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U.S. Revenue Surprises: Are Happy Days Here to Stay?

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U.S. Revenue Surprises: Are Happy Days Here to Stay?

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Abstract

A key question for U.S. policymakers is whether the recent strength in federal revenue is likely to continue. This question is addressed through an econometric analysis of the determinants of tax revenue, using time series that are adjusted for tax policy changes. The results suggest that growth in corporate profits and capital gains each contributed forty percent of the increase in the revenue-to-GDP ratio from 2004-2006, and rising income inequality explains much of the rest. While part of the revenue rise is the result of structural changes taking place in the U.S. economy, some of the recent buoyancy is likely to prove temporary, reflecting the highly cyclical nature of these variables.

JEL Classification Numbers: E66, H24, H25

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I. INTRODUCTION

Recent fiscal developments in the United States have been considerably more favorable than expected. The Administration's goal of halving the deficit by FY 2009 was achieved three years early, mainly as a result of a sharp rebound in tax revenue from a post-recession, post-tax-cut trough in 2004. Underlying this strong revenue performance has been a sharp increase in revenue buoyancy—i.e., a rise in tax collections over and above the rate of GDP growth—that has been widely noted in the press but not fully explained (The Economist, 2006, Guha and Yeager, 2006). A key question for policymakers, who need a reliable revenue forecast in order to formulate sensible spending plans, is whether and for how long this trend is likely to continue. If tax buoyancy remains high, the revenue-GDP ratio will continue growing; if it instead declines, the revenue ratio could stagnate or possibly fall.

This paper attempts to shed light on this question through an empirical analysis of what determines revenue growth. First, we construct tax revenue series (including by tax categories) that are adjusted for the impact of major tax policy changes in the 1990s and 2000s. Second, we model adjusted revenue as a function of labor and capital income tax bases, the income distribution, and other variables. Third, we use the model results to analyze recent trends in tax revenue and forecast future revenue based on economic assumptions in recent government documents. The results, which are derived only on the basis of a handful of variables, serve as a simple cross-check on the more complex revenue estimation process conducted by the U.S. Treasury and the Congressional Budget Office (CBO, 2006).

The models explain the data well even as the relationship between revenue and tax bases has changed in recent decades. We find that forty percent of the 2004–06 revenue surge can be explained by corporate profits' growing faster than GDP. Another forty percent is attributable to growth in capital gains, while most of the rest is the result of stronger income growth at the upper end of the income distribution (which, given the progressive tax system, implies higher average tax rates). Only a fraction of the revenue surge is left unexplained.

The results lead to the conclusion that the revenue-to-GDP ratio will remain high if corporate profits, capital gains, and income growth continue to follow their current path. However, the volatility of these variables over the business cycle poses a clear risk to the revenue outlook. While the baseline out-of-sample forecast features a revenue ratio that is broadly constant, a substantial decline could occur if capital gains and corporate profits were to fall toward historical levels over the next few years.

The paper is organized as follows. Section II provides a methodology for adjusting revenue for the effects of policy measures, introducing the concepts of tax buoyancy and tax elasticity. Section III uses this methodology to explain the construction of the data set and presents the adjusted revenue series. Section IV presents the main regression results, which are used in Section V to determine the factors behind recent revenue growth and perform forecasts. Section VI concludes.

II. TAX REVENUE CHANGES: BASE GROWTH VERSUS POLICY CHANGES

The level of tax revenue can be thought of as the outcome of a function that maps a tax system (as given by tax legislation and associated rules) onto a given tax base (for example, wage or capital income). In practice, this function cannot be easily defined. As any taxpayer knows, it can be difficult to calculate one's tax liability, or even taxable income, given the complex laws and regulations that may apply to a particular case. At the macro level, this problem is also complex, since overall revenue comes from several sources whose tax bases are not directly connected to familiar macroeconomic aggregates.

Analyzing factors that contribute to *changes* in revenue collections can be even more complicated, since these can be attributed to changes in both the tax system and the tax base. Critical as it may be to distinguish between these two causes, there are periods when the tax system is relatively stable. In this case, the concept of *tax buoyancy*—the responsiveness of headline revenue to the tax base—is useful since it easily allows forecasting future revenue based on projections of the underlying tax base, such as GDP or personal income.

However, if the period of analysis spans years with major tax policy changes, the buoyancy concept may lead to a misinterpretation of headline numbers. In this case, it is necessary to consider what revenue would have been under a constant tax system. If we can adjust for the effects of tax policy changes, we measure *tax elasticity*—the underlying responsiveness of constant-policy revenue to growth in the tax base, from which further analysis can proceed. We now turn to a simple model that formalizes these concepts.

A. A Stylized Tax Revenue Model

For simplification, we assume that a tax system T_t in a given year t remains unchanged for the whole year. All changes in the tax structure compared to the previous year are assumed to become effective on the first day of the year. It is further assumed that the budget for each year is passed on the last day of the previous year, and that the budget for t contains a set of legislative tax measures (or rule changes) $\underline{\boldsymbol{L}}^{\boldsymbol{t}}$ that cover t and later years:

$$\underline{\boldsymbol{L}}^{\boldsymbol{t}} = \{\ L_t^t,\ L_{t+1}^t, L_{t+2}^t,\ \ldots\ \} \tag{1}$$

where the superscript indicates the budget year and the subscript states the year a particular provision comes into force. For simplicity, we do not consider retroactive tax changes.

The tax system

As an example, let T_0 be the initial tax system in year *0*. During *0*, the legislature passes a set of tax policy measures for the following years: $\underline{\boldsymbol{L}}^{\boldsymbol{1}} = \{\ L_1^1,\ L_2^1, L_3^1,\ \ldots\ \}$. The tax system in year *1* is then defined as a concatenation of T_0 and tax legislation for *1*:

$$T_1 = T_0 \circ\ L_1^1 \tag{2}$$

The tax system for year *2* is the concatenation of T_1 with legislation for *2* passed in both previous years or, equivalently, the concatenation of T_0 with all subsequent legislation:

$$T_2 = T_1 \circ L_2^1 \circ L_2^2 = T_0 \circ L_1^1 \circ L_2^1 \circ L_2^2 \tag{3}$$

Generalizing this example, the tax system in *t* is defined as the concatenation of T_0 with all subsequent pieces of tax legislation. With ∑ denoting a sequence of concatenations, it holds:

$$\begin{aligned} T_t &= T_{t-1} \circ L_t^o \circ L_t^1 \circ \ldots \circ L_t^t = \\ &= \left(T_0 \circ L_1^1 \circ \sum_{i=1}^{2} L_2^i \circ \ \ldots \ \circ \sum_{i=1}^{t-1} L_{t-1}^i \right) \circ \sum_{i=1}^{t} L_t^i \\ &= T_0 \circ \sum_{j=1}^{t} \sum_{i=1}^{j} L_j^i \end{aligned} \tag{4}$$

For clarity, we also introduce the concept of a *baseline* tax system, which is often used in budget discussions. The baseline tax system for *t* is defined by all legislative changes up to and including the ones in the budget for *t-1*. It is defined as:

$$T_t^B = \left(T_0 \circ L_1^1 \circ \sum_{i=1}^{2} L_2^i \circ \ \ldots \ \circ \sum_{i=1}^{t-1} L_{t-1}^i \right) \circ \sum_{i=1}^{t-1} L_t^i = T_{t-1} \circ \sum_{i=1}^{t-1} L_t^i \tag{5}$$

such that $T_t = T_t^B \circ L_t^t$.

Tax revenue

We define tax revenue as a function of the tax system and tax base *Y* in any given year:

$$R_t = R(\, T_t, Y_t \,) \tag{6}$$

Tax *buoyancy* is defined as the change in revenue from one year to another, divided by the change in the tax base:

$$\mu_t = \frac{R(T_t, Y_t)}{R(T_{t-1}, Y_{t-1})} \left(\frac{Y_t}{Y_{t-1}} \right)^{-1} \tag{7}$$

However, to understand changes in an economy's revenue-generating capacity, it is necessary to calculate the *elasticity* of the tax system, which is defined as the change in revenue corresponding to a change in the tax base under an unchanged tax system:

$$\varepsilon_t = \frac{R(T_{t-1}, Y_t)}{R(T_{t-1}, Y_{t-1})} \left(\frac{Y_t}{Y_{t-1}} \right)^{-1} \tag{8}$$

Since tax systems tend to be subject to changes every year, the variable $R(T_{t-1},Y_t)$ is usually unobservable. The calculation of tax elasticity therefore requires information on the impact of legislative changes on revenue. Assuming such information is available, and assuming additivity of R, tax elasticity can be calculated as:

$$\hat{\varepsilon}_t = \frac{R(T_t,Y_t) - R\left(\sum_{i=1}^{t} L_t^i, Y_t\right)}{R(T_{t-1},Y_{t-1})} \left(\frac{Y_t}{Y_{t-1}}\right)^{-1} \tag{9}$$

where $R(\sum_{i=1}^{t} L_t^i, Y_t)$ denotes the impact on revenue in t of all tax legislation since the initial budget year.

B. Time Series Analysis

A time series analysis of tax revenue requires the construction of revenue data under a tax system that has notionally been unchanged over a number of years. Strictly speaking, a general equilibrium model would be needed to capture changes in behavior imposed by a switch to a fictional tax system.[2] Fortunately, budget estimates for the short to medium-term impact of tax changes tend to be relatively accurate—in part because they come from microsimulation models designed exactly for this purpose (see below). Following Chand (1975), such estimates can be used to provide an approximation for a revenue time series under an unchanged tax system. In the following, such a series will be called "adjusted" revenue series (R_t^a). The relationship between the adjusted series and the original series is depicted schematically in Figure 1.

After choosing a base year t_0, it holds by definition that:[3]

$$R_{t_0+1}^a = R(T_{t_0}, Y_{t_0+1}) = \varepsilon_{t_0+1} \frac{Y_{t_0+1}}{Y_{t_0}} R_{t_0} \tag{10}$$

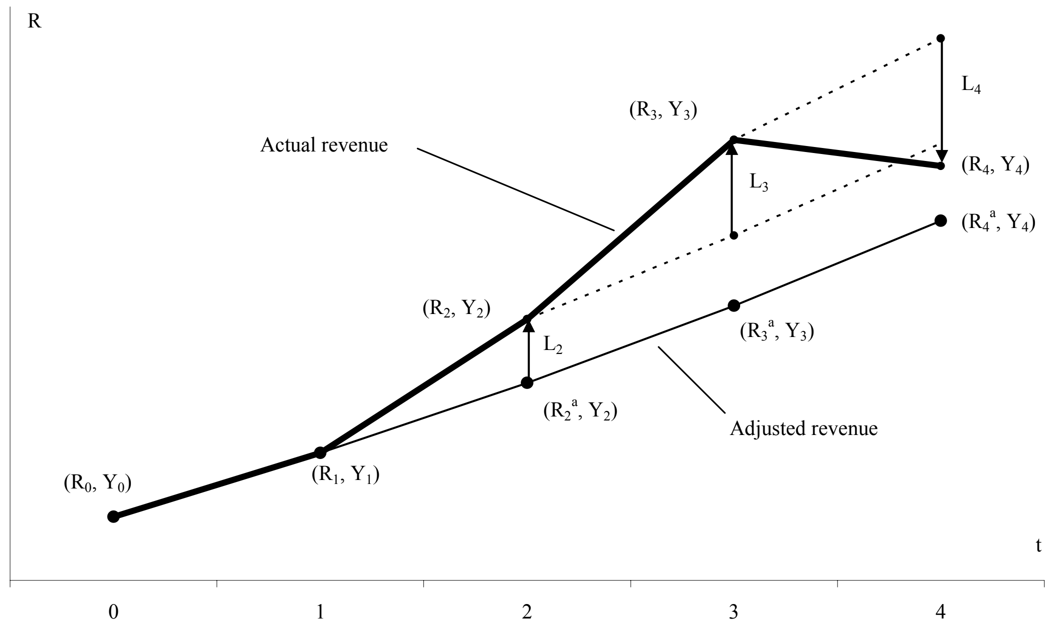
It is assumed that:

$$\frac{R_t^a}{R_{t-1}^a} \left(\frac{Y_t}{Y_{t-1}}\right)^{-1} \equiv \varepsilon_t \tag{11}$$

[2] For instance, such a model would need to take into account the incentive effects of higher or lower marginal tax rates on labor supply, production, and investment—all of which are still being debated in the literature. An example is provided by Creedy and Gemmell (2004) who estimate revenue elasticities for both income and consumption taxes in the United Kingdom, using individual taxpayer data. Creedy and Gemmell (2005) refine the analysis by endogenizing the labor supply decision and thus distinguishing the "tax-wage elasticity" from the "tax-income elasticity."

[3] The choice of the base year is not critical for these calculations, which depend on year-to-year percent changes in tax revenue, and not on revenue levels.

Figure 1. Actual and Adjusted Tax Revenue



which may not be trivial, since our "unchanged" tax system anchored to t_0 may feature different marginal tax rates, exemptions, or other parameters than the tax system in *t*, and elasticities could hypothetically differ.

Applying this assumption to $R^a_{t_0+2}$ and recursively substituting $R^a_{t_0+1}$ yields:

$$R^a_{t_0+2} = \varepsilon_{t_0+1}\varepsilon_{t_0+2}\frac{Y_{t_0+2}}{Y_{t_0}}R_{t_0} \tag{12}$$

and, in the general case:

$$R^a_t = \frac{Y_t}{Y_{t_0}}R_{t_0}\prod_{i=1}^{t-t_0}\varepsilon_{t_0+i} \tag{13}$$

In other words, a times series of adjusted revenue data is obtained by multiplying the revenue in base year t_0 with the ratio of the size of the tax bases in year *t* and t_0, and with the product of year-to-year tax elasticities from t_0+1 to *t*.

III. CONSTRUCTING ADJUSTED REVENUE SERIES

A. A Practical Approach

As shown in the previous section, our approach requires high-quality estimates for the impact of legislative changes on government tax revenue. In most countries, such estimates are only prepared *ex ante*, and the published data do not lend themselves easily to calculating elasticities. In the United States, tax legislation proposed by the President (in the annual budget) typically includes an estimate for baseline tax revenue $\hat{R}(T_t^B, \hat{Y}_t)$, together with estimates for the revenue impact of proposed tax changes over the following five years.[4]

In our notation, the budget provides the following revenue impact estimates:

$$\hat{R}(L_t^t, \hat{Y}_t),\ \hat{R}(L_t^t \circ L_{t+1}^t, \hat{Y}_{t+1}),\ \ldots,\ \hat{R}(\sum_{i=0}^{4} L_{t+i}^t, \hat{Y}_{t+4}) \tag{14}$$

These can be used to calculate budgeted tax revenue as the sum of baseline revenue and the revenue impact estimates. For example,

$$\hat{R}_t = \hat{R}(T_t^B, \hat{Y}_t) + \hat{R}(L_t^t, \hat{Y}_t) \tag{15}$$

It is not possible to obtain tax elasticities from this information, since the baseline includes tax changes applicable to year *t* that were legislated in prior years. Therefore, several budgets need to be combined to obtain $\hat{R}(L_t^{t-1}, \hat{Y}_t)$, $\hat{R}(L_t^{t-2}, \hat{Y}_t)$, etc. For example, the budget for year *t–1* contains the following estimates:

$$\hat{R}(T_{t-1}^B, \hat{Y}_{t-1}),\ \hat{R}(L_{t-1}^{t-1}, \hat{Y}_{t-1}),\ \hat{R}(L_{t-1}^{t-1} \circ L_t^{t-1}, \hat{Y}_t),\ \ldots,\ \hat{R}(\sum_{i=0}^{4} L_{t-1+i}^{t-1}, \hat{Y}_{t+3})$$

This could be used to obtain

$$\hat{R}(L_t^{t-1}, \hat{Y}_t) = \hat{R}(L_{t-1}^{t-1} \circ L_t^{t-1}, \hat{Y}_t) - \hat{R}(L_{t-1}^{t-1}, \hat{Y}_t) \tag{16}$$

and similarly for earlier legislation. Since most tax changes are phased in over only a few years, this is a workable approximation despite the following caveats:

- First, $\hat{R}(L_{t-1}^{t-1}, \hat{Y}_t)$ is usually unobservable and needs to be inferred from $\hat{R}(L_{t-1}^{t-1}, \hat{Y}_{t-1})$, for example, by scaling in line with the base.

[4] These estimates are based on detailed revenue simulations, using micro data from actual tax returns combined with macroeconomic impact studies. They are prepared by the Office of Management and Budget (OMB) or the Joint Committee of Taxation (JCT), with input from the Internal Revenue Service.

- Second, the tax administration's estimates of $\hat{Y}_t$ do not remain constant from one budget to another: $\hat{R}(L_t^{t-i}, \hat{Y}_t) - R(L_t^{t-i}, Y_t)$ can be large for higher *i*. This problem can also be mitigated through scaling, but in the case of significant tax measures, the impact on the elasticity estimate could still be sizable.

B. Revenue Adjustments

Our starting point for the construction of an adjusted revenue time series is a U.S. Treasury paper by Tempalski (2006), which lists the revenue impact, usually extending to four years, of all major pieces of U.S. tax legislation between 1939 to 2006. These figures were produced by the Treasury Department for the budget following the enactment of each tax bill, and thus contain more precise information than available in *ex ante* budget estimates. We make further adjustments by accounting for the impact of policy changes outside the four-year window considered by Tempalski, and by using more accurate estimates in some cases where they were available.[5]

The Tempalski data cover the first four years after passage of a tax bill, providing each tax bill's cumulative impact on revenue in year *t*, …, *t+3*, similar to (14). This provides $\hat{R}(L_t^t, \hat{Y}_t)$ and, following the methodology in (16), is used to construct $\hat{R}(L_{t+i}^t, \hat{Y}_{t+i})$:[6]

$$\hat{R}(L_{t+i}^t, \hat{Y}_{t+i}) = \hat{R}\left(\sum_{j=1}^{i} L_{t+j}^t, \hat{Y}_{t+i}\right) - \hat{R}\left(\sum_{j=1}^{i-1} L_{t+j}^t, \hat{Y}_{t+i-1}\right) \frac{\hat{Y}_{t+i}}{\hat{Y}_{t+i-1}} \tag{17}$$

Further information is needed for our analysis of revenue subcategories, since the Tempalski data consider only total tax revenue. Examining the budget documents which underlie the Tempalski numbers yields data up to the mid-1990s. Since that time, the budget documents have not included this information, so we examine the *ex ante* estimates prepared by the Joint Committee on Taxation and assign the various provisions to the appropriate revenue categories.

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[5] Tempalski (2006) cites one of the largest errors—the Crude Oil Windfall Profit Tax Act of 1980—which was estimated to raise $21 billion in 1984, but only turned out to yield $4 billion due to a decline in oil prices. In this particular case, we used the estimates contained in Lazzari (1990). For some recent tax legislation, we used *ex ante* estimates provided by the Joint Committee on Taxation in order to have data on overall revenue consistent with the impact broken down by category; however, the differences are not large.

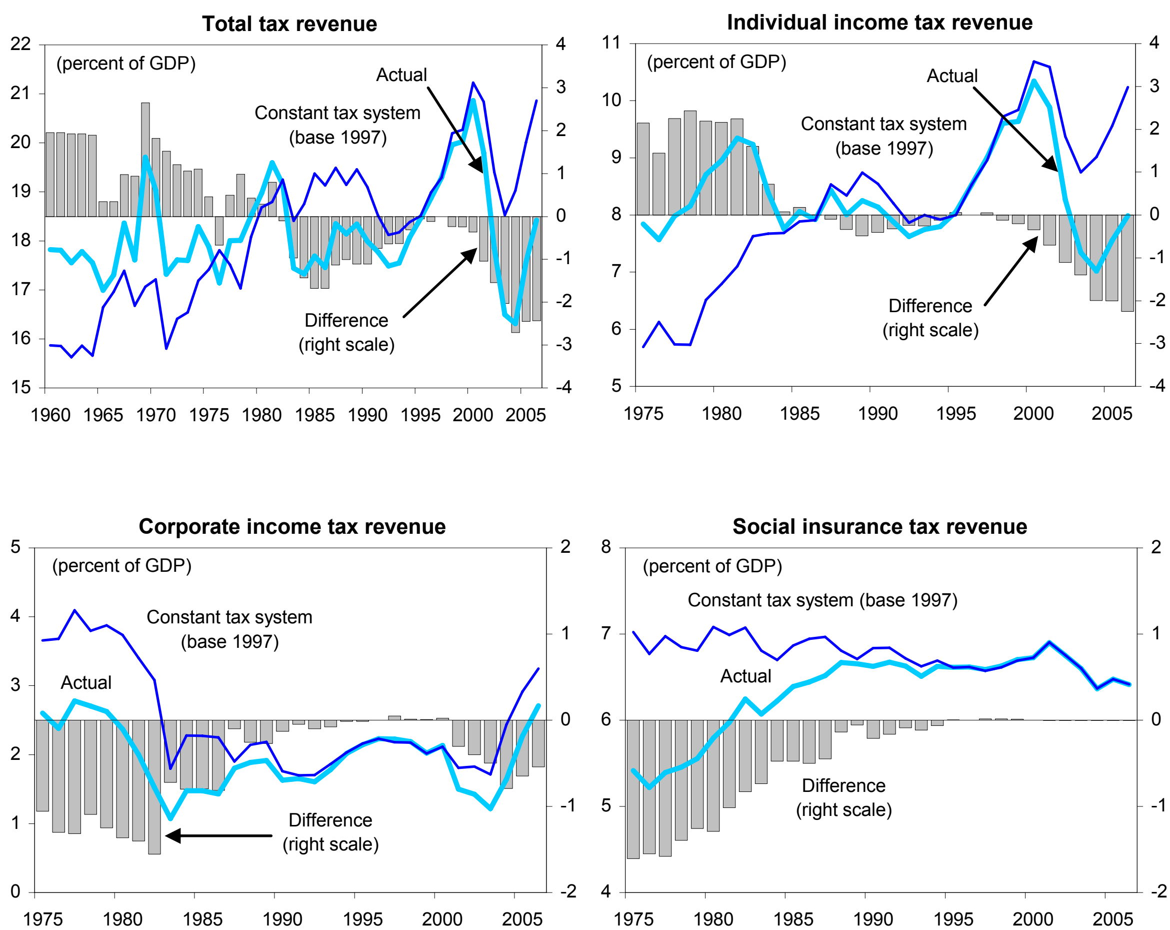
[6] For convenience, GDP has been used as a tax base to adjust revenue in (17). It seems more accurate to use tax bases for individual revenue categories, but the differences are likely to be too small to justify the extra effort.

C. Stylized Facts

Actual and adjusted series for total tax revenue and its main components—individual income tax (IIT), corporate income tax (CIT), and social insurance tax (SIT)—are displayed in Figure 2. The data for total revenue go back to 1960, while that for revenue components go back to 1974. The base year for the adjusted series is set to 1997, such that the difference between actual and adjusted total revenue as a share of GDP roughly averages out to zero over the sample period.

In each panel, the gap between the two lines can be interpreted as the cumulative change to the tax system between 1997 and a given date (or vice versa). For ease of interpretation, these differences are also plotted. The following observations apply:

Figure 2. Constant Tax System Revenue



Source: IMF staff calculations.

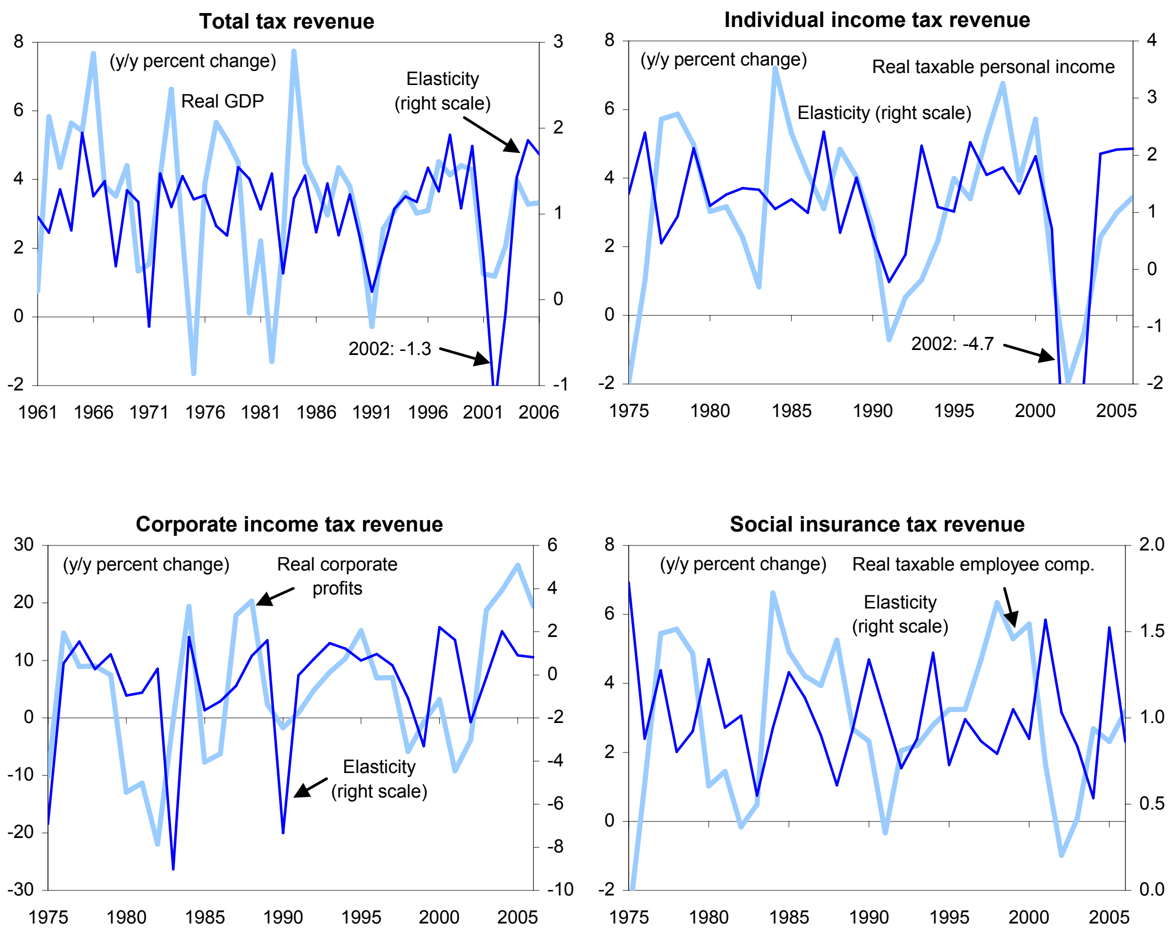
- There have been substantial tax cuts over the last decade. Since 1997, adjusted tax revenue—particularly IIT—has been much higher than headline revenue. The IIT has been cut by a cumulative 2 percent of GDP, and CIT by ½ percent of GDP, suggesting that about half of the steep decline in revenue after the 2001 recession was due to the tax cuts that were implemented.
- Conversely, taxes were generally raised between 1986 to 1997, increasing revenue by over 1½ percent of GDP. The CIT, SIT, and other taxes (not shown) were raised, with insignificant net changes to individual income taxes.
- From the early 1970s to the early 1980s, the revenue that would have been obtained under a constant tax system increased rapidly due to the effects of high inflation and the lack of indexation. This combination had the same effect as a legislated tax increase, although it would not qualify as a change to the tax system. Instead, measured tax elasticity was higher than average during this period (Figure 3). Actual revenue fell further with the passage of tax cuts in the early 1980s.

Our calculations show that tax elasticity has remained broadly constant over the past four decades, although there is considerable volatility in the series (see Figure 3). As should be expected, the elasticity of revenue to the tax base is higher when real growth in the tax base is strong, especially in the more progressive individual income tax system. However, other factors may also play a role: there are lags between the realization of income and the payment of tax liabilities; growth in actual tax bases differs from growth in the proxies here (capital gains being one example); the income distribution may shift; and certain tax provisions are not indexed to inflation. Some of these items will be examined below. Table 1 shows that the positive correlation between elasticity and the base is found only in the last two decades, suggesting that the role of the tax base has increased relative to other factors.

IV. Long-run Equations and Short-run Dynamics

The analysis of tax elasticities in the United States is not new, although earlier authors largely focused on changes in state tax bases caused by the economic cycle. Groves and Kahn (1952) were the first to write on this topic, arguing that the more income-elastic bases would deliver more revenue over the long run, albeit at the cost of increased volatility over the business cycle. Sobel and Holcombe (1996) distinguished between long-run and short-run responses in an error correction mechanism (ECM) framework, suggesting that a tax base that grows more rapidly than income over time need not be more volatile. Bruce *et al.* (2006) also used an ECM approach, but allowed for *asymmetric* short-run error corrections. These authors present state-specific results on short-run and long-run elasticities of both sales and income taxes. They show that the long-run elasticity of income tax bases is generally higher, but do not find major differences in short-run volatility.

Figure 3. Tax Base Growth and Tax Revenue Elasticity 1/



Source: IMF staff calculations.
1/ Revenue elasticity is defined as the ratio of the percent change in revenue adjusted for legislative changes to the percent change in the tax base. See the text for more details.

Table 1. Correlations Between Revenue Elasticity and the Tax Base

	Total revenue	Individual income taxes	Corporate income taxes	Social insurance taxes
1975–2006	0.28	0.46	0.40	-0.09
1975–1987	-0.18	-0.40	0.34	-0.18
1987–2006	0.70	0.70	0.36	0.00

Source: IMF staff calculations.

A. The Estimation Approach

This paper also employs the error correction approach, although we directly examine the elasticity of revenue with respect to the relevant bases, rather than the elasticities of bases with respect to GDP as in the previous literature. This is possible because we have accounted for the impact of tax policy changes as described above.

We estimate the following equation:

$$R_t^a = \beta_0 + \beta_1 Y_t + \varphi X_t + \nu_t \tag{18}$$

where Y_t is a vector containing one or more variables representing the tax base (such as GDP, or personal and capital incomes), X_t is a vector of other variables that also affect revenue (for example, demographics), and ν_t is an error term.[7] The coefficient β_1 measures the average elasticity of tax revenue with respect to the base. As discussed in the previous section, unobserved factors could push year-to-year elasticities away from this relationship; such dynamics would be captured by the following ECM:

$$\Delta R_t^a = \alpha_0 + \alpha_1 (Y_t - Y_{t-1}) + \delta(X_t - X_{t-1}) + \alpha_2 \nu_{t-1} + \mu_t \tag{19}$$

which measures the reversion of (18) to equilibrium by including the prior value of the long-run error term, ν_{t-1}, in a regression of the yearly change in revenue on the change in its underlying determinants, using a constant α_0 and a short-run error term μ_t. The coefficient on the lagged error term, α_2, is expected to be negative and measures the speed with which deviations from the long-run relationship are corrected. If this term is statistically significant and negative, then there is evidence that revenue returns, over time, to the level implied by its long-run relationship.

Large differences between the short-run and long-run response are also interesting, as they indicate that the impact of a particular variable either builds over time (in terms of our coefficients, $\beta_1 > \alpha_1$) or is largest on impact and diminishes subsequently ($\beta_1 < \alpha_1$). In most of our results, however, the difference between long-run and short-run coefficients is small, consistent with the nature of the tax system: although there are some tax provisions that take into account income or deductions for prior years, the impact of these is generally minor relative to the importance of current year variables.

We estimate the model on the full sample, 1960–2006, and on two subsamples, 1960–86 and 1987–2006. This break was chosen because of major changes to the tax system in the 1980s, which makes inferences drawn from the whole sample tentative at best. First, the Economic Recovery Tax Act of 1981 drastically lowered marginal tax rates over a period of four years,

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[7] Revenue and other nominal variables have been deflated by the GDP deflator and are expressed in logs. All other variables are expressed as ratios. See the data appendix for a complete description.

1982–1985. Second, the tax system was indexed to inflation beginning in 1985. Third, the Tax Reform Act of 1986 came into effect in 1987. This act further reduced marginal rates, broadened both the corporate and individual tax base by eliminating deductions and tax shelters, harmonized capital gains tax rates with individual income tax rates, and redefined the categorization of some corporate and individual income.[8] We therefore focus on the results for the 1987–2006 period, and present full-sample results mainly for comparison.

B. Results for Overall Tax Revenue

In this section, we present the estimation outcome for overall tax revenue (Table 2). Besides confirming that revenue is strongly related to the tax bases of its major components—personal income and corporate profits—the results suggest the following:

- The first column shows a standard regression of revenue on GDP. The long-run elasticity of adjusted revenue to GDP is between 1.1 and 1.2, consistent with the estimates for tax bases in Sobel and Holcombe (1996) and Bruce *et al.* (2006).
- The elasticity of overall revenue with respect to personal taxable income is roughly 0.8 for the full sample and the second half of the sample.[9]
- Corporate profits are always highly significant, with a higher coefficient in the first subsample, consistent with the higher share of the corporate income tax in overall revenue during that period.
- The sign on capital gains is only positive and significant for the 1987–2006 period, with a significant negative relationship before then. A more concentrated distribution of income also raises revenue for a given level of overall income, but the effect is strongest in the pre-1986 period. Column 3 shows that the impact of capital gains is positive and significant for the full sample when the income distribution is excluded.[10] These variables appear to be capturing the same effect, as the correlation between the income distribution and the ratio of capital gains to GDP is 0.93 over the full sample.

[8] See Tax Policy Center (2006) for an overview of tax legislation over the last several decades.

[9] The elasticity of individual income taxes to personal income, which is usually greater than one due to the progressivity of the income tax system and real bracket creep, will be discussed in the next subsection.

[10] The coefficient on capital gains in the first subsample turns positive when income distribution is excluded, but it is not statistically significant.

Table 2. Total Tax Revenue: Long-Run and Short-Run Elasticities

	Long-run equations					Short-run equations			
	1960–2006			1960–1986	1987–2006	1960–2006	1960–1986	1987–2006	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Constant	-3.155 **	-1.976 **	-1.783 **	-2.984 **	-0.765 **	-0.004	0.009	-0.007	0.001
	(0.130)	(0.159)	(0.133)	(0.216)	(0.313)	(0.007)	(0.017)	(0.004)	(0.007)
Log real GDP	1.168 **	--	--	--	--	--	--	--	--
	(0.015)								
Log real taxable personal income	--	0.843 **	0.825 **	1.075 **	0.809 **	1.144 **	0.811 *	0.947 **	0.710 **
		(0.038)	(0.041)	(0.032)	(0.041)	(0.226)	(0.390)	(0.108)	(0.274)
Log real corporate profits	--	0.084 **	0.087 **	0.195 **	0.106 **	0.008	0.051	0.158 **	0.094 **
		(0.014)	(0.021)	(0.045)	(0.009)	(0.025)	(0.053)	(0.018)	(0.024)
Log real capital gains	--	0.003	0.068 **	-0.131 **	0.061 **	0.029	-0.004	0.050 **	0.038
		(0.021)	(0.014)	(0.033)	(0.012)	(0.025)	(0.043)	(0.013)	(0.035)
Income share of top 1 percent	--	0.013 **	--	0.042 **	0.007 **	0.009 **	0.013	0.006 **	0.013 **
		(0.003)		(0.009)	(0.003)	(0.002)	(0.011)	(0.001)	(0.004)
Working-age share of population	--	0.020 **	0.017 **	--	--	--	--	--	--
		(0.004)	(0.004)						
Error-correction term	--	--	--	--	--	-0.783 **	-1.133 **	-1.398 **	--
						(0.117)	(0.115)	(0.146)	
Autoregressive term	--	--	--	--	--	--	--	--	-0.522 **
									(0.153)
Adjusted R-squared	0.995	0.998	0.997	0.995	0.998	0.777	0.795	0.969	0.899
Durbin-Watson	0.73	1.25	1.00	2.08	2.18	1.68	1.66	1.77	1.91

Source: IMF staff calculations.
Notes: Dependent variable is log of tax revenue adjusted for legislative changes. Heteroskedasticity and autocorrelation-adjusted standard errors are in parentheses, while * and ** represent coefficients that are significant at the 10 or 5 percent levels.
In columns 6 through 9, variables are expressed in changes (except error-correction term, autoregressive term, and constant).

- The share of population at working age is positively related to revenue over the full sample, as the tax code provides deductions for people under 18 and over 65. However, it is not significant in the first half of the sample and of a very small magnitude in the second half, and therefore has been excluded from those regressions.
- The explanatory variables account for the vast majority of the variation in revenue. For the full sample, Durbin-Watson statistics indicate the presence of autocorrelation in the residuals, which is further justification to focus on the second subsample.[11]

The results for the short-run equations are also presented in Table 2. Each short-run equation uses the residual of the long-run equation estimated for the same period (for the full sample, we used column 2). The following points are noteworthy:

- For the full sample, the coefficient of -0.78 on the error-correction term indicates that almost 80 percent of the deviation of revenue from its long-run fundamentals is erased in a year. The coefficient on personal income is slightly higher in the short-run than in the long-run, while capital gains and corporate profits are not significant.
- For the post-1986 period, personal income, corporate profits, capital gains, and the income distribution are all highly significant, and the model fits quite well, explaining over 95 percent of the year-to-year variation in revenue.

The ECM coefficient since 1987 is significantly larger than 1, which would normally suggest instability in the error correction process. In this case, however, there is little doubt that tax revenue is mostly driven by contemporaneous variables, and that any revenue "losses" in one year are quickly recovered in the next. This may give rise to negative autocorrelation in the short-run equation: the Durbin-Watson statistic for the regression without the ECM is 3.0. To test whether tax returns are indeed driven largely by current-year information, the short-term equation is estimated in differences, including the residual from the previous period. The equation becomes:

$$\Delta R_t^a = \alpha_0 + \alpha_1 (Y_t - Y_{t-1}) + \delta(X_t - X_{t-1}) + \alpha_2 \mu_{t-1} + \mu_t \tag{20}$$

Since μ_{t-1} is the unexplained movement in revenue from the previous period, α_2 is expected to be less than zero. The results of this specification, shown in column 9, confirm that the equation in differences fits well. Negative autocorrelation in the short-run deviation from equilibrium is playing a role in the magnitude of the error-correction coefficient in

[11] Other variables were tried but found not to have a significant impact, including stock prices, equity market capitalization (neither of which is surprising given the presence of capital gains and income distribution), house prices, the output gap, labor market variables, and an interaction term for inflation with a dummy for the period before the tax system was indexed. We also searched for a short-run impact from the variables that were tried but rejected in the long-run equation.

Column 8—revenue growth in excess of fundamentals one year has been followed by an underperformance the next year, and vice versa.

C. Results by Revenue Subcategory

Following the approach in the previous section, we now analyze determinants of revenue by individual tax category, data for which is available starting in 1974. Individual income tax (IIT) revenue and taxable personal income are closely related, with a long-run coefficient statistically higher than one for the post-1986 period (Table 3). This increase in buoyancy despite the lowering of marginal tax rates could be due to strong growth in the upper income brackets. Mirroring the results for overall revenue, capital gains have a very strong impact on revenue since 1987, while the effect of the income distribution is more powerful in the pre-1986 period. The effect of each becomes stronger when the other is removed from the regression (not shown), again attesting to multicollinearity issues.

- The short-run results are similar to those for overall revenue—idiosyncratic shocks to revenue are more than reversed the following year—as the error-correction coefficient is -0.7 for the full sample but -1.8 since 1987. The equation in column 5 confirms that negative autocorrelation in the short-run is again driving this result. Factors that lead to an overperformance one year tend to not only disappear, but lead to weakness in revenue the next year.
- There is little difference between the short-run and long-run coefficients, and the model explains over 95 percent of the variance in revenue since 1987.

The corporate income tax (CIT) equations fit the least well, with the estimated long-run elasticities significantly below unity (Table 4), likely reflecting the fact that the CIT is the most volatile revenue component. The coefficient on the output gap is positive and significant since 1987, which might be capturing changes in the operating losses of previous years that can be carried forward, or other unobserved factors.[12] The CIT error-correction coefficient is not significantly different from -1 for the second subsample, while the short-run coefficient on profits is roughly one.

As expected, social insurance taxes depend almost exclusively on the level of taxable employee compensation (Table 5). The elasticity is slightly below unity, with the difference being statistically significant. This is as expected, given that the amount of income subject to the social security portion of the payroll tax is capped. There has been some volatility since 1987, with short-run changes not tracking as closely, but the error-correction coefficient is not significantly different from minus 1, so deviations from equilibrium are not long-lasting.

[12] Using corporate profits as defined by the IRS yielded similar results, suggesting that the difference between the definition of profits for national accounts versus tax purposes is not an issue. The output gap is expressed as actual output in percent of potential, with a positive gap indicating the economy being above full capacity.

These results show that legislation-adjusted revenue data can be used to accurately estimate the performance of overall revenue and its components using a small number of variables. In all cases, revenue depends strongly on the performance of the tax base, with smaller contributions from other factors. Deviations from trend are reversed quickly; in fact, for overall revenue and individual income taxes, since 1987 errors in one direction have tended to be followed by errors in the opposite direction.

Table 3. Individual Income Tax Revenue: Long-Run and Short-Run Elasticities

	Long-run equations		Short-run equations		
	1974–2006	1987–2006	1974–2006	1987–2006	
	(1)	(2)	(3)	(4)	(5)
Constant	-5.319 **	-3.811 **	-0.005	-0.008 **	0.001
	(1.113)	(0.137)	(0.009)	(0.003)	(0.004)
Log real taxable personal income	1.121 **	1.116 **	1.305 **	1.323 **	1.048 **
	(0.123)	(0.019)	(0.366)	(0.104)	(0.141)
Log real capital gains	0.012	0.102 **	0.021	0.128 **	0.088 **
	(0.038)	(0.010)	(0.030)	(0.013)	(0.016)
Income share of top 1 percent	0.020 **	0.012 **	0.020 **	0.012 **	0.016 **
	(0.007)	(0.003)	(0.004)	(0.001)	(0.003)
Working-age share of population	0.028 **	--	--	--	--
	(0.008)				
Log GDP deflator (1974–1984 only)	0.091 **	--	0.311 **	--	--
	(0.041)		(0.144)		
Error-correction term	--	--	-0.686 **	-1.777 **	--
			(0.205)	(0.195)	
Autoregressive term	--	--	--	--	-0.637 **
					(0.194)
Adjusted R-squared	0.995	0.998	0.704	0.979	0.939
Durbin-Watson	1.33	2.23	2.14	1.46	2.14

Source: IMF staff calculations.
Notes: Dependent variable is log of tax revenue adjusted for legislative changes. Heteroskedasticity and autocorrelation-adjusted standard errors are in parentheses, while * and ** represent coefficients that are significant at the 10 or 5 percent levels. In columns 3 through 5, variables are expressed in changes (except error-correction term, autoregressive term, and constant).

Table 4. Corporate Income Tax Revenue: Long-Run and Short-Run Elasticities

	Long-run equations		Short-run equations	
	1974–2006	1987–2006	1974–2006	1987–2006
	(1)	(2)	(3)	(4)
Constant	1.570 **	-0.628	0.008	-0.019
	(0.693)	(0.423)	(0.020)	(0.016)
Log real corporate profits	0.561 **	0.885 **	0.410	1.062 **
	(0.108)	(0.064)	(0.274)	(0.138)
Output gap	0.026	0.048 **	0.028 *	0.052 **
	(0.019)	(0.014)	(0.014)	(0.013)
Error-correction term	--	--	-0.342 *	-1.066 **
			(0.200)	(0.256)
Adjusted R-squared	0.640	0.952	0.373	0.780
Durbin-Watson	0.67	1.67	2.08	2.37

Source: IMF staff calculations.
Notes: Dependent variable is log of tax revenue adjusted for legislative changes. Heteroskedasticity and autocorrelation-adjusted standard errors are in parentheses, while * and ** represent coefficients that are significant at the 10 or 5 percent levels. In columns 3 and 4, variables are expressed in changes (except error-correction term and constant).

Table 5. Social Insurance Tax Revenue: Long-Run and Short-Run Elasticities

	Long-run equations		Short-run equations	
	1974–2006	1987–2006	1974–2006	1987–2006
	(1)	(2)	(3)	(4)
Constant	-1.752 **	-1.600 **	0.005 *	0.009 **
	(0.110)	(0.094)	(0.003)	(0.002)
Log real taxable employee compensation	0.952 **	0.934 **	0.825 **	0.589 **
	(0.013)	(0.011)	(0.105)	(0.041)
Error-correction term	--	--	-0.786 **	-1.184 **
			(0.102)	(0.141)
Adjusted R-squared	0.997	0.996	0.737	0.848
Durbin-Watson	1.24	1.95	1.99	2.09

Source: IMF staff calculations.
Notes: Dependent variable is log of tax revenue adjusted for legislative changes. Heteroskedasticity and autocorrelation-adjusted standard errors are in parentheses, while * and ** represent coefficients that are significant at the 10 or 5 percent levels. In columns 3 and 4, variables are expressed in changes (except error-correction term and constant).

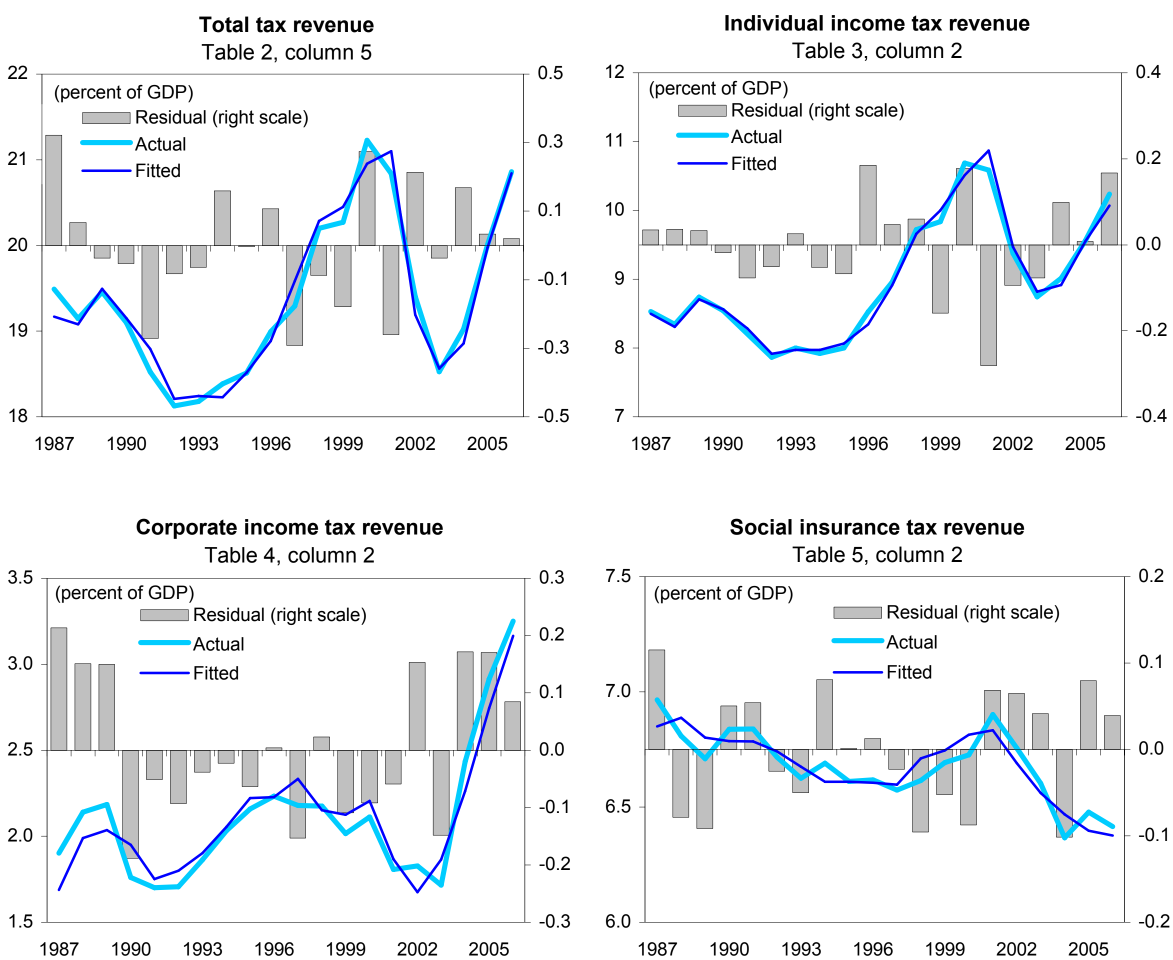
V. Where Has Revenue Been and Where is it Headed?

This section applies our empirical findings to explain the recent surge in U.S. tax revenue and provides an outlook for the future. We evaluate the out-of-sample performance of the model and use simulations to allocate recent changes in revenue to movements in the underlying determinants. Finally, we perform forecasts for 2007–2009 based on various scenarios for some key variables.

A. Model Performance

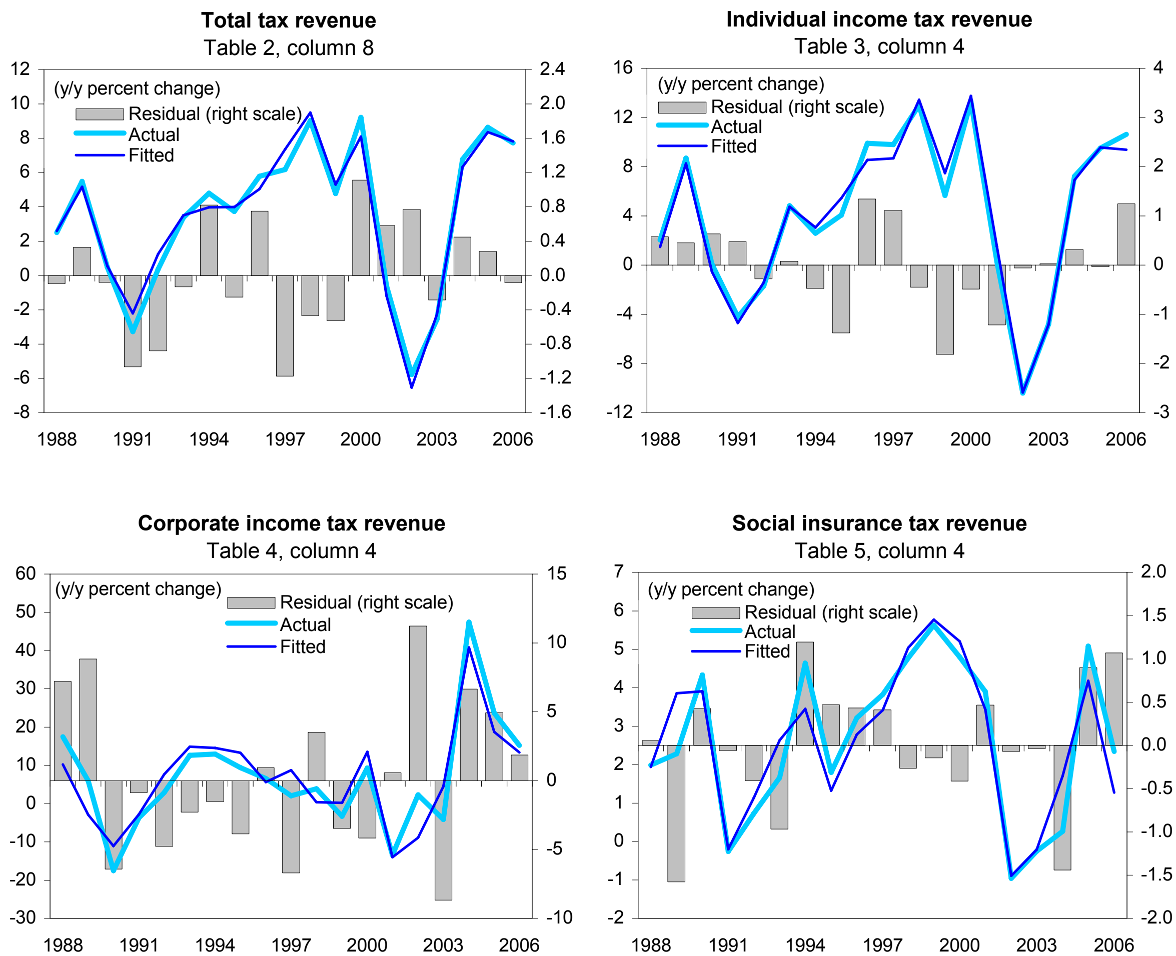
The forecast performance of the model is depicted in Figures 4 and 5, which compare actual data with model-fitted values. For ease of interpretation, values from the long-run equations have been converted from log levels to shares of GDP and the log differences from the short-run equations are converted to year-to-year percentage changes.

Figure 4. Fitted Values and Residuals From Long-Run Equations



Source: IMF staff calculations.

Figure 5. Fitted Values and Residuals From Short-Run Equations 1/



Source: IMF staff calculations.
1/ All values are in real terms (converted from nominal using the GDP deflator).

The results suggest that:

- Deviations from the long-run equilibrium have typically been within a quarter percentage point of GDP, and smaller for the subcategories.

- Yearly revenue growth has been predicted within ±2 percentage points accuracy for overall revenue, individual income taxes, and social insurance taxes. The errors for corporate income taxes are somewhat larger (±8 pts.), but still small relative to the volatility of the actual changes, which range from –20 to 50 percent.

- Movements in the residuals across revenue categories are not highly correlated, and the equations for overall revenue and the subcomponents usually tell a similar story (Table 6). However, in the long-run equations, the error for 2006 in each of the subcomponents is greater than the overall error, and the change in the short-run overall residual is inconsistent with the behavior of the disaggregated residuals. Thus, while the results for total revenue show current revenue roughly at its equilibrium level, the results by category suggest an overshoot of about 0.3 percent of GDP.

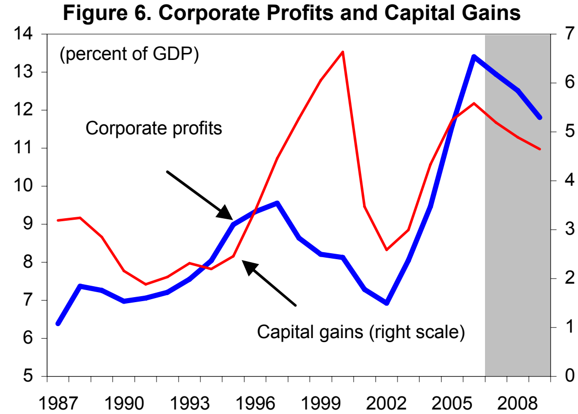
Table 6. Correlations Between Residuals, 1987–2006

		Total	Individual	Corporate	Social
			Short-run		
Total		0.76	-0.07	0.41	0.02
Individual	*Long-run*	0.50	0.65	0.16	0.02
Corporate		0.46	0.27	0.94	-0.26
Social		-0.11	-0.42	-0.15	0.74

Source: IMF staff calculations.
Note: The cells above the diagonal show the correlation between short-run residuals, cells below the diagonal show the correlation between long-run residuals, and along the diagonal show the correlation between long-run and short-run in a revenue category.

B. Decomposing the Recent Surge in Revenue

Figure 6. Corporate Profits and Capital Gains



Sources: Congressional Budget Office; and Haver Analytics.

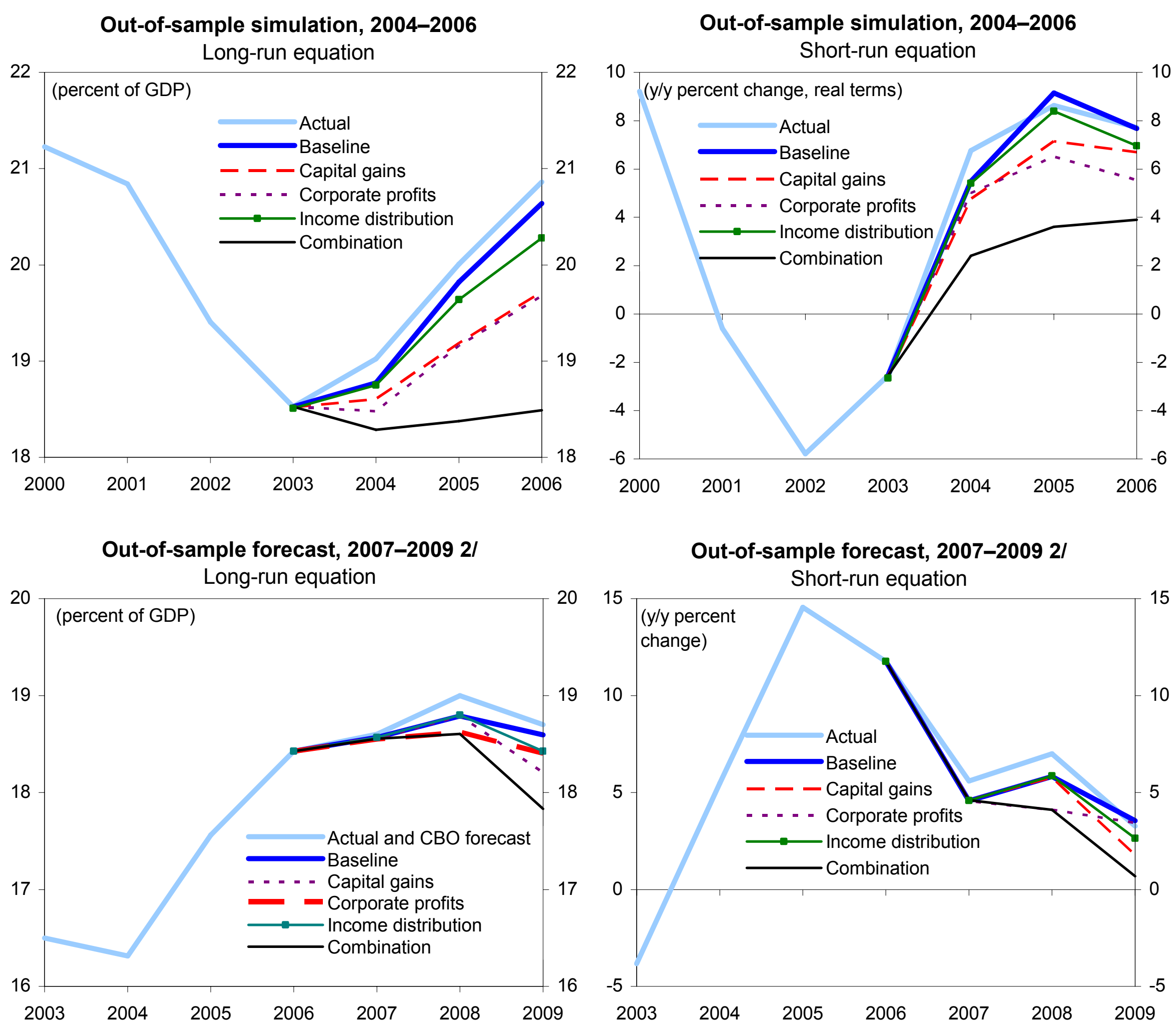
Our results so far indicate that most of the strong performance of tax revenue in recent years has been no mystery, but rather the result of buoyant corporate profits and capital gains, and increasing income inequality. The ratios of corporate profits and capital gains to GDP have risen rapidly since 2003 (Figure 6). Income from capital gains has increased from 2.6 percent of GDP in calendar year 2002 to 5.6 percent in 2006, a change of 2 standard deviations, while the ratio of corporate profits to GDP has increased from 8.1 percent in 2003 to 13.4 percent in 2006, a change of 3 ¼ standard deviations. The income share of the top 1 percent of the distribution bottomed out at 16.9 percent in 2002 before rising to 21.8 percent in 2005.[13] Accordingly, we focus on the contributions of these three variables to recent movements in revenue.

[13] The measure of income distribution includes capital gains; excluding these, the income share of the top 1 percent of taxpayers has risen 2.7 percentage points from 2002 to 2005. The data are an updated version of those first presented in Piketty and Saez (2003).

For the out-of-sample analysis, we re-estimated our preferred equations from Table 2 for the 1987–2003 period. The results were close to those obtained previously. Those same specifications were used to perform an out-of-sample dynamic forecast for the long-run and short-run equations. The dynamic baseline forecast uses the actual 2003 revenue outcome, plus actual values for the independent variables, to predict revenue over the 2004–06 period (Figure 7).

The top panels of Figure 7 show that the baseline explains most of the recent surge in revenue, although an unexplained factor of about 0.2 percent of GDP enters in 2004 and persists through 2006. The results using the short-run equation are similar—revenue growth in 2004 was stronger than predicted but the model tracked 2005 and 2006 quite closely. The baseline is then modified in the following ways (each is depicted separately in Figure 7):

Figure 7. Scenario Results: Total Revenue 1/

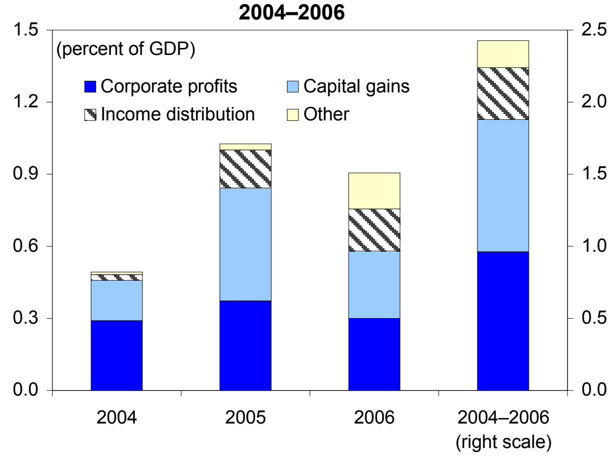


Sources: Congressional Budget Office; and IMF staff calculations.
1/ See text for description of simulation parameters.
2/ Includes effects of inflation and legislative changes.

- Leaving corporate profits at their 2003 share of GDP (8 percent) would have lowered revenue by slightly less than 1 percent of GDP through 2006, with the impact divided evenly between the three years.
- Holding capital gains to their 2002 share of GDP (2.6 percent) would have lowered revenue by 0.9 percent of GDP by 2006, with the largest impact in 2005, given a 43 percent rise in capital gains realizations the previous year.[14]
- Keeping constant the top one percent's share of income from sources other than capital gains would have reduced revenue by ⅓ percent of GDP through 2006.[15]

The combined revenue impact of these three scenarios attributes the majority of the gain in revenue since 2003 to these two variables. Real revenue growth would have averaged 3.3 percent from 2004–2006, slightly lower than the 3½ percent average GDP growth over the period. As shown in Figure 8, the contribution of other factors from 2004–06 is less than 0.2 percent of GDP.[16]

Figure 8. Contribution to Revenue Increase, 2004–2006



Source: IMF staff calculations.

C. Outlook

We now examine the future revenue outlook, with a particular focus on the sensitivity of revenue to capital gains and corporate profits. We start with our preferred long-run and short-run equations from Table 2, columns 5 and 8, to construct the same type of dynamic forecast for 2007–09 that we did for 2004–06. In principle, the forecast could extend beyond 2009, but the phasing out of many current tax provisions would make this analysis overly complex for this paper. Our values for the independent variables are from CBO (2007), except for the income share of the top 1 percent of earners, which is assumed to vary in line with its historical correlation with capital gains.

[14] Capital gains are held constant from 2002 because they affect revenue with a lag in our equations, both because of the lapse in time between realization and payment of the tax, and because the data are on a calendar year rather than fiscal year basis.

[15] The income distribution is affected by fluctuations in capital gains, as around 80 percent go to taxpayers with adjusted gross income of over $200,000 (Balkovic 2006, 2007). Using the Piketty and Saez (2003) data, we calculated that about half of the increased income share of the top one percent was due to capital gains and half from other sources. This variable also affects revenue with a lag because it is on a calendar year basis.

[16] This includes the discrepancy between the baseline scenario and the actual outcome.

The CBO baseline assumes that capital gains and corporate profits will be relatively flat in nominal terms: capital gains are projected to decline from 5.6 percent of GDP to 4.6 percent of GDP from 2006–09, and corporate profits are expected to fall from 13.4 percent of GDP to 11.8 percent of GDP over the same period. Real GDP growth is projected to average 2.4 percent in 2007 before rebounding to 2.9 percent in 2008 and 3.1 percent in 2009.

In the context of flat corporate profits and capital gains, our baseline model projects revenue growth of about 5 percent in 2007, 6 percent in 2008, and 4 percent in 2009 (see Figure 7). The short-run equation is slightly less optimistic than the long-run equation in all three years, largely due to the higher coefficient on corporate profits. Our baseline scenario for revenue growth is lower than the CBO prediction for 2007 and 2008 but higher in 2009, so the revenue-GDP ratio remains lower throughout—indicating that there are downside risks to the CBO's revenue projection.

Turning to the impact on revenue of shocks to capital gains and corporate profits, we construct three scenarios (Table 7).[17] In the first, the ratio of capital gains to GDP is 1 standard deviation lower than assumed in the CBO baseline for 2008 and 2009—erasing most of the run-up in recent years.[18] In the second scenario, the share of corporate profits in GDP is 1 standard deviation lower than the CBO baseline in 2008 and 2009. In order to maintain a link to the national income identity, higher personal income is assumed to offset 30 percent of this shock, in line with the correlation in yearly changes of the two variables' ratios to GDP. This is also in line with developments from 2003-2006, when higher corporate profits were only partially offset by a decline in the share of personal income in GDP. The share of profits in GDP drops to 10 percent in 2009 but would remain above the levels prevailing in the 1980s and 1990s. The shock to the income distribution is a one standard deviation decline in the non-capital gains share of the top one percent of taxpayers. The combination scenario combines the changes made in the three other scenarios.

As shown in the lower left panel of Figure 7, the capital gains scenario cuts 0.4 percent of GDP from revenue by 2009. The impact of the corporate profits scenario is only 0.2 percent of GDP, as higher personal income offsets some of the effects. The income distribution scenario cuts another 0.2 percent of GDP from revenue. In the combined scenario, revenue would be lower by 0.8 percent of GDP in 2009, with revenue growth around 4 percent in 2008 before dipping to about 1 percent in 2009. Under this scenario, revenue would be 17.8 percent of GDP in 2009, roughly comparable to the 17.6 percent seen in 2005, despite an increase in revenue due to the phasing out of some tax cuts.

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[17] In this model, the effects of a positive and negative shock are of equal size and opposite in sign, but only the negative shock is presented.

[18] The standard deviations of the GDP shares of capital gains and corporate profits over the 1987–2006 period are 1.5 and 1.7 percentage points, respectively.

Table 7. Scenario Parameters

Year	CBO Baseline		Assumed	Scenarios		
	Capital gains	Corporate profits	Top 1 percent income share	Capital gains	Corporate profits	Top 1 percent income share
2002	2.6	6.9	16.9	2.6	6.9	16.9
2003	3.0	8.1	17.5	3.0	8.1	17.5
2004	4.3	9.5	19.8	4.3	9.5	19.8
2005	5.2	11.6	21.8	5.2	11.6	21.8
2006	5.6	13.4	22.1	5.6	13.4	22.1
2007	5.2	12.9	21.8	5.2	12.9	22.1
2008	4.9	12.5	21.6	3.4	10.8	20.7
2009	4.6	11.8	21.4	3.2	10.1	20.5
1995–2005 Average	4.3	8.7	18.6			

Sources: Haver Analytics; Congressional Budget office; Piketty and Saez, 2003; and Fund staff calculations.

Our simulations for 2007–2009 mirror the results for 2004–2006, and show that significant shifts in capital gains and corporate profits would have a large impact on revenue. Insofar as there has been a structural increase in the capital share of income, some of the recent gains could prove permanent. In this case, however, revenue volatility may have increased, as capital gains and corporate profits both tend to vary substantially over the business cycle. This underscores the risks to the current revenue outlook.

VI. Conclusions

This paper has attempted to analyze the determinants of revenue growth in order to assess the likely prospects for tax revenue collections. After adjusting headline revenue numbers for the effects of tax policy changes, we estimate how revenue responds to growth in the underlying tax base over both the long and short run.

The models explain the data well, with statistically signficant revenue elasticities and indications that deviations from trend are very quickly reversed. Most of the revenue surge during 2004-06 is explained by growth in corporate profits and capital gains, as well as increased income inequality. There has also been an unexplained increase in the elasticity of taxes with respect to income, but this accounts for only a small portion of recent developments, and, if history is any guide, this will prove a temporary phenomenon.

Out-of-sample forecasts using this data serve as a simple cross-check on more complicated methods, and our results are broadly in line with other forecasts. However, with capital income typically being quite volatile over the business cycle, there is a real risk that future revenue growth may slow sharply if the economy enters a weaker phase. Illustrative scenarios indicate that the revenue-GDP ratio could fall by nearly 1 percent of GDP, relative to the baseline, should capital gains and corporate profits revert toward historical levels.

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Data and Programs

The programs and data used in this paper are posted online at www.imf.org. All estimation was conducted using EViews version 5.1. Following is a description of the files:

data.csv: Contains the data used in the paper. For the out-of-sample forecast, data are from the CBO's set of fiscal year projections in the January, 2007 *Budget Outlook*, except capital gains, which, in order to be consistent with the historical data, are from the calendar year projections. The series mnemonics are explained in Table A1.

prog_final.prg: Runs all the regressions presented in Tables 2, 3, 4, and 5. It also produces a csv file containing the residuals that were used in Figures 4 and 5.

prog_insamp.prg: Solves the models based on regressions through 2003 and runs scenarios for 2004 through 2006, as shown in the top half of Figure 7. The program produces a csv file containing the underlying data for the series shown (before transformations).

prog_outofsamp.prg: Solves the models based on regressions through 2006 and runs scenarios for 2007 through 2009, as shown in the bottom half of Figure 7. The program produces a csv file containing the underlying data series shown. The raw data differs from that shown in the figure as it is not converted to nominal terms and does not include the effects of legislative changes.

Table A1. Data Sources and Descriptions

Variable	Mnemonic	Source	Haver codes	Transformations
Real GDP	gdp_r	Haver Analytics	GDPZ@USNA	Converted quarterly data to fiscal year basis.
Nominal GDP	gdp	Haver Analytics	GDPX@USNA	Converted quarterly data to fiscal year basis.
GDP deflator	gdp_p	Calculated in EViews.		Fiscal year nominal GDP over real GDP.
Output gap	trendgap	Calculated in EViews.		H-P filtered fiscal year real GDP.
Taxable personal income	yptax	Haver Analytics	YPW@USNA, GRCSI@USNA, and YPIAR@USNA	Converted quarterly data to fiscal year basis. Includes wages and salaries, employee contributions to government social insurance, and personal income receipts on assets. Grows with total personal income for forecast.

Table A1 (continued). Data Sources and Descriptions

Taxable employee compensation	ypayroll	Haver Analytics	YPW@USNA, YLSUS@USNA, and GRCSI@USNA	Converted quarterly data to fiscal year basis. Includes wages and salaries and both employer and employee contributions to government social insurance.
Corporate profits	profits	Haver Analytics	YCBT@USNA	Converted quarterly data to fiscal year basis.
Working age population ratio	pop_wa	Haver Analytics	POP15WJ @USECON and POPJ@USECON	Population 15 years of age and older, over total population. The Haver series also include projections.
Capital gains	capgain	Congressional Budget Office		
Income share of top 1 percent	inctop1	Piketty and Saez (2003)		
Total revenue, adjusted	temprev_alt	Haver Analytics	FYTR@GOVFIN	Adjustments for legislative changes described in text.
Individual income tax revenue, adjusted	trev_ind	Haver Analytics	FYTRI@GOVFIN	Adjustments for legislative changes described in text.
Corporate income tax revenue, adjusted	trev_crp	Haver Analytics	FYTRC@GOVFIN	Adjustments for legislative changes described in text.
Social insurance tax revenue, adjusted	trev_soc	Haver Analytics	FYTRS@GOVFIN	Adjustments for legislative changes described in text.