared remains approximately the same across Columns 3 to 5. Hence, misestimates of economic variables explain approximately 58% of mandatory spending projection errors.

Errors made with respect to inflation and the unemployment rate appear to have an impact on mandatory spending errors that is statistically signficant at the 1% level. A one percentage point increase in the error for inflation leads the projection error for mandatory spending to decrease (or increase in magnitude) by 0.2 percentage points. A one percentage point increase in the error for unemployment leads the projection error for mandatory spending to increase by 0.6 percentage points.

Notice however, exlcuding the impact of the Great Recession, the CBO underestimates cumulative mandatory spending on average by 0.3% of cumulative GDP, a result that is not suggestive of systematic bias (Column 2 of Table 14). The mean absolute error is 0.5% of cumulative GDP. As shown in Figure 22, errors are primarily driven by underestimates of cumulative non-means-tested spending, which average -0.2% of cumulative GDP across reports published from 1996-2008. However, cumulative means-tested spending errors average -0.1% of cumulative GDP across the same reports. The disaggregation of mandatory spending projection errors into those due to economic and technical/legislative forecast errors without taking into account the effects of the Great Recession is shown in Table 16:

Table 16: Disaggregation of Mandatory Spending Projection Errors (Excl. Great Recession)

| VARIABLES | (1) Mandatory Spending Error | (2) Mandatory Spending Error | (3) Mandatory Spending Error | (4) Mandatory Spending Error | (5) Mandatory Spending Error |
|---|---|---|---|---|---|
| GDP | -0.0472 | -0.0374 | 0.0508** | 0.0603** | 0.0588** |
| | (0.0268) | (0.0250) | (0.0173) | (0.0199) | (0.0192) |
| CPI | | 0.309*** | 0.308*** | 0.296*** | 0.268*** |
| | | (0.0926) | (0.0932) | (0.0764) | (0.0779) |
| Unemployment | | | 0.577*** | 0.687** | 0.759*** |
| | | | (0.0699) | (0.223) | (0.216) |
| Treasury Bill | | | | 0.0543 | 0.131 |
| | | | | (0.111) | (0.117) |
| Treasury Note | | | | | -0.160 |
| | | | | | (0.130) |
| Constant | -0.00502** | -0.00354* | -0.000148 | -0.000700 | -0.000495 |
| | (0.00205) | (0.00186) | (0.00142) | (0.00248) | (0.00212) |
| Observations | 88 | 88 | 88 | 88 | 88 |
| Adjusted R-Squared | 0.0562 | 0.277 | 0.488 | 0.490 | 0.495 |

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Errors with respect to unemployment and inflation add substantial explanatory power to the impact of economic forecast errors on mandatory spending errors. The Adjusted R-Squared rises from 0.056 to 0.49 from Columns 1 to 3 of Table 16. As was the case in analyzing mandatory spending errors, taking into account the effects of the Great Recession, errors with respect to interest rate forecasts do not add much more explanatory power to the model, with the Adjusted R-Squared rising to 0.5 in Column 5. Hence, economic forecast errors explain roughly half of the variation in mandatory spending forecast errors, slightly less than that explained taking into account the Great Recession.

Furthermore, a one percentage point increase in the error for inflation leads the error for mandatory spending to increase by 0.3 percentage points. A one percentage point increase in the error for unemployment leads the error for mandatory spending to increase by 0.8 percentage points. These results are statistically significant at the 1% level.

**Means-Tested Spending**

Figure 23 shows CBO forecast errors for cumulative means-tested spending. Whereas in earlier periods, during which overestimates of cumulative Medicaid spending drive overestimates of cumulative means-tested spending, averaging 0.1% of GDP, the CBO's underesimates of means-tested spending in its reports published after 1997 are primarily driven by underestimates of cumulative Food Stamps spending and other categories. Underestimates of cumulative Food Stamps spending average 0.1% of cumulative GDP in reports published from 1999 to 2008. Within the category named "Other," errors with respect to forecasts of the cumulative Earned Income and Child Tax Credit (averaging -0.2% of cumulative GDP) drive misestimates. These results are reconcilable given that average monthly participation in SNAP grew from 26.3 million in 2007 to 46.5 million in December of 2011, an increase the CBO would not have been able to anticipate. Overall, the CBO *underestimates* cumulative means-tested spending on average by 0.2% of cumulative GDP in its reports published from 1996 to 2008 (Column 3 of Table 14). The mean absolute error is 0.3%.

Without taking into account the effects of the Great Recession, as shown in Figure 24 and Column 4 of Table 14, the CBO's average underesimate of cumulative means-tested spending falls (in magnitude) to 0.1% of cumulative GDP. This figure, while smaller, is still statistically significant and suggestive of systemtatic bias (Column 4 Table 14). Errors here are also driven primarily by the "Other" category. However, no particular line-item appears to drive this relatively small error.

**Non-Means-Tested Spending**

Figure 25 shows CBO forecast errors for cumulative non-means-tested spending. Interestingly, in reports published from 1996 to 1998 and 2004 to 2008, the CBO overestimates cumulative Medicare spending on average by 0.3% of cumulative GDP though it underestimates such cumulative spending in those reports published from 1999 to 2003 on average by 0.3% of cumulative GDP. Hence, across all reports, the CBO overestimates Medicare spending on average by 0.1% of cumulative GDP. The mean absolute error is 0.3% of cumulative GDP. Hence, the CBO does not perform well in accurately forecasting Medicare spending. Nonetheless, on average, the CBO underestimates cumulative non-means-tested spending by 0.4% of cumulative GDP. As per Column 5 of Table 14, this figure is statistically significant at the 10% level and is marginally suggestive of systematic bias.  The mean absolute error is 0.6% of cumulative GDP. Hence substantial variation in cumulative non-means-tested spending forecast errors obscures the relatively large error the CBO makes with respect to this item in each of its reports.

Driving its average underestimation are errors made with respect to Medicare in reports published from 2000 to 2003 and the "Other" category, particularly for reports published after 1998. In particular, the CBO underestimates cumulative unemployment compensation in each report published after 1999. Such errors average -0.2% of cumulative GDP across all reports. The CBO also significantly underestimates veterens benefits in reports published after 2004 as veterens from wars in Afghanistan and Iraq began coming home. The CBO underestimates cumulative veterens benefits on average by 0.1% of cumulative GDP on average across all reports.

Without taking into account the effects of the Great Recession, as shown in Figure 26 and Column 6 of Table 14, the CBO's average underesimate of cumulative non-means-tested spending falls (in magnitude) to 0.2% of cumulative GDP. This figure is smaller than that found in results that take into account the recession and is statistically insignificant (Column 6 of Table 14). Errors here are also driven primarily by the errors made with respect to Medicare in reports published after 1999, which average -0.13% of cumulative GDP.

## Assesing the Accuracy of 30-Year Forecasts

In the May 1996 Budget Report, the CBO also provides less detailed, long-term budgetary projections for the years 2010, 2015, 2020, 2025, 2030, and 2050. It does so, anticipating members of the baby-boom generation to retire beginning in 2010, drawing benefits from the government's three biggest entitlement programs – Social Security, Medicare, and Medicaid. Whereras the CBO believes its 10-year projections to reflect a relatively modest increase in Debt Held by the Public, it comes to the conclusion, based on its much longer-term projections, that "the nation's current budget policies are unsustainable even under optimistic assumptions, including favorable demographic trends and historically high rates of productivity growth."

Based on future assumptions of a substantial increase in the number of elderly people, a slowdown in labor force growth, and the continued rapid growth of federal health expenditures, the CBO projects Debt Held by the Public to increase from its level of 51% of GDP in 1995 to 77% of projected GDP in 2015, 97% of projected GDP in 2020, 124% of projected GDP in 2025, and 157% of projected GDP in 2030. The CBO provides additional forecasts taking into account the adverse effects of high levels of public debt on the economy. Accounting for these economic feedbacks, the CBO projects Debt Held by the Public to increase to 78% of projected GDP in

2015, 104% of projected GDP in 2020, 148% of projected GDP in 2025, and 229% of projected GDP in 2030.

The only year for which we can measure the CBO's forecast error is 2015. At the end of 2015, Debt Held by the Public stood at 72.5% of GDP. Hence, under both debt forecasts, the CBO overestimates Debt Held by the Public in 2015 by 4.5 percentage points (without economic feedbacks) and 5.5 percentage points (with economic feedbacks). In its latest projections (published in January 2019), the CBO forecasts Debt Held by the Public to grow to 79.6% of projected GDP in 2020, 87.7% of projected GDP in 2025, and 92.7% of projected GDP in 2029. Hence, solely in examining the latest CBO Budget Report do we suspect that Debt projections have been revised downward since the May 1996 Budget Report was published.

To investigate this further, I focus solely on the CBO's 30-year debt projection (that for the year 2025) in its May 1996 Budget Report (without economic feedbacks) and examine subsequent baseline projections of Debt Held by the Public in reports for which this data is available. Unfortunately, the CBO only began consistently publishing extended-baseline forecasts beginning in 2009. Hence, I compare the debt forecast of the May 1996 Budget Report to those published after 2009. As shown in Figure 27, in its most recent reports, the CBO forecasts Public Debt as a percentage of GDP to be substantially lower than that published in May 1996. Across these reports, Debt Held by the Public as a percentage of output in 2025 averages 76.8%. Hence, despite accounting for the Great Recession (including the slow recovery), wars in Afghanistan, Iraq, and Syria, and even more recent tax reforms, the CBO projects Debt Held by the Public in 2025 to be substantially lower than that predicted in May of 1996.

## **Conclusion**

This paper has primarily focussed on quantifying historical CBO long-term forecast errors. The existing literature on this topic has focussed on historical CBO short-term projections. But given the importance of CBO 10- and 30-year projections in informing public policy and even campaign rhetoric, a preliminary examination of long-term forecasts was in dire need. I hope to have begun a conversation on why the CBO has been so innacuate in its 10- and 30-year projections.

Given the analysis above, it firstly appears clear that historically, forecast errors (excluding the effects of the Great Recession) have been driven primarily by underestimates in spending. As mentioned earlier, in reports published from 1996-2008, on average, the CBO underestimates cumulative nominal spending by 1.5% of cumulative GDP. Errors for revenue (excluding the effects of the Great Recession) are comparitvely small. And within spending, underestimates of discretionary spending appear to be the largest and most detemining factor. Furthermore, we see that defense spending forecast errors play the largest role (excluding the effects of the Great Recession) in determining discretionary spending forecast errors.

Hence, in further examination of this topic, I believe that the conversation must begin in determining why discretionary spending forecasts are so inaccurate. Improvements made in forecasting this specific element of the budget can go a long way in improving the CBO's forecasts of the entire budget.

# Works Cited


Auerbach, A. (1999). On the Performance and Use of Government Revenue Forecasts. *National Tax Journal*. Retrieved May 3, 2019.

Auerbach, A., & Gale, W. G. (2017). The Fiscal Outlook in a Period of Policy Uncertainty. *Tax Policy Center*. Retrieved May 3, 2019.

Belasco, A. (2014). The Cost of Iraq, Afghanistan, and Other Global War on Terror Operations Since 9/11. *Congressional Research Service*. Retrieved May 3, 2019.

CBO. (2017). An Evaluation of CBO's Past Outlay Projections. Retrieved May 3, 2019.

CBO. (2017). CBO's Economic Forecasting Record: 2017 Update. Retrieved May 4, 2019.

CBO. (1996). The Economic and Budget Outlook: Fiscal Years 1997-2006. Retrieved May 3, 2019.

CBO. (1997). The Economic and Budget Outlook: Fiscal Years 1998-2007. Retrieved May 3, 2019.

CBO. (1998). The Economic and Budget Outlook: Fiscal Years 1999-2008. Retrieved May 3, 2019.

CBO. (1999). The Economic and Budget Outlook: Fiscal Years 2000-2009. Retrieved May 3, 2019.

CBO. (2000). The Economic and Budget Outlook: Fiscal Years 2001-2010. Retrieved May 3, 2019.

CBO. (2001). The Economic and Budget Outlook: Fiscal Years 2002-2011. Retrieved May 3, 2019.

CBO. (2002). The Economic and Budget Outlook: Fiscal Years 2003-2012. Retrieved May 3, 2019.

CBO. (2003). The Economic and Budget Outlook: Fiscal Years 2004-2013. Retrieved May 3, 2019.

CBO. (2004). The Economic and Budget Outlook: Fiscal Years 2005-2014. Retrieved May 3, 2019.

CBO. (2005). The Economic and Budget Outlook: Fiscal Years 2006-2015. Retrieved May 3, 2019.

CBO. (2006). The Economic and Budget Outlook: Fiscal Years 2007-2016. Retrieved May 3, 2019.

CBO. (2007). The Economic and Budget Outlook: Fiscal Years 2008-2017. Retrieved May 3, 2019.

CBO. (2008). The Economic and Budget Outlook: Fiscal Years 2009-2018. Retrieved May 3, 2019.

CBO. (2009). The Economic and Budget Outlook: Fiscal Years 2010-2019. Retrieved May 3, 2019.

CBO. (2010). The Economic and Budget Outlook: Fiscal Years 2011-2020. Retrieved May 3, 2019.

CBO. (2011). The Economic and Budget Outlook: Fiscal Years 2012-2021. Retrieved May 3, 2019.

CBO. (2012). The Economic and Budget Outlook: Fiscal Years 2013-2022. Retrieved May 3, 2019.

CBO. (2013). The Economic and Budget Outlook: Fiscal Years 2014-2023. Retrieved May 3, 2019.

CBO. (2014). The Economic and Budget Outlook: Fiscal Years 2015-2024. Retrieved May 3, 2019.

CBO. (2015). The Economic and Budget Outlook: Fiscal Years 2016-2025. Retrieved May 3, 2019.

CBO. (2016). The Economic and Budget Outlook: Fiscal Years 2017-2026. Retrieved May 3, 2019.

CBO. (2017). The Economic and Budget Outlook: Fiscal Years 2018-2027. Retrieved May 3, 2019.

CBO. (2018). The Economic and Budget Outlook: Fiscal Years 2019-2028. Retrieved May 3, 2019.

CBO. (2019). The Economic and Budget Outlook: Fiscal Years 2020-2029. Retrieved May 3, 2019.

Hoechle, D. (2007). Robust Standard Errors for Panel Regressions with Cross-Sectional Dependence. *The Stata Journal: Promoting Communications on Statistics and Stata,7*(3), 281-312. doi:10.1177/1536867x0700700301

Kliesen, K. L., & Thornton, D. L. (2012). How Good Are the Government's Deficit and Debt Projections and Should We Care? *Review,94*(1). doi:10.20955/r.94.21-39

Plesko, G. (1988). The Accuracy of Government Forecasts and Budget Projections. *National Tax Journal*. Retrieved May 3, 2019.

Stock, J. H., & Watson, M. W. (2020). *Introduction to econometrics*. Harlow, United Kingdom: Pearson Education Limited.

Tempalski, J. (n.d.). Revenue Effects of Major Tax Bills Updated Tables for all ... Retrieved May 3, 3, from https://www.treasury.gov/resource-center/tax-policy/taxanalysis/Documents/WP81-Table2013.pdf

The Legacy of the 2001 and 2003 "Bush" Tax Cuts. (2017, November 14). Retrieved from https://www.cbpp.org/research/federal-tax/the-legacy-of-the-2001-and-2003-bush-taxcuts

# Appendix

Figure 1: 1996 Budget Balance Projection Errors (% of GDP)

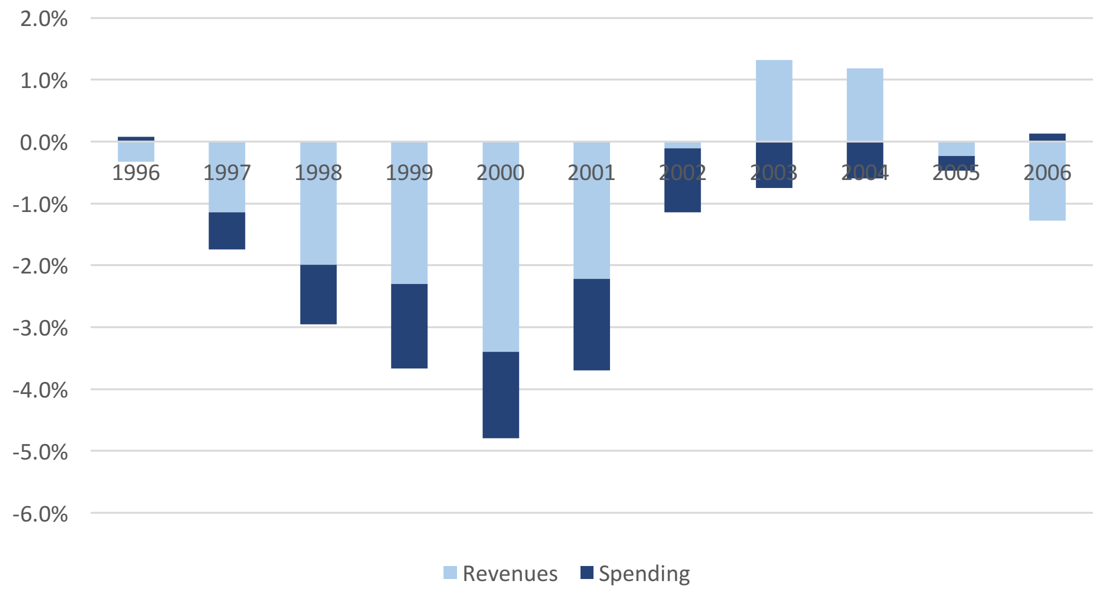
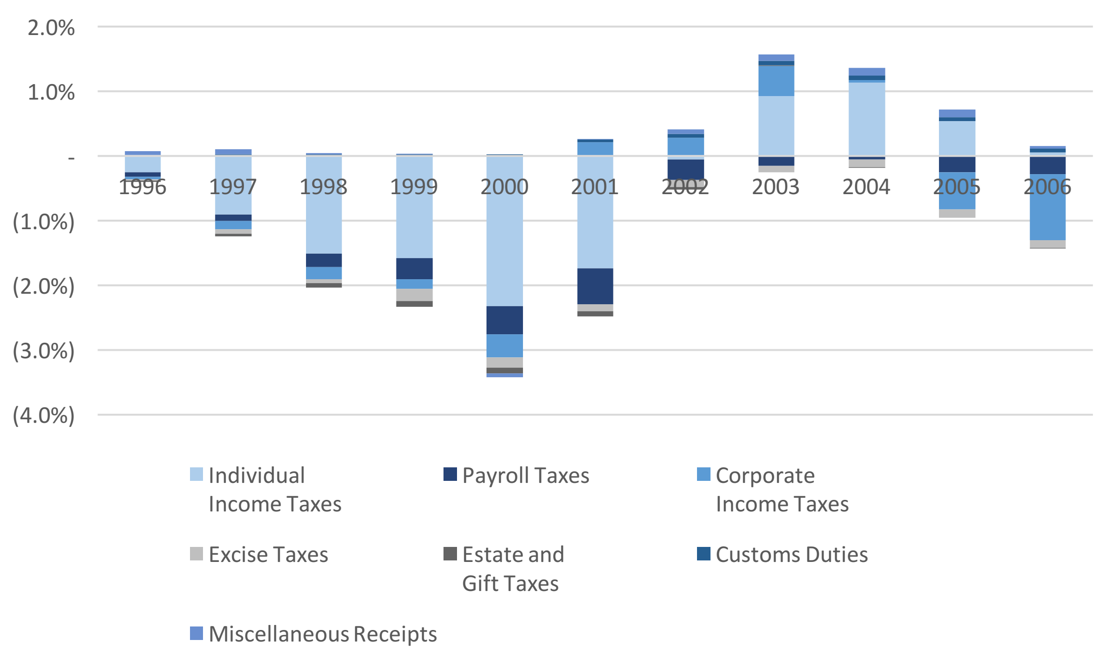



Figure 2: 1996 Revenue Projection Errors (% of GDP)



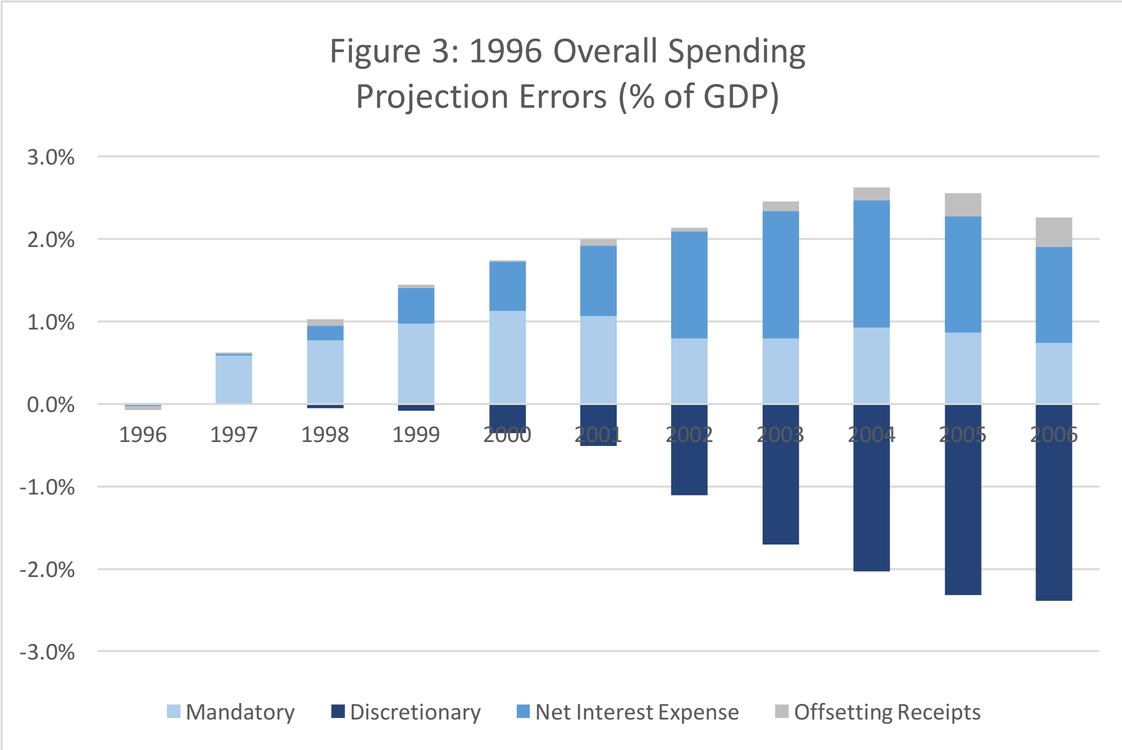


Figure 3: 1996 Overall Spending Projection Errors (% of GDP)
3.0%
2.0%
1.0%
0.0%
-1.0%
-2.0%
-3.0%
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
Mandatory
Discretionary
Net Interest Expense
Offsetting Receipts

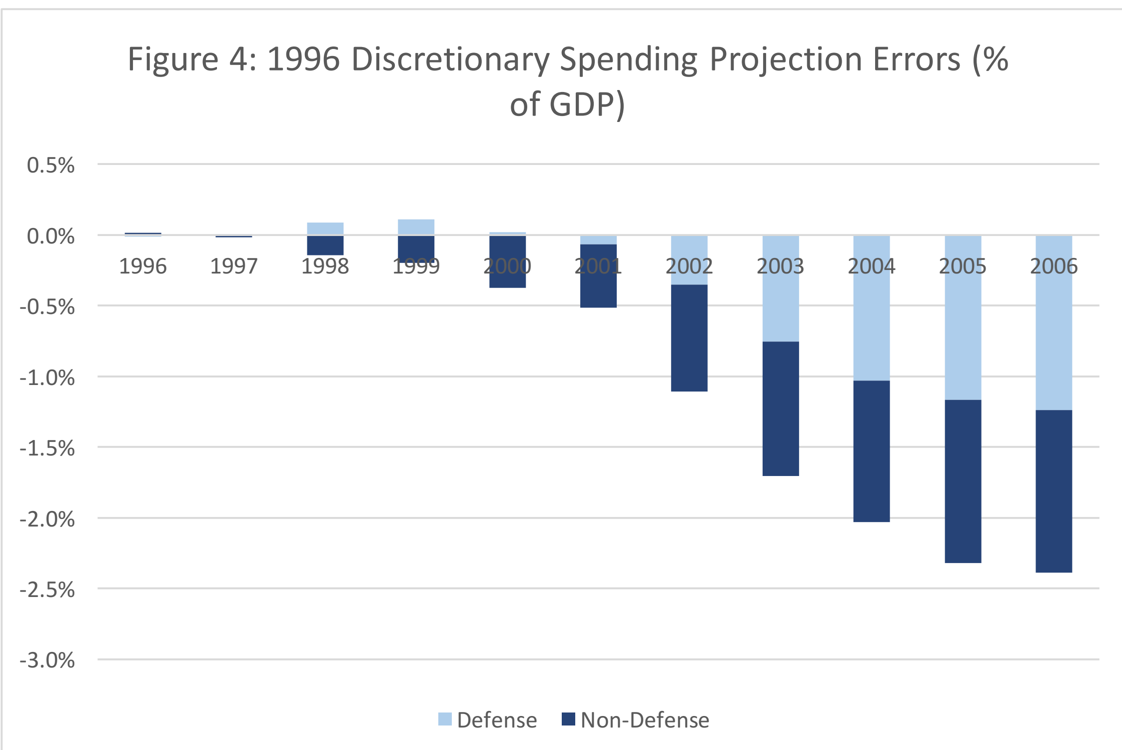


Figure 4: 1996 Discretionary Spending Projection Errors (% of GDP)
0.5%
0.0%
-0.5%
-1.0%
-1.5%
-2.0%
-2.5%
-3.0%
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
Defense
Non-Defense

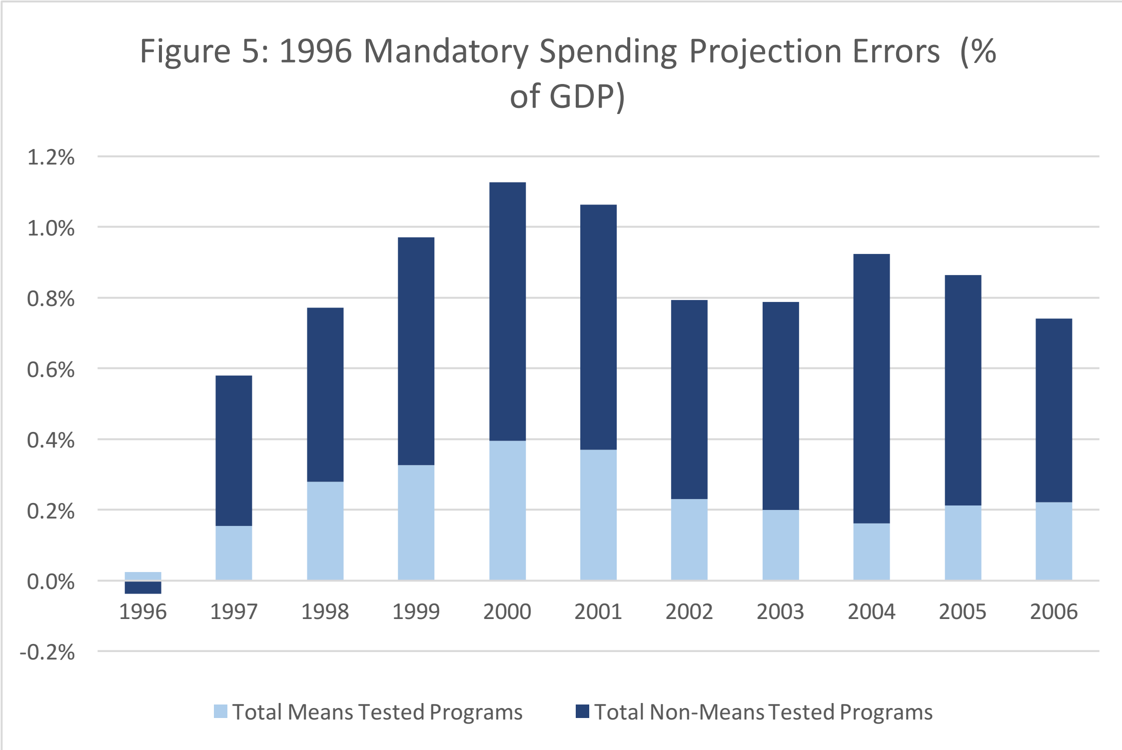


Figure 5: 1996 Mandatory Spending Projection Errors (% of GDP)
1.2%
1.0%
0.8%
0.6%
0.4%
0.2%
0.0%
-0.2%
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
Total Means Tested Programs
Total Non-Means Tested Programs

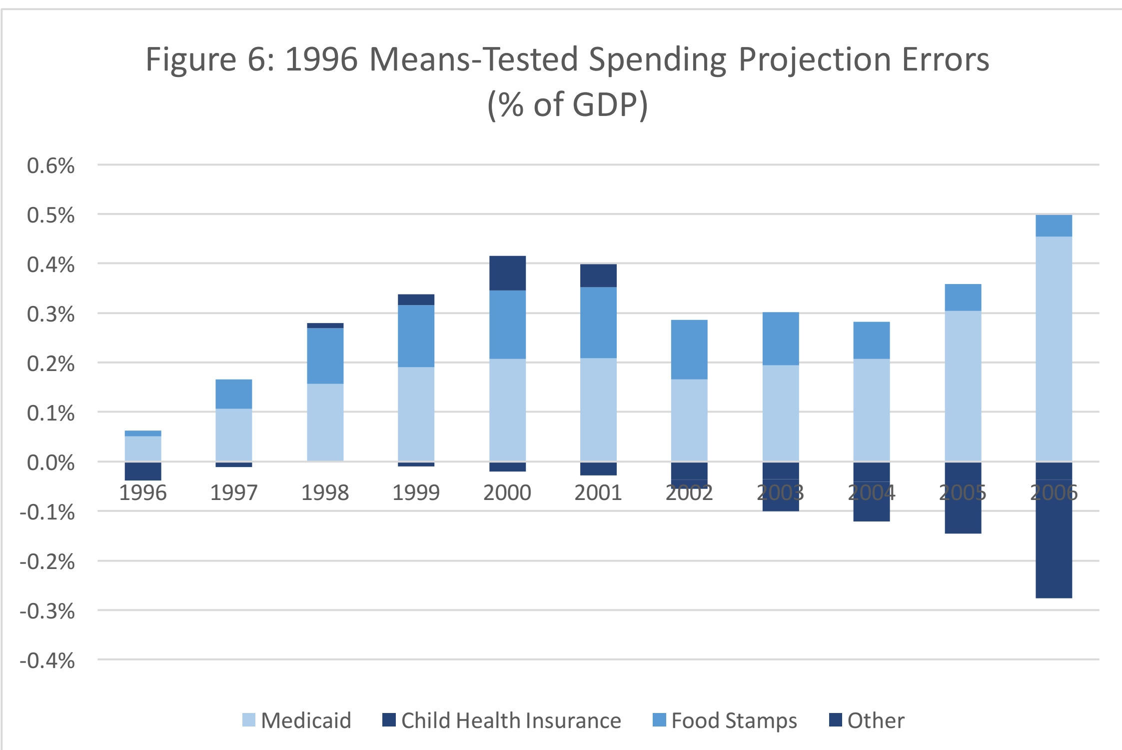


Figure 6: 1996 Means-Tested Spending Projection Errors (% of GDP)
0.6%
0.5%
0.4%
0.3%
0.2%
0.1%
0.0%
-0.1%
-0.2%
-0.3%
-0.4%
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
Medicaid
Child Health Insurance
Food Stamps
Other

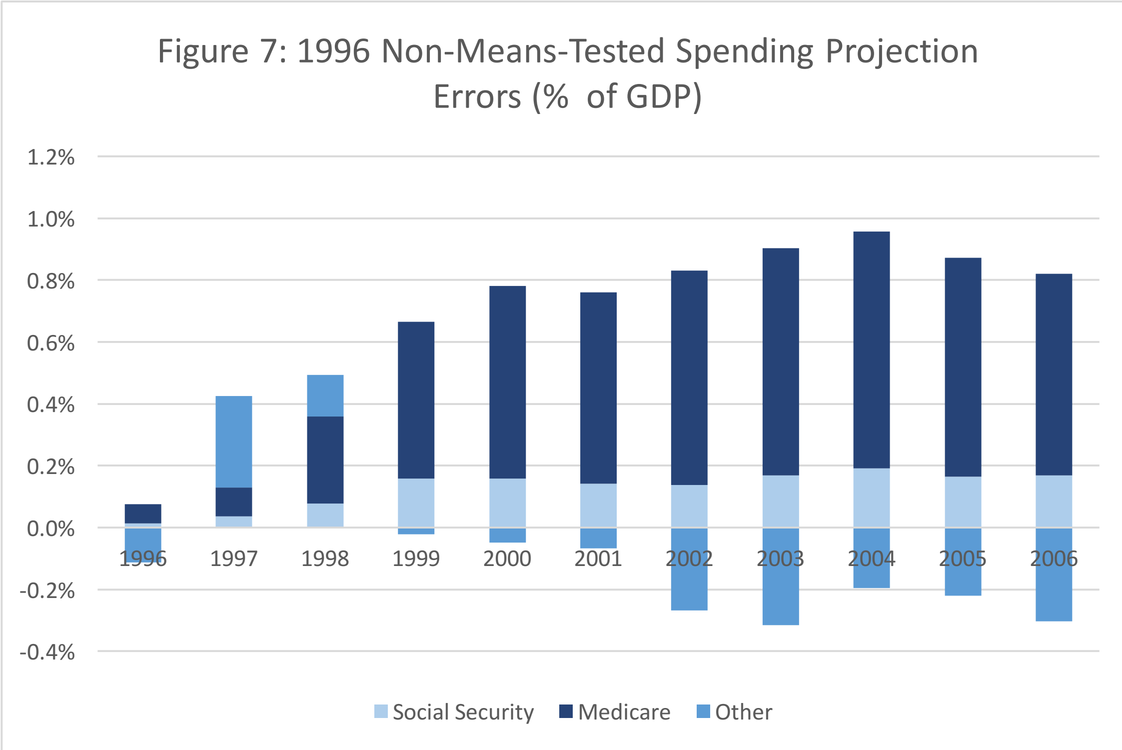


Figure 7: 1996 Non-Means-Tested Spending Projection Errors (% of GDP)
1.2%
1.0%
0.8%
0.6%
0.4%
0.2%
0.0%
-0.2%
-0.4%
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
Social Security
Medicare
Other

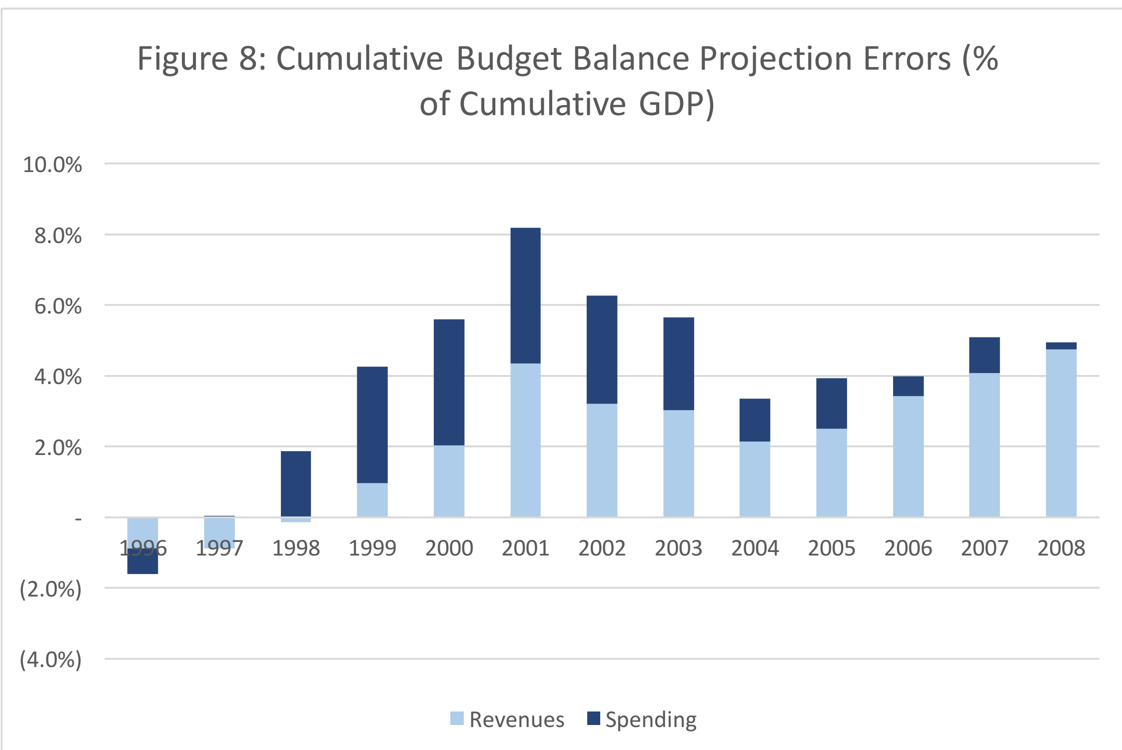


Figure 8: Cumulative Budget Balance Projection Errors (% of Cumulative GDP)
10.0%
8.0%
6.0%
4.0%
2.0%
-
(2.0%)
(4.0%)
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Revenues
Spending

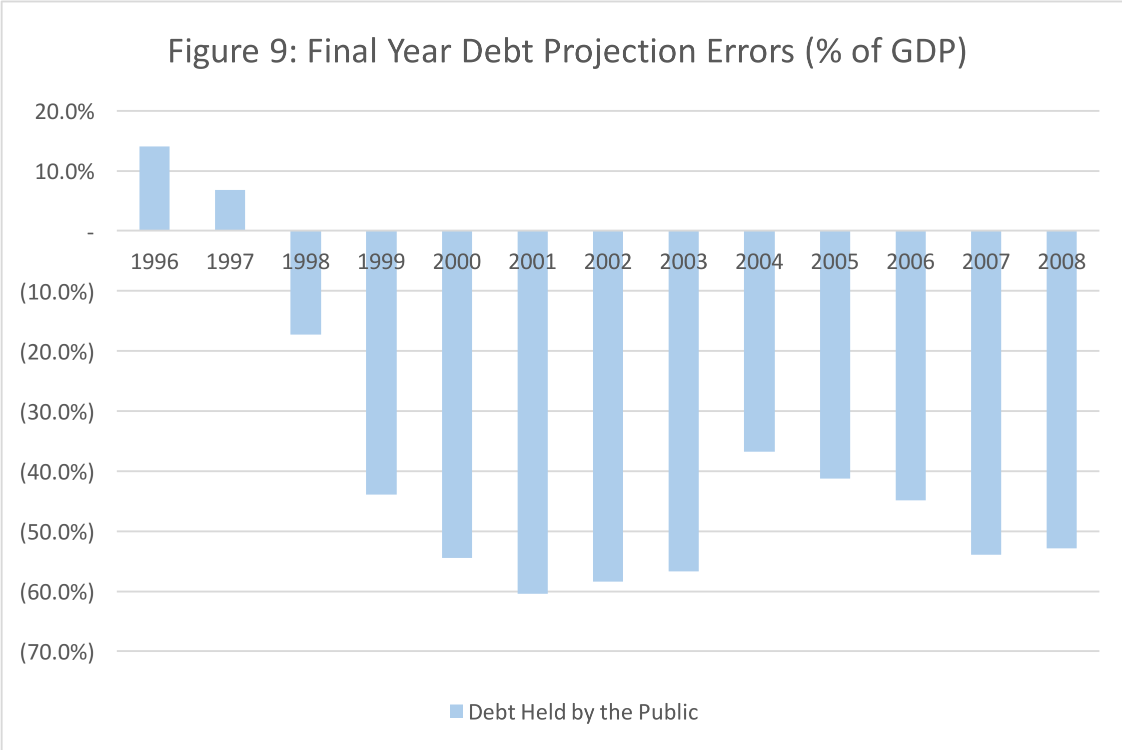


Figure 9: Final Year Debt Projection Errors (% of GDP)
20.0%
10.0%
-
(10.0%)
(20.0%)
(30.0%)
(40.0%)
(50.0%)
(60.0%)
(70.0%)
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008
Debt Held by the Public

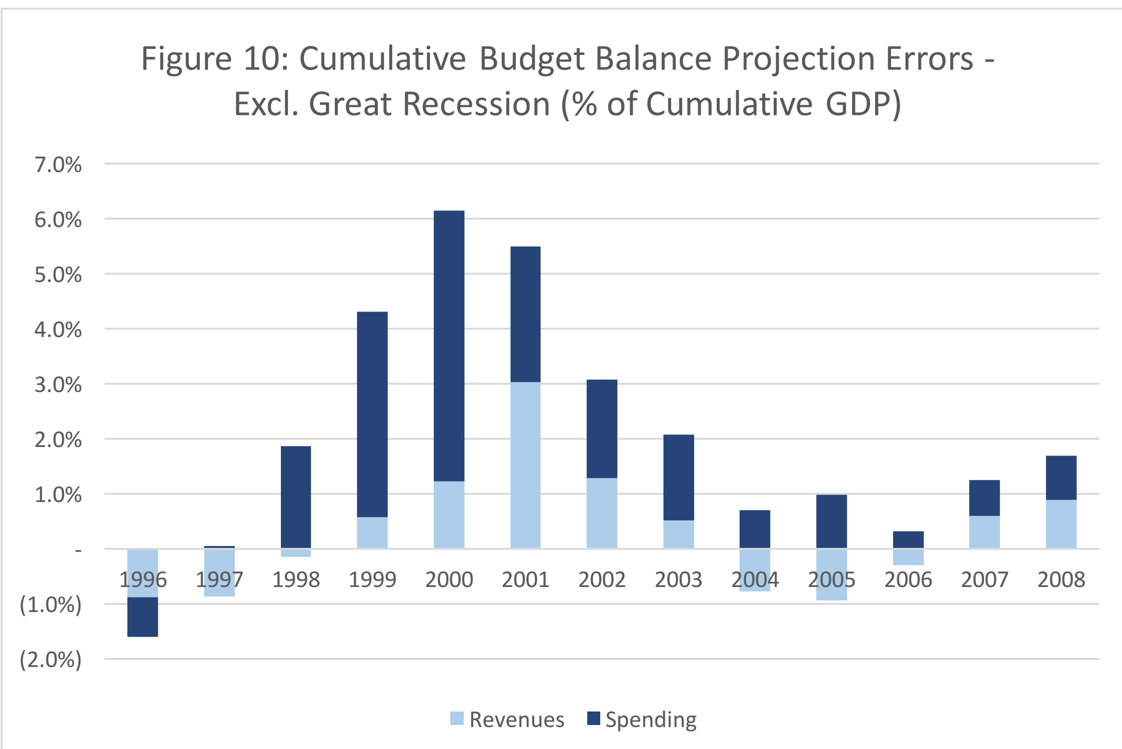


Figure 10: Cumulative Budget Balance Projection Errors - Excl. Great Recession (% of Cumulative GDP)
7.0%
6.0%
5.0%
4.0%
3.0%
2.0%
1.0%
-
(1.0%)
(2.0%)
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008
Revenues
Spending

Figure 11: Cumulative Revenue Projection Errors (% of Cumulative GDP)

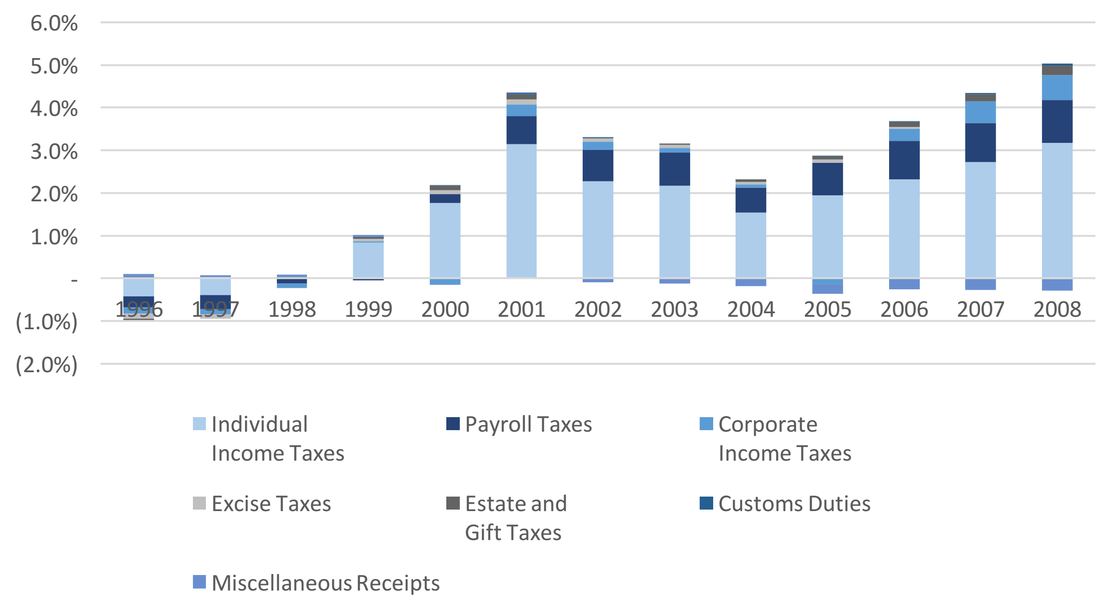
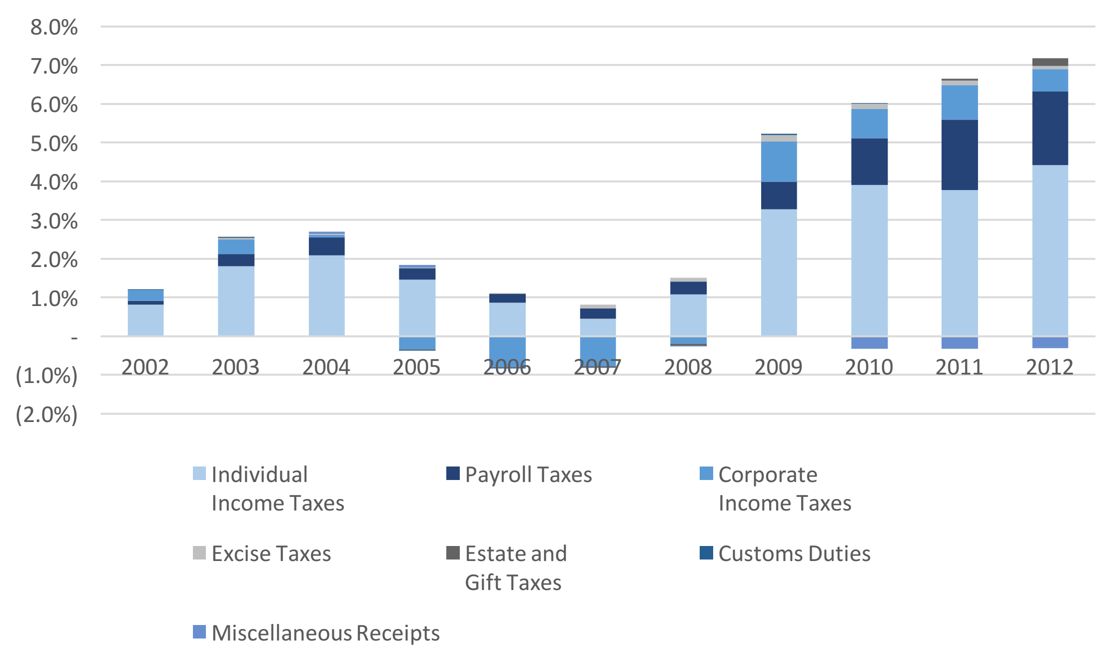



Figure 12: 2002 Revenue Projection Errors (% of GDP)



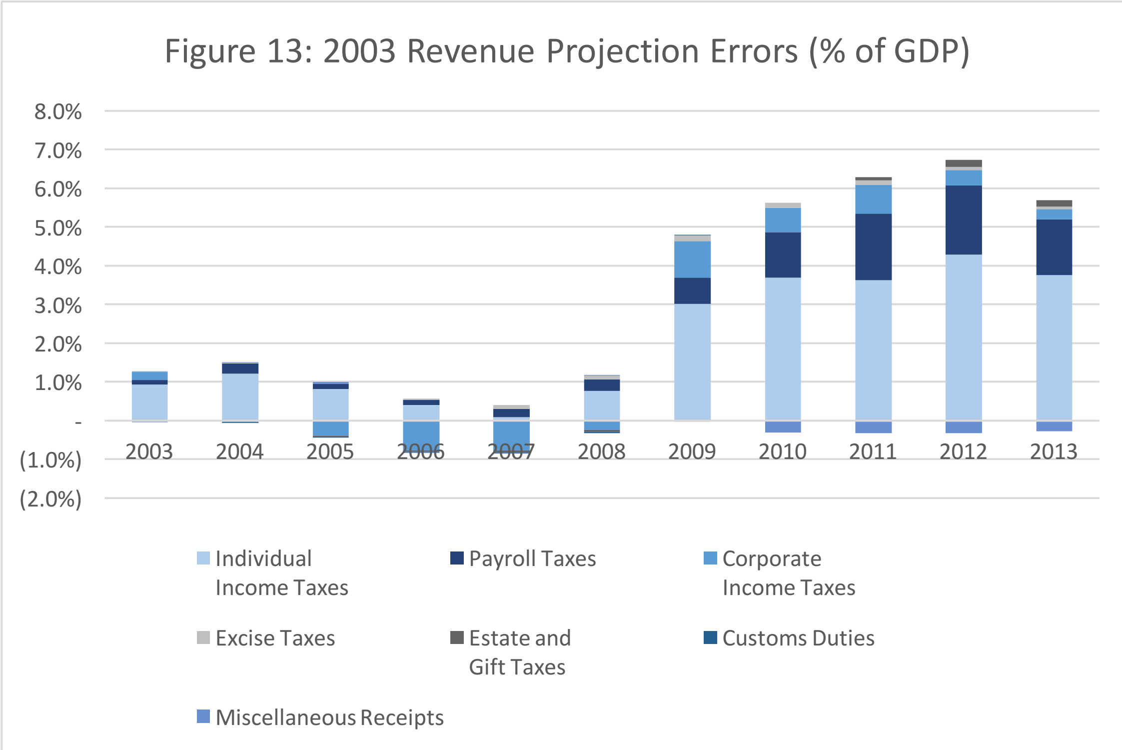


Figure 13: 2003 Revenue Projection Errors (% of GDP)
8.0%
7.0%
6.0%
5.0%
4.0%
3.0%
2.0%
1.0%
-
(1.0%)
(2.0%)
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
Individual Income Taxes
Payroll Taxes
Corporate Income Taxes
Excise Taxes
Estate and Gift Taxes
Customs Duties
Miscellaneous Receipts

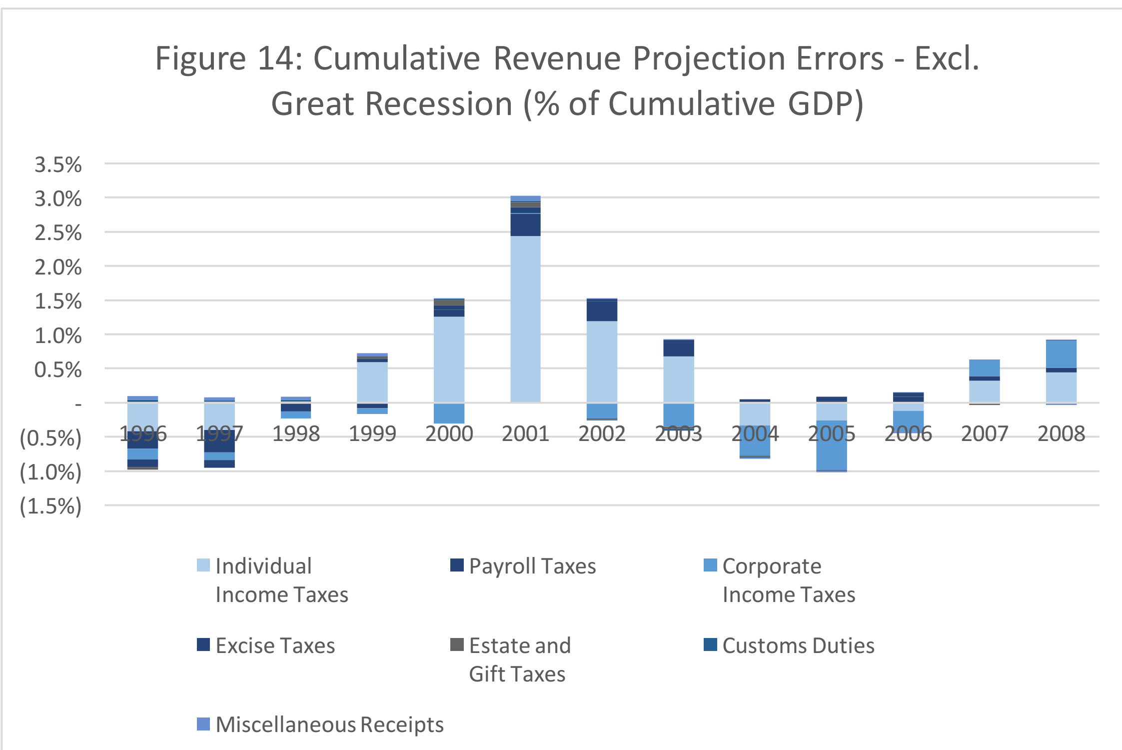


Figure 14: Cumulative Revenue Projection Errors - Excl. Great Recession (% of Cumulative GDP)
3.5%
3.0%
2.5%
2.0%
1.5%
1.0%
0.5%
-
(0.5%)
(1.0%)
(1.5%)
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Individual Income Taxes
Payroll Taxes
Corporate Income Taxes
Excise Taxes
Estate and Gift Taxes
Customs Duties
Miscellaneous Receipts

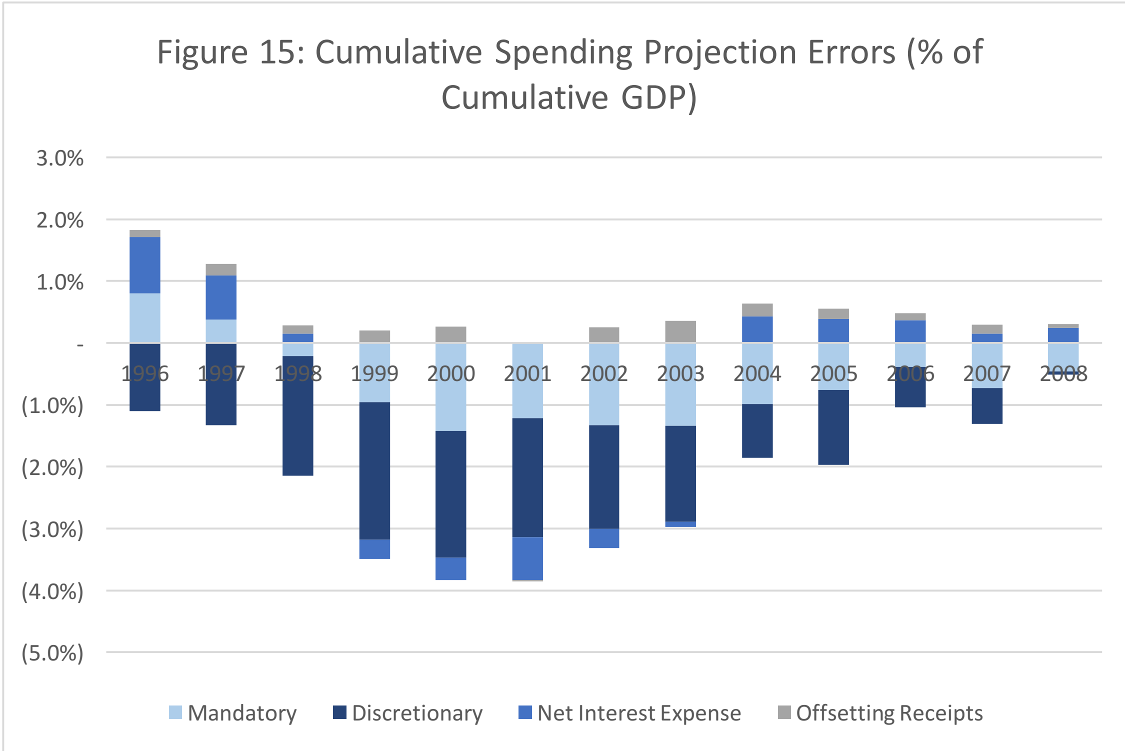


Figure 15: Cumulative Spending Projection Errors (% of Cumulative GDP)
3.0%
2.0%
1.0%
-
(1.0%)
(2.0%)
(3.0%)
(4.0%)
(5.0%)
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Mandatory
Discretionary
Net Interest Expense
Offsetting Receipts

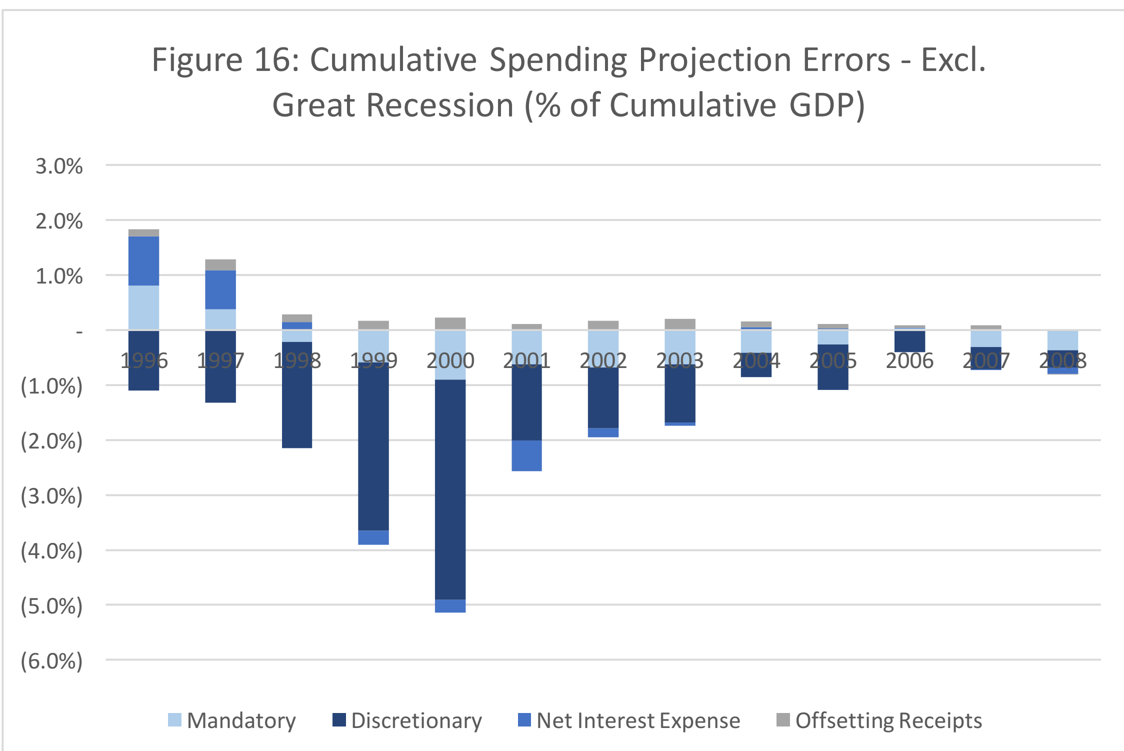


Figure 16: Cumulative Spending Projection Errors - Excl. Great Recession (% of Cumulative GDP)
3.0%
2.0%
1.0%
-
(1.0%)
(2.0%)
(3.0%)
(4.0%)
(5.0%)
(6.0%)
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Mandatory
Discretionary
Net Interest Expense
Offsetting Receipts

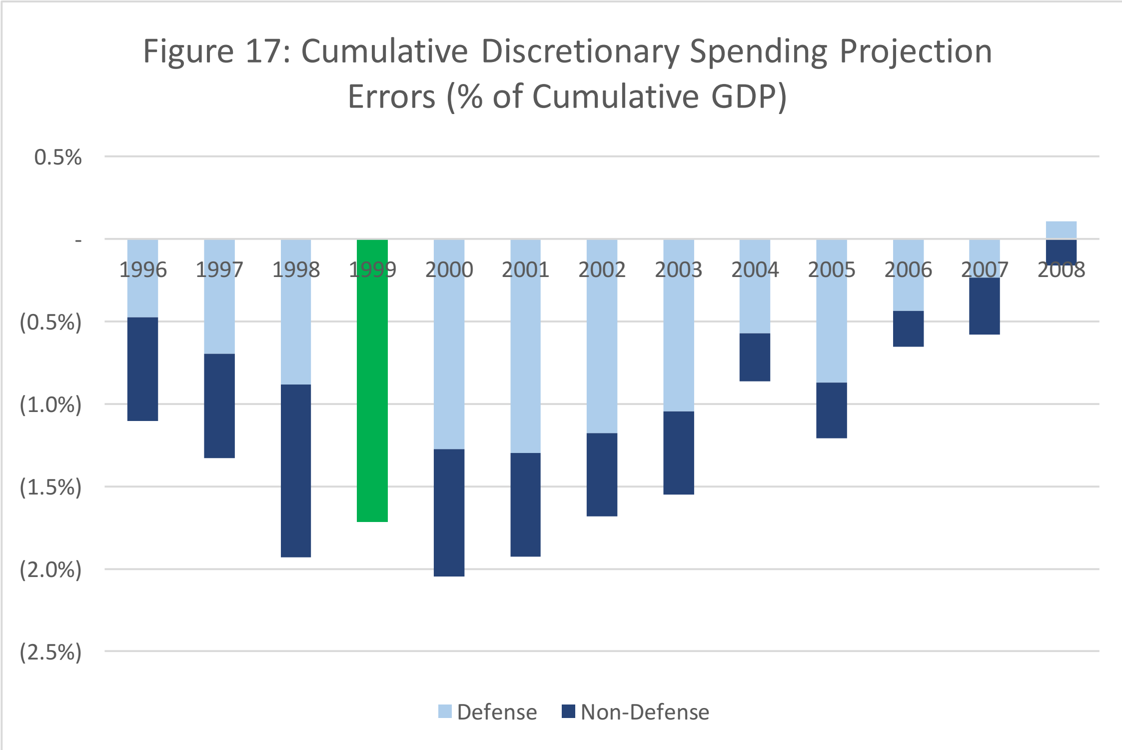


Figure 17: Cumulative Discretionary Spending Projection Errors (% of Cumulative GDP)
0.5%
-
(0.5%)
(1.0%)
(1.5%)
(2.0%)
(2.5%)
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Defense
Non-Defense

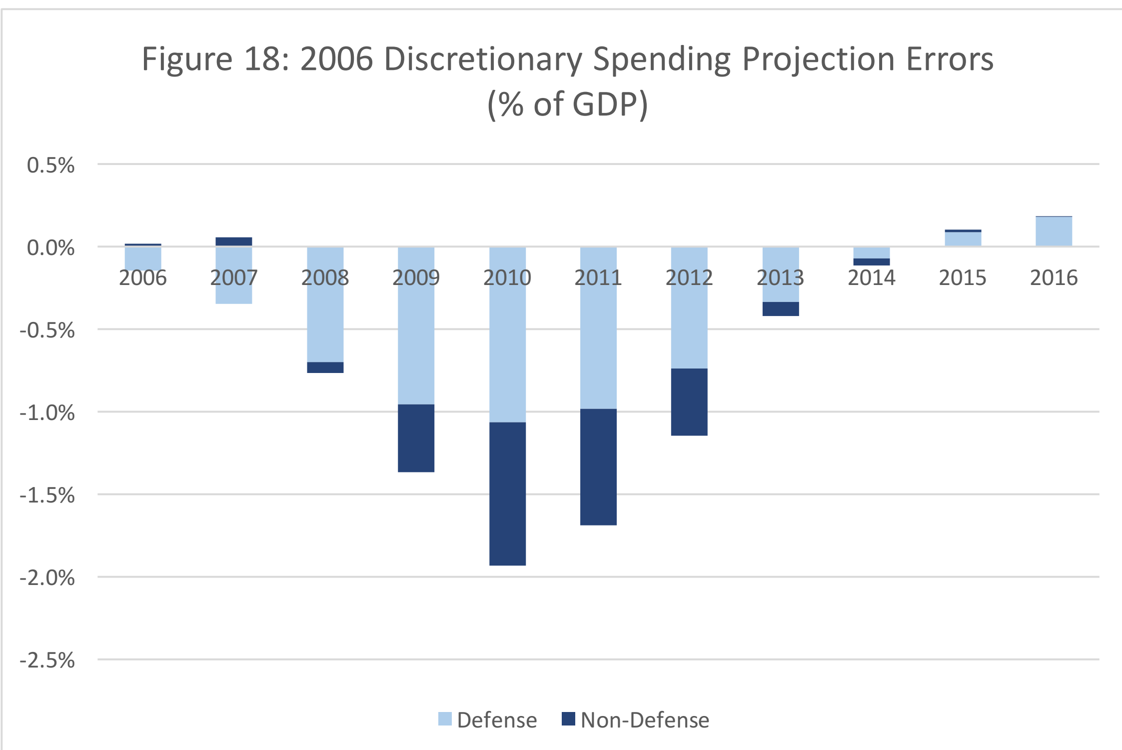



Figure 18: 2006 Discretionary Spending Projection Errors (% of GDP)
0.5%
0.0%
-0.5%
-1.0%
-1.5%
-2.0%
-2.5%
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
Defense
Non-Defense

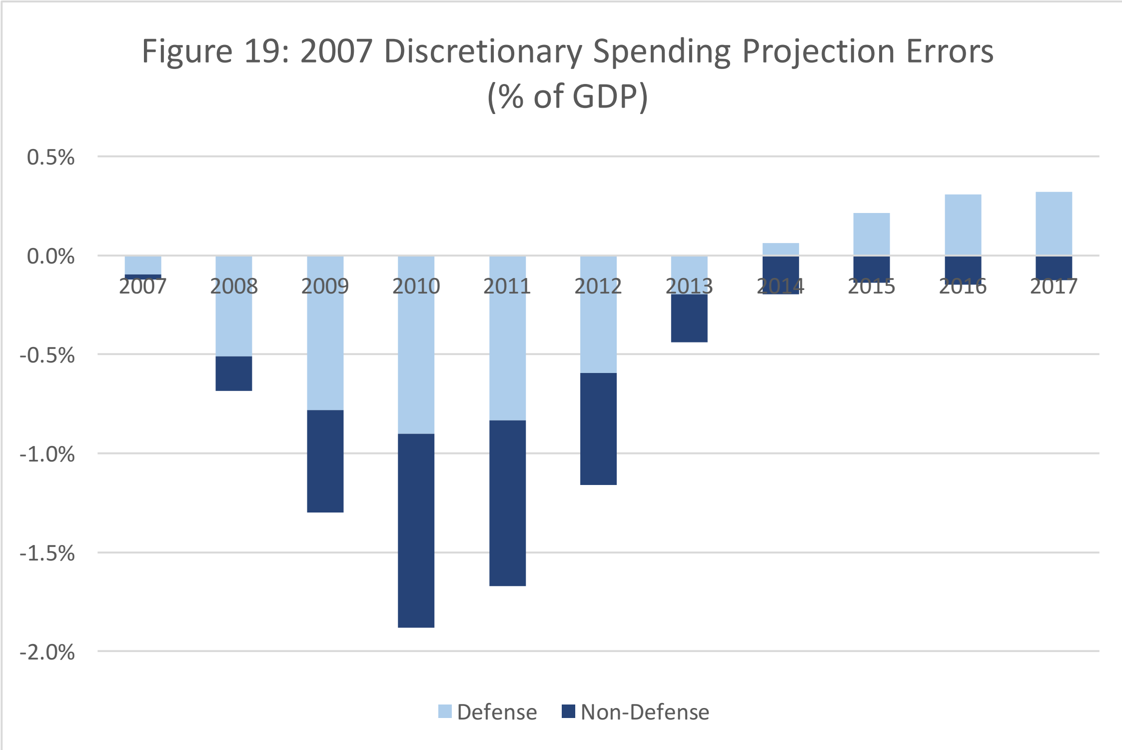


Figure 19: 2007 Discretionary Spending Projection Errors (% of GDP)
0.5%
0.0%
-0.5%
-1.0%
-1.5%
-2.0%
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
Defense
Non-Defense

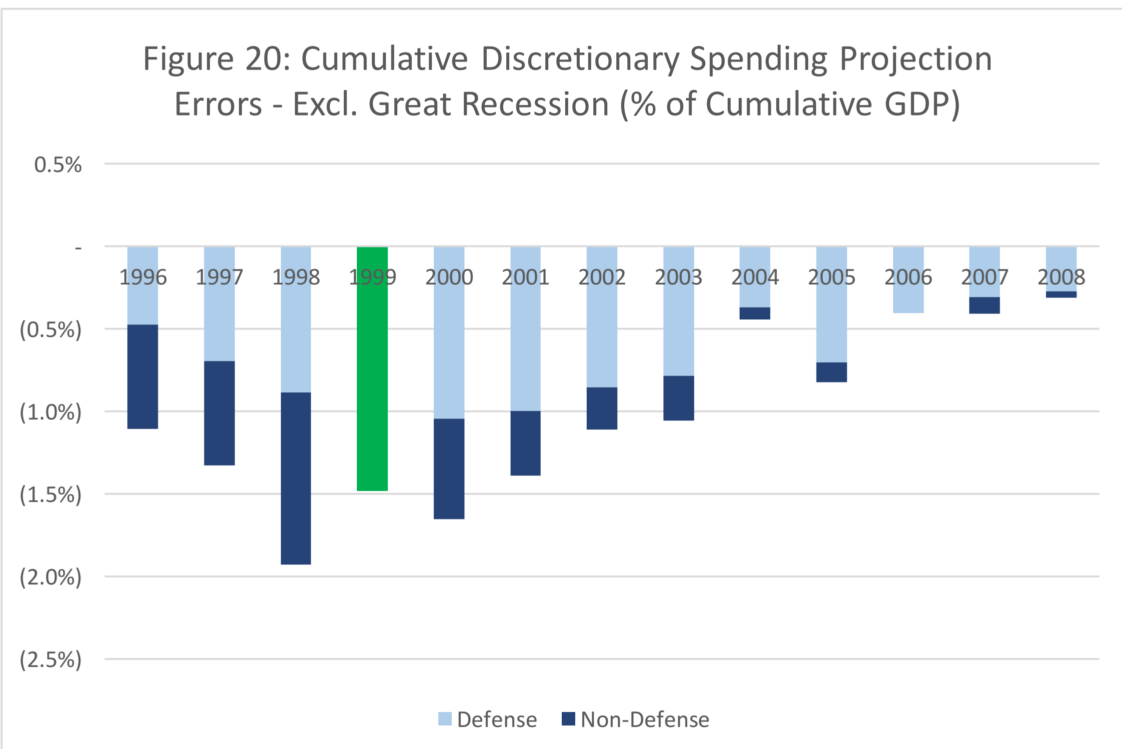


Figure 20: Cumulative Discretionary Spending Projection Errors - Excl. Great Recession (% of Cumulative GDP)
0.5%
-
(0.5%)
(1.0%)
(1.5%)
(2.0%)
(2.5%)
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Defense
Non-Defense

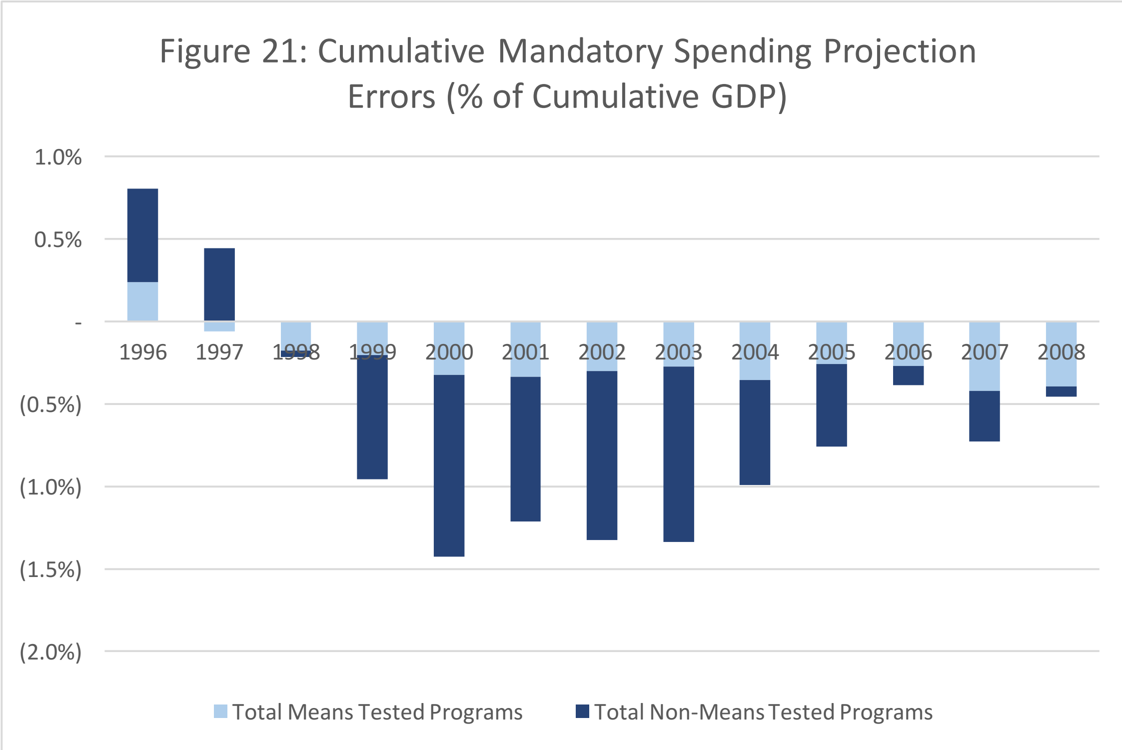


Figure 21: Cumulative Mandatory Spending Projection Errors (% of Cumulative GDP)
1.0%
0.5%
-
(0.5%)
(1.0%)
(1.5%)
(2.0%)
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Total Means Tested Programs
Total Non-Means Tested Programs

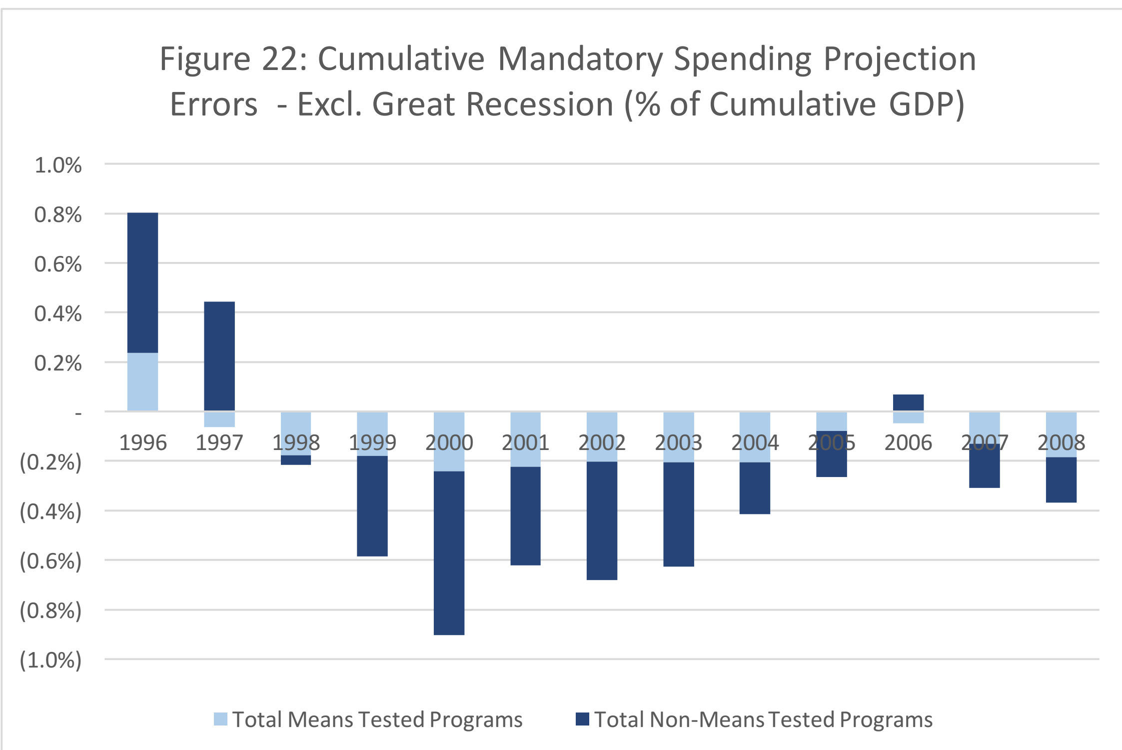


Figure 22: Cumulative Mandatory Spending Projection Errors - Excl. Great Recession (% of Cumulative GDP)
1.0%
0.8%
0.6%
0.4%
0.2%
-
(0.2%)
(0.4%)
(0.6%)
(0.8%)
(1.0%)
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Total Means Tested Programs
Total Non-Means Tested Programs

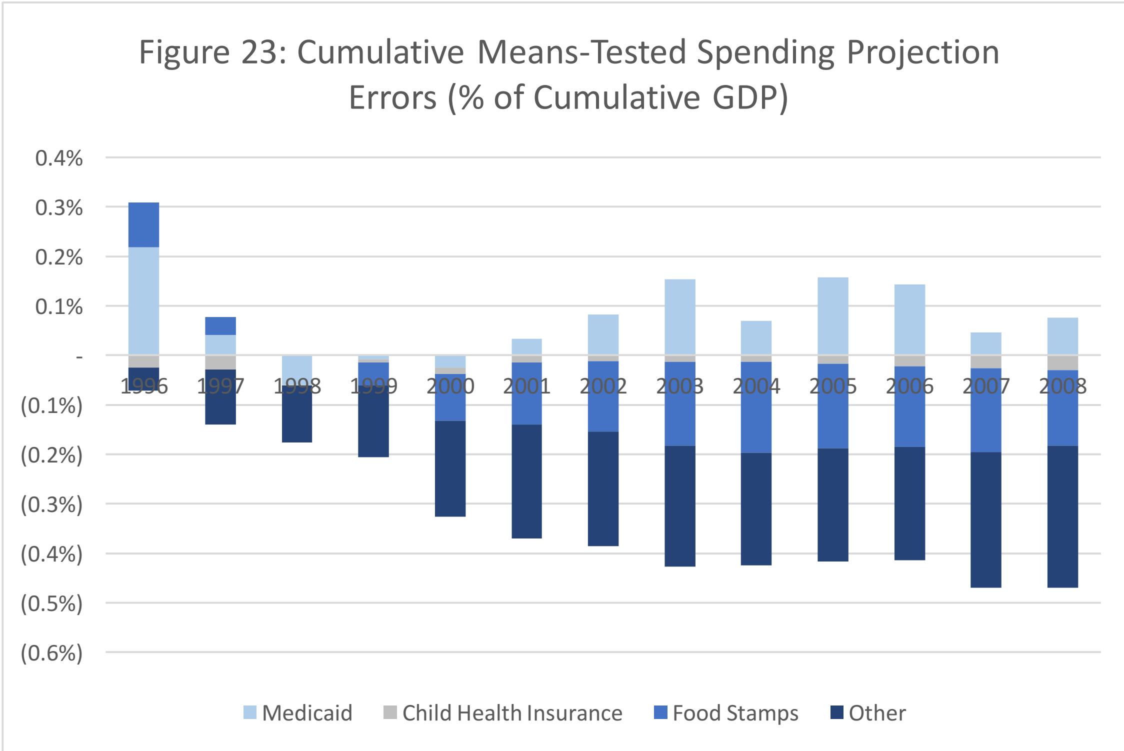


Figure 23: Cumulative Means-Tested Spending Projection Errors (% of Cumulative GDP)
0.4%
0.3%
0.2%
0.1%
-
(0.1%)
(0.2%)
(0.3%)
(0.4%)
(0.5%)
(0.6%)
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Medicaid
Child Health Insurance
Food Stamps
Other

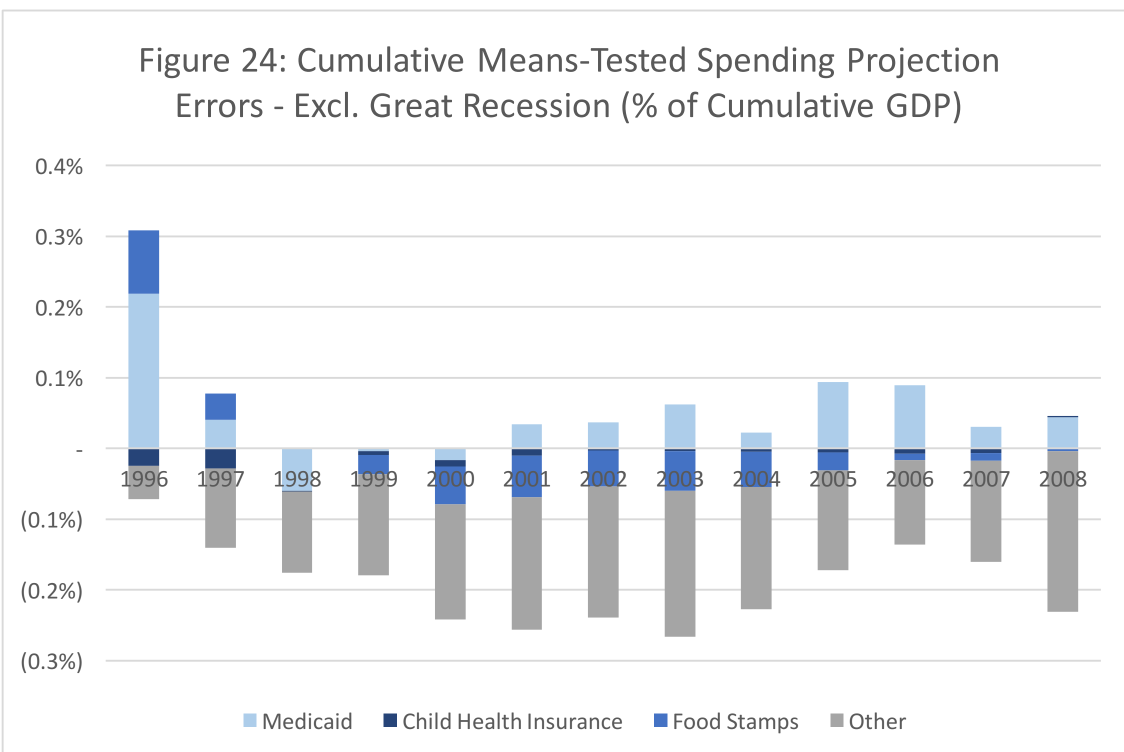


Figure 24: Cumulative Means-Tested Spending Projection Errors - Excl. Great Recession (% of Cumulative GDP)
0.4%
0.3%
0.2%
0.1%
-
(0.1%)
(0.2%)
(0.3%)
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Medicaid
Child Health Insurance
Food Stamps
Other

Figure 25: Cumulative Non-Means-Tested Spending Projection Errors (% of Cumulative GDP)

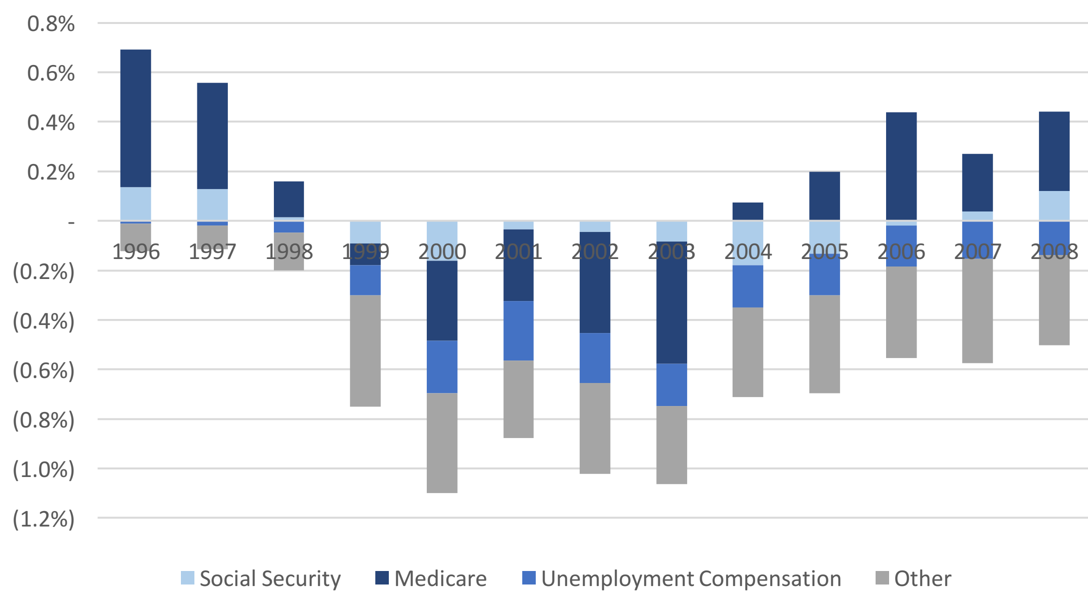
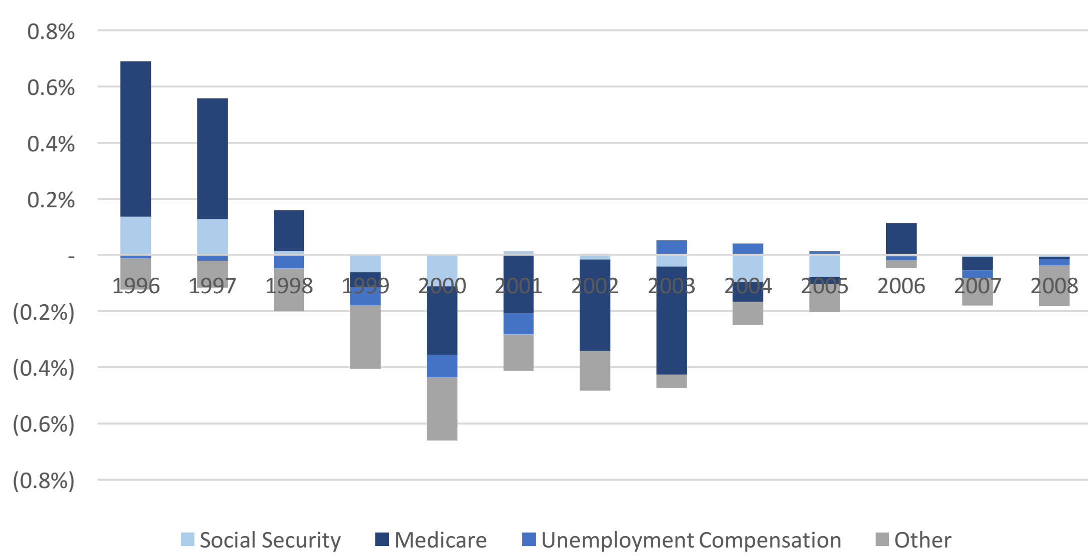



Figure 26: Cumulative Non-Means-Tested Spending Projection Errors - Excl. Great Recession (% of Cumulative GDP)



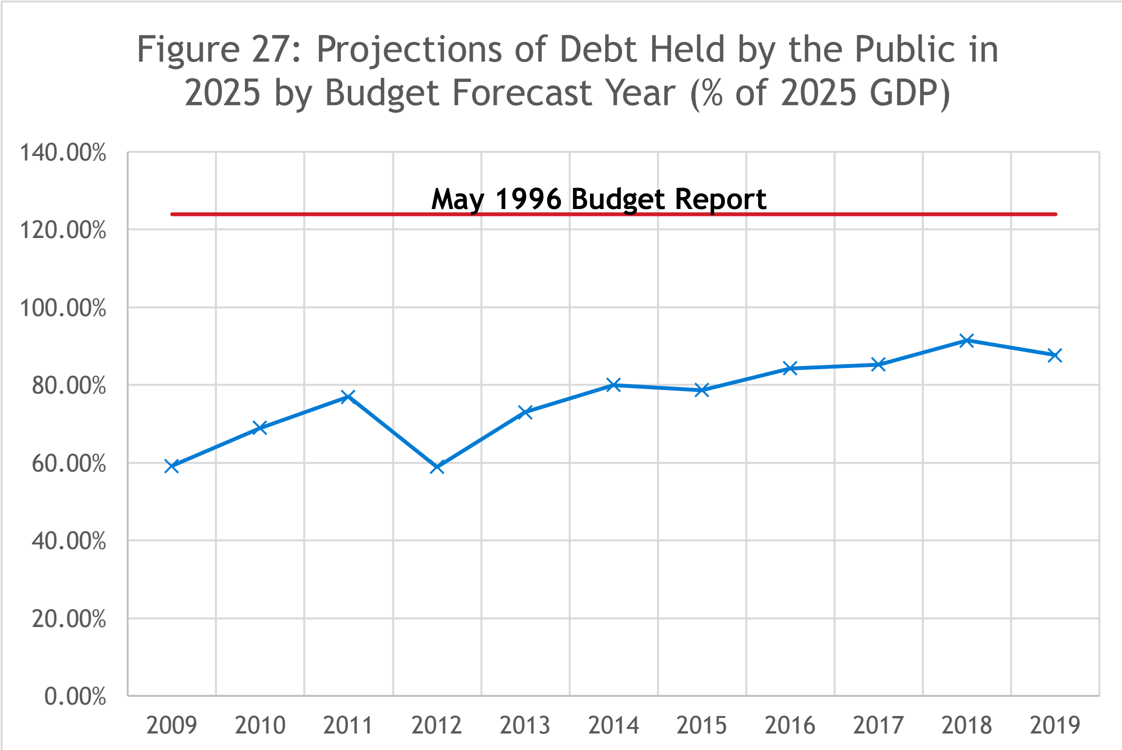


Figure 27: Projections of Debt Held by the Public in 2025 by Budget Forecast Year (% of 2025 GDP)
May 1996 Budget Report
140.00%
120.00%
100.00%
80.00%
60.00%
40.00%
20.00%
0.00%
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019