

# Additional Technical Detail on GAO's Model: The Economic Model and Key Assumptions

The simulations incorporate feedback from budget surpluses or deficits to the economy using a standard model of economic growth originally developed by economists at the Federal Reserve Bank of New York. The major determinants of economic growth in the model are changes in the labor force, capital formation, and the growth in total factor productivity. We modified the original model to include a set of relationships that describe the federal budget and its links to the economy, using the framework of the National Income and Product Accounts (NIPA).

The model is helpful for exploring the long-term implications of national saving and fiscal policy and for comparing alternative paths within a common economic framework. Since 1992, GAO has provided the Congress with a long-term perspective on alternative fiscal policy paths.<sup>1</sup> The results provide illustrations rather than precise forecasts of the economic and budget outcomes associated with alternative policy or saving rate assumptions. The model depicts the links between saving and the economy over the long term and does not reflect their interrelationships during short-term business cycles. We have made several simplifying assumptions such as holding interest rates and total factor productivity growth constant, but sensitivity analyses suggest that variations in these assumptions

generally would not affect the relative outcomes of alternative policies. These simulations are not predictions of what will happen in the future as policymakers would likely take action to prevent damaging out-year fiscal and economic consequences.

## Overview of the Model

In the model, GDP is determined by the labor force, capital stock, and total factor productivity. GDP in turn influences nonfederal saving, which consists of the saving of the private sector and state and local government surpluses or deficits. Through its effects on federal revenues and spending, GDP also helps determine the NIPA federal budget surplus or deficit.

Nonfederal and federal saving together compose national saving, which influences investment and the next period's capital stock. Capital combines with labor and total factor productivity to determine GDP in the next period, and the process continues.

In particular, the model provides a useful framework for assessing the long-term implications of alternative budget policies through their effect on national saving. Our model does not differentiate between tax policy changes and spending changes. The aggregate effect on the amount of federal government saving is what affects the level of national saving and economic growth. Federal surpluses increase national saving

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<sup>1</sup> See *Budget Policy: Prompt Action Necessary to Avert Long-Term Damage to the Economy* (GAO/OCG-92-2, June 5, 1992), *The Deficit and the Economy: An Update of Long-Term Simulations* (GAO/AIMD/OCE-95-119, April 26, 1995), *Budget Issues: Deficit Reduction and the Long-Term* (GAO/T-AIMD-96-66, March 13, 1996), *Budget Issues: Analysis of Long-Term Fiscal Outlook* (GAO/AIMD/OCE-98-19, October 22, 1997), *Budget Issues: Long-Term Fiscal Outlook* (GAO/T-AIMD/OCE-98-83, February 25, 1998), *Budget Issues: July 2000 Update of GAO's Long-Term Simulations* (GAO/AIMD-00-272R, July 26, 2000), and *Long-Term Budget Issues: Moving From Balancing the Budget to Balancing Fiscal Risk* (GAO-01-385T, February 6, 2001).

while deficits reduce national saving, and higher saving translates into higher GDP.

In our simulations, we make the simplifying assumption that the combined saving rate of the household, business, and state and local government sectors is consistent with historical experience, typically the average over the last ten years. When the most recent historically saving rate is substantially above or below the longer-term historical average, we gradually phase in our long-term saving rate assumption over about ten years. The specific assumptions used in our current simulations are shown in the key model assumptions table. Future saving rates of these sectors will of course vary in response to a variety of influences, such as demographics, expectations, and changes in preferences. Nonetheless, this simplifying assumption allows us to assess the effect of budget policy on saving, investment, and output in the future.

## Labor Input

Economic growth is partly dependent on how much labor is employed. In our simulations, we used the labor input assumptions of the Social Security Administration actuaries underlying the intermediate projections in the most recent *Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Disability Trust Funds*. The intermediate projections, which reflect the Trustees' best estimate, reflect changes in the working age population, particularly the increasing rate of retirement by the baby boom generation after 2010. They also reflect projections of labor force participation rates, unemployment rates, and weekly hours worked. The demographic and economic assumptions imply a sharp drop in the average annual growth of aggregate hours worked after 2010.

## Total Factor Productivity

The three sources of economic growth in the model are increased labor input, capital accumulation, and the advance of total factor productivity. The latter is a catch-all category reflecting sources of growth not captured in straightforward measures of aggregate labor input and aggregate physical capital employed. These include not only the improvements in products and processes yielded by advancing technology but also the improved quality of labor and capital inputs, reallocation of inputs to uses where they are more productive, and improvements in physical and social infrastructure.

Our simulations use CBO's total factor productivity growth assumption for the first ten years. Thereafter, we set total factor productivity growth equal to the average over the last fifty years. Although the future course of productivity growth is essentially unknowable, the experience over the past fifty years provides a reference path for the simulations.

## International Financial Flows

There are also important links between national saving and investment and the international sector. In an open economy such as the United States, a decrease in saving due to an increase in the federal budget deficit or a decrease in other saving may not result in an equivalent decrease in domestic investment. Instead, some or all of the decrease in U.S. saving may be offset by an increase in net borrowing from other countries. Borrowing from other countries can help sustain domestic investment.

However, at least a portion of the future returns to the domestic investments financed by such borrowing flows abroad to repay foreign lenders.

The model incorporates a simple representation of net financial flows between the U.S. economy and the rest of the world. In the first ten years, we set the current account balance (which equals U.S. net lending or borrowing plus net capital transfers abroad) equal to its share of GDP in the base year (the year before the simulation begins) plus one-third of the change in gross national saving's share of GDP since the base year. Over the long run, we assume the market forces such as adjustments in exchange rates, interest rates, and prices will tend to move the current account balances towards zero. Accordingly, in all years after the ten-year budget window, the nominal current account balance as a share of GDP is equal to its base-year share of GDP times nominal GDP in the tenth budget year, divided by nominal GDP in the projection year, plus one-third of any change in the saving rate since the base year. As a result, changes in national saving cause the ratio of the current account balance (and thus also U.S. net lending or borrowing) to GDP to move around its long-term trend. Basically, we assume that the nation's current account balance increases by one-third of any increase in the national saving rate. For each additional dollar saved, therefore, about 67 cents are used for domestic investment and 33 cents are lent to other countries. Conversely, each dollar decrease in national saving is offset by 33 cents in foreign lending to the United States. Our assumption is consistent with the strong correlation between national saving and domestic investment that persists even in the context of a global economy.<sup>2</sup>

## Budget and Other Assumptions

The key model assumptions table lists the most important assumptions incorporated in the model. While most of the assumptions are relatively straightforward, the treatment of Social Security and health care spending merit additional explanation. Social Security outlays in the model are based on the number and age composition of the OASDI beneficiary population under the intermediate assumptions of the most recent Trustees' Report. The average Social Security benefit per beneficiary is adjusted in each simulation to reflect the different rates of economic growth. In all simulations, we assume that Social Security benefits will continue to be paid even after the OASDI trust fund is exhausted. Medicare outlays follow CBO's projections for the first ten years, after which the model gradually phases in the intermediate assumptions of the most recent HI and SMI Trustees' reports. In all simulations, we assume that Medicare benefits will continue to be paid even after the trust funds are exhausted. Medicaid outlays are based on the most recent CBO 10-year baseline and long-term projections. Health care spending is expressed as a share of GDP in our simulations, and the share is unaffected by differences in economic growth across simulations.

Several of the assumptions used tend to provide conservative estimates of the benefit of running surpluses or lower deficits and of the harm of increasing deficits. The interest rate on the national debt is held constant, for example, even when deficits climb and the national saving rate plummets. Under such conditions, there could be a rise in the rate of interest and a more rapid increase in federal interest payments than our simulations

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<sup>2</sup> See Martin Feldstein and Philippe Bacchetta, "National Saving and International Investment," *National Saving and Economic Performance*, D. Bernheim and J. Shoven, eds. (Chicago: University of Chicago Press, 1991) pp. 201–226; and Maurice Obstfeld and Kenneth Rogoff, "The Six Major Puzzles in International Macroeconomics: Is There a Common Cause?" NBER Working Paper No. 7777 (July 2000).

display. Another conservative assumption is that the rate of total factor productivity growth is unaffected by the amount of investment. Productivity is assumed to advance at its assumed rate each year through the end of the simulation period even if investment collapses. Finally, one-third of any saving decline is assumed to be offset by net inflows of foreign capital, even in the event of a dramatic saving decline that might set off a flight of capital from the United States. Such assumptions tend to moderate the effect of changes in national saving in our simulations. Sensitivity analyses reveal that variations in these assumptions generally would not affect the relative outcomes of alternative policies.