



How CBO Analyzes the Effects of Changes in Federal Fiscal Policies on the Economy

Summary

Analyzing the effects on the overall economy of changes in federal fiscal policies—that is, policies governing taxes and spending—requires complex modeling and a significant amount of time. The Congressional Budget Office (CBO) undertakes such analyses in certain reports and for some major pieces of legislation; some of those analyses include the feedback effects of changes in the economy on the federal budget.¹ CBO estimates the economic effects of changes in fiscal policies in both the short term and the longer term. The agency conducts its analyses using evidence about the effects of similar policies that have been implemented previously and using results from a variety of economic models.

In the short term, changes in fiscal policies affect the overall economy primarily by influencing the demand for goods and services by consumers, businesses, and governments, which leads to changes in output relative to potential (maximum sustainable) output. For example,

decreases in taxes and increases in government spending generally boost demand, which encourages businesses to gear up production and hire more workers than they otherwise would; tax increases and spending cuts generally reduce demand, which has the opposite effects. In addition, changes in the supply of labor (the number of hours of labor that workers would like to provide) can affect output in the short term if the labor market is sufficiently tight—that is, if the demand for workers is high relative to the supply.

In the longer term, changes in fiscal policies primarily affect output by altering people's incentives to work and save as well as businesses' incentive to invest, thereby changing potential output. For example, policy changes that reduce marginal tax rates—the percentage of an additional dollar of earnings that is unavailable to a taxpayer because it is paid in taxes—generally encourage more work and saving. As another example, policy changes that reduce the federal deficit typically lead to more national saving (the total amount of saving by households, businesses, and governments) and investment, ultimately boosting output and income. Changes to fiscal policies may also affect potential output by altering the amount of government investment (for example, spending or tax subsidies for infrastructure, education and training, or research and development).

How Does CBO Estimate the Short-Term Effects of Changes in Fiscal Policies on the Overall Economy?

CBO assesses the short-term effects of changes in fiscal policies on the overall economy by estimating the impact of those policies on the demand for goods and services and combining those results with estimates of the

1. CBO's estimates of the budgetary effects of proposed legislation generally do not reflect changes in behavior that would affect total output in the economy, such as any changes in the labor supply or private investment resulting from changes in fiscal policy. That is, CBO's cost estimates generally do not include what is sometimes known as "dynamic scoring." The convention of not incorporating macroeconomic effects in cost estimates, a practice that has been followed in the Congressional budget process since it was established in 1974, primarily reflects several facts: Doing macroeconomic analysis of all proposed legislation would not be feasible; nearly all proposed legislation analyzed by CBO would have negligible macroeconomic effects (and thus negligible feedback to the federal budget); and estimates of macroeconomic effects are highly uncertain.

policies' impact on the supply of labor. The impact on the demand for goods and services is the product of a policy's direct effects—the immediate or “first-round” effects on the economy—and indirect effects, which either offset or enhance direct effects. CBO uses evidence about the effects of similar policies to estimate a policy's direct effects on spending for goods and services and uses the results generated by macroeconomic models to estimate the indirect effects. To estimate a policy's short-term impact on the labor supply, CBO analyzes the effects of the policy change on incentives to work; the estimated effects on output of those changes in the labor supply depend on the state of the labor market.

A policy's direct effects on spending result from changes in purchases of goods and services by federal agencies and by the people and organizations that receive federal payments or pay federal taxes. The size of the direct effect of a change in fiscal policy, per dollar of budgetary cost, depends on whether the change is permanent or temporary and on the financial circumstances of those affected by the policy. For example, a temporary tax cut generally has a smaller effect on a household's purchases than a permanent cut because a temporary cut has a smaller effect on the household's lifetime disposable (after-tax) income. In addition, increases in disposable income are likely to boost purchases more for lower-income households than for higher-income households.

The indirect effects of changes in fiscal policies can be summarized by a “demand multiplier,” defined as the total change in output for each dollar of direct effect on demand. The value of that multiplier is affected by economic conditions; CBO estimates that indirect effects are largest when the Federal Reserve is keeping short-term interest rates close to zero. Because considerable uncertainty surrounds the estimation of the effects of fiscal policy on demand, CBO's analyses of changes in fiscal policies generally use a range of estimates of the demand multiplier that encompasses a wide array of economists' views about the relevant economic relationships.² The full economic impact of a change in demand in the short term is the product of the direct effects and indirect

effects. That combined impact can be summarized by an “output multiplier.”

In addition, CBO's short-term analysis incorporates the effect on output of changes in the supply of labor, but the magnitude of that effect depends on the state of the economy. When unemployment is high and output is far from its potential—that is, when the economy has considerable unused labor and capital resources, or “slack”—a policy that increases or decreases the supply of labor will generally have little effect on output. In those circumstances, if a policy leads some people to leave the labor force (which means that they are neither employed nor looking for work), the jobs they vacate or could have filled will probably be filled by other people who will otherwise be unemployed; if a policy leads some people to join the labor force, those people will probably be unable to find a job (or, if they find a job, other people will become unemployed).

How Does CBO Estimate the Longer-Term Effects of Changes in Fiscal Policies on the Overall Economy?

CBO generally uses two models of potential output to estimate the effects of changes in fiscal policies on the overall economy over the longer term—a Solow-type growth model and a life-cycle growth model. In those models, output depends on the amount and quality of the labor that is employed and the stock of productive capital (such as factories, vehicles, and computers that support future production and consumption) available for use in the economy, which, in turn, depend on decisions regarding work, saving, and investment. Output depends also on the efficiency with which those inputs are used to produce goods and services, which depends on government investment and other factors affecting the productivity of the labor and capital inputs. In the Solow-type model, people base their decisions about working and saving primarily on current economic conditions, such as wage levels, interest rates, and government policies; and those decisions reflect people's anticipation of future policies in a general way but not their responses to specific future developments. By contrast, in the life-cycle growth model, people make choices about working and saving in response to both current economic conditions and their explicit expectations of future economic conditions.

In using both models, CBO employs alternative estimates of some key economic relationships to reflect the high degree of uncertainty that attends them. For example,

2. For a further discussion of multipliers and their role in CBO's estimates of the economic effects of changes in fiscal policies, see Felix Reichling and Charles Whalen, *Assessing the Short-Term Effects on Output of Changes in Federal Fiscal Policies*, Working Paper 2012-08 (Congressional Budget Office, May 2012), www.cbo.gov/publication/43278.

CBO uses alternative estimates of the responsiveness of labor supply to changes in after-tax wages, the response of international capital flows to changes in national saving, and the return on government investment. The ranges of estimates that CBO uses are based on the research literature in those areas. By using two different models and alternative estimates of some key parameters, CBO generally produces a range of estimated effects of changes in fiscal policies that reflects different views about how the economy operates.

CBO estimates the effects of changes in fiscal policy in the transitional period between the short term and the long term by blending results from the short-term analysis and the long-term analysis using the Solow-type growth model. That blending puts full weight on estimated short-term effects on output in the initial years; increasing weight on the estimated effects on potential output under the Solow-type growth model over the next few years; and then full weight on the estimated effects on potential output in later years. Some recent research suggests that, under certain circumstances, changes in fiscal policies that affect the demand for goods and services in the short term can have significant effects on potential output in the long term apart from the impact of the changes in government borrowing; CBO continues to investigate that issue.

Estimating Short-Term Effects of Changes in Fiscal Policies on the Overall Economy

CBO estimates the short-term economic effects of changes in fiscal policies by focusing on the impact of those changes on the overall demand for goods and services.³ That impact includes both the direct effects on demand and the indirect effects on demand that arise when the direct effects propagate throughout the economy. CBO estimates those effects using evidence about

the effects of similar policies in place in the past and using results produced by macroeconomic models. In its analyses, the agency takes into account the state of the economy when fiscal policy is changed and the reaction of monetary policy—which affects interest rates and the availability of credit—to that change. In addition, CBO estimates the short-term impact on output of changes in incentives to work created by changes in fiscal policies. Because considerable uncertainty surrounds the estimation of the effects of changes in fiscal policies, CBO generally reports its analyses using ranges and central estimates (the effects predicted when key inputs to CBO's analyses are at the midpoint of their ranges).

Estimating the Direct Effects of Changes in Fiscal Policies on Demand

The direct effects of changes in fiscal policies consist of changes in purchases of goods and services by federal agencies and by the people and organizations that receive federal payments or pay federal taxes. For example, if a change in fiscal policy results in a dollar increase in purchases by the federal government, then the direct effect on demand is one dollar. Alternatively, if someone receives a dollar in transfer payments (such as Social Security or unemployment insurance benefits) or tax cuts and then spends 80 cents (saving the other 20 cents), the direct effect on demand is 80 cents; if someone receives a dollar and spends less than 80 cents, the direct impact on demand would be proportionately smaller.

In CBO's analyses, both the size and the timing of the direct effect that results from a change in fiscal policy depend on the type of policy. The size of the direct effect, per dollar of budgetary cost, depends on the duration of the policy change and the characteristics of those affected by the change (for example, whether the recipient of a tax cut or transfer payment has high or low income). Temporary tax cuts generally have smaller effects on households' purchases than permanent cuts because temporary cuts have smaller effects on lifetime disposable income. In addition, increases in disposable income are likely to boost purchases more for lower-income households than for higher-income households, at least in part because a larger share of people in lower-income households cannot borrow as much money as they wish to finance their desired spending. Regarding timing, direct effects typically begin during the quarter in which a policy changes and last for at least a few quarters, but some policies affect demand more quickly than others. For example, increased government purchases boost spending in the

3. For examples of such analyses, see Congressional Budget Office, *The Economic Effects of the President's 2015 Budget* (July 2014), pp. 11–12, www.cbo.gov/publication/45540; Congressional Budget Office, *Estimated Impact of the American Recovery and Reinvestment Act on Employment and Economic Output in 2013* (February 2014), www.cbo.gov/publication/45122; Congressional Budget Office, *Macroeconomic Effects of Alternative Budgetary Paths* (February 2013), pp. 6–10, www.cbo.gov/publication/43769; and Congressional Budget Office, *Economic Effects of Policies Contributing to Fiscal Tightening in 2013* (November 2012), pp. 2–12, www.cbo.gov/publication/43694.

quarter in which they occur, whereas changes to tax or transfer policies are expected to affect spending more slowly over time.

Estimating the Indirect Effects of Changes in Fiscal Policies on Demand

The indirect effects of changes in fiscal policies enhance or offset the direct effects. The direct effects of lower taxes or higher government spending, for example, are magnified when stronger demand for goods and services prompts companies to increase investment and hire more workers than they otherwise would. In the other direction, direct effects could also be muted. For example, an increase in interest rates resulting from higher government deficits raises the cost of borrowing for households and businesses, discouraging investment and spending on durable goods such as cars. The magnitude of those indirect effects relative to the direct effects can be represented by a demand multiplier.

In estimating demand multipliers, CBO draws heavily on macroeconomic forecasting models. CBO's analyses incorporate simplified versions of three such models—two created by private forecasting companies (Macroeconomic Advisers and IHS Global Insight) and one developed by the Federal Reserve (FRB-US). The equations of those models reflect both economic theory and the historical relationships among macroeconomic variables. In those models, people make decisions about working and saving in response to current economic conditions—especially wage levels, interest rates, and government policies. Those empirically estimated responses reflect, in part, an anticipation of other policies that might follow; for example, the response of household spending to tax cuts in the past has depended partly on the anticipation of future tax policy. Therefore, the forecasting models reflect people's anticipation of future policies in a general way but do not incorporate the assumption that people anticipate the exact nature of future policies.

CBO's estimates of demand multipliers are also influenced by evidence from time-series models and dynamic general-equilibrium models. Time-series models rely heavily on past data and place less emphasis on economic theory; they document the historical correlation between fiscal policy and measures of overall economic activity. Dynamic general-equilibrium models rely less on past data and place greater emphasis on economic theory; the explicit assumptions about economic decisionmaking in

such models can be particularly useful when analyzing the effects of changes in fiscal policies that have not been observed previously.

The magnitude of CBO's estimates of demand multipliers varies significantly with economic conditions and therefore the reaction of monetary policy to a change in fiscal policy. For example, when output is well below its potential level and inflation is low, prompting the Federal Reserve to keep short-term interest rates close to zero, the Federal Reserve's response to changes in fiscal policies is likely to be limited. Under those circumstances, CBO estimates multipliers that are substantially larger than when interest rates are well above zero and the Federal Reserve is likely to respond more strongly to counteract the effects of changes in fiscal policies.

Economic conditions also affect the timing of demand multipliers. Under all economic conditions, CBO's analyses incorporate indirect effects that persist for at least four quarters (beginning in the quarter in which the direct effect occurs). When short-term interest rates are close to zero and the Federal Reserve's response to changes in fiscal policies is likely to be limited, CBO does not include any indirect effects beyond those four quarters. However, when economic conditions are such that the Federal Reserve is likely to respond more strongly to offset the effects of changes in fiscal policies by altering interest rates, those changes in interest rates affect the economy for about two years. As a result, output in the following four quarters moves in the opposite direction of its initial path. Specifically, for policies with positive direct effects, output in the fifth quarter through the eighth quarter would be lower than the amount that would have been produced in the absence of the policies; and for policies with negative direct effects, output in those quarters would be higher than the amount that would have been produced in the absence of the policies. Therefore, under those conditions, CBO includes different indirect effects over four quarters and over eight quarters.

Considerable uncertainty exists about the magnitude of demand multipliers under any set of economic conditions. That uncertainty arises because isolating the effects on output of changes in demand is difficult. For example, observing economic outcomes following changes in fiscal policies does not directly show the size of demand multipliers because that would require knowing what path the economy would have taken in the absence of a given

policy action. In recognition of that uncertainty, CBO uses a range of estimates of those multipliers that encompasses a broad spectrum of economists' views about the relevant economic relationships.

Taking all of those considerations together, CBO's estimates of the demand multiplier are the following:

- When the Federal Reserve's response to changes in fiscal policies is likely to be limited, CBO uses estimates of the demand multiplier over four quarters that range from 0.5 to 2.5, with a central estimate of 1.5.⁴
- When the Federal Reserve's response to changes in fiscal policies is likely to be stronger, CBO uses estimates of the demand multiplier over four quarters that range from 0.4 to 1.9, with a central estimate of 1.2, and estimates of the demand multiplier over eight quarters that range from 0.2 to 0.8, with a central estimate of 0.5.

Estimating the Combined Impact of Direct and Indirect Effects

Apart from effects on output resulting from changes in the supply of labor (discussed below), the full short-term effect of a change in fiscal policy on output is the product of that change's direct effects and the demand multiplier. That product is sometimes referred to as an output multiplier.

Output multipliers vary across different fiscal policies because the direct effects differ. For instance, a change in federal purchases has a direct effect of 1, so the output multiplier for federal purchases equals the demand multiplier. Most other changes in fiscal policies have direct effects that are less than 1 (because recipients of benefits and payers of taxes tend to adjust their spending by less than a dollar for every dollar change in their income), in which case their output multipliers are smaller than the demand multiplier.

4. For the time pattern associated with the effect on output of changes in the demand for goods and services, see Congressional Budget Office, "The Effect of a \$1 Increase in Aggregate Demand on GDP Over Eight Quarters" (supplemental material for Felix Reichling and Charles Whalen, *Assessing the Short-Term Effects on Output of Changes in Federal Fiscal Policies*, CBO Working Paper 2012-08, May 2012), www.cbo.gov/publication/43278.

CBO's analysis earlier this year of the impact of the American Recovery and Reinvestment Act of 2009 provides an example of how direct and indirect effects combine.⁵ That analysis used output multipliers that ranged from a low estimate of zero and a high estimate of 0.4 for corporate tax provisions primarily affecting cash flow, to a low estimate of 0.5 and a high estimate of 2.5 for purchases of goods and services by the federal government.

Estimating the Short-Term Effects of Changes in Incentives to Work

Changes in fiscal policies can also affect output by altering incentives to work. In choosing how much to work, people respond to incentives that are partly determined by taxes on income from that work and by government benefits that vary with income. An increase in the marginal tax rate on labor income leads some workers to reduce the amount of hours they work or to leave the labor force altogether. In addition, an increase in transfer benefits leads some workers to reduce the amount of hours they work.

In CBO's assessment, the effects of changes in the supply of labor on output and employment in the short term depend on the state of the labor market.⁶ Specifically, CBO's analyses reflect the view that the magnitude of the effects of such changes diminishes considerably with greater labor market slack. In those analyses, that slack is represented by the difference between the unemployment rate and the natural rate of unemployment (the rate that arises from all sources except fluctuations in overall demand for goods and services) that is implied by the "output gap," which is the difference between output and CBO's estimate of potential output.⁷

5. See Congressional Budget Office, *Estimated Impact of the American Recovery and Reinvestment Act on Employment and Economic Output in 2013* (February 2014), www.cbo.gov/publication/45122.

6. For an example of how CBO's estimates of the effects of changes in fiscal policies depend on the state of the labor market, see the agency's analysis of the labor market effects of the Affordable Care Act in Congressional Budget Office, *The Budget and Economic Outlook: 2014 to 2024* (February 2014), p. 126, www.cbo.gov/publication/45010.

7. On average in the past, an output gap of -2 percent (that is, output being 2 percent below its estimated potential) has been associated with an unemployment rate about 1 percentage point above the natural rate.

When that difference in unemployment rates is 1 percentage point, CBO estimates that about 60 percent of changes in the labor supply will be reflected in changes in employment and output; when that difference is 2 percentage points, about 15 percent of changes in the labor supply will be reflected in changes in employment and output; and when that difference is larger than 2 percentage points, CBO estimates that the effects of changes in the labor supply on employment and output will be minimal. In the latter case, jobs that are vacated or left unfilled by people who reduce the number of hours that they work will be filled by the many other workers who are unemployed, and jobs that are filled by people who increase the number of hours that they work will not be available to other workers who will then be unemployed. As a result, under those circumstances, changes in the supply of labor primarily decrease or increase the number of unemployed workers seeking each vacant position.

By contrast, when the labor market is tight, meaning that the actual unemployment rate is less than or equal to the natural rate of unemployment, more employers are struggling to find workers to fill open positions. In that case, CBO estimates, changes in labor supply will be fully reflected in changes in employment and output.

Estimating Longer-Term Effects of Changes in Fiscal Policies on the Overall Economy

The nation's potential to produce goods and services is the key determinant of economic output over the long term, so CBO's estimates of the long-term economic effects of changes in fiscal policies rely on models of potential output—in contrast with CBO's estimates of the short-term effects of changes in fiscal policies, which largely rely on models of the demand for goods and services.⁸ Potential output depends on the size and quality of the labor force, on the stock of productive capital, and on total factor productivity (the efficiency with which labor and capital are used to produce goods and services). Fiscal policies affect potential output primarily by changing the

following: the amount of government borrowing; the incentives for individuals and businesses to work, save, and invest; and the amount of government investment, which influences the productivity of labor and private capital.

One model that CBO uses to estimate the effects of fiscal policy changes over the long term is a Solow-type growth model, which is an enhanced version of a widely known model developed by Robert Solow. The other model that CBO uses to estimate the long-term effects of changes in fiscal policies is a life-cycle growth model. Because the effects of fiscal policies on the economy are uncertain, CBO generally reports its analyses using ranges and central estimates. For example, when ranges are presented for analyses using the Solow-type model, they reflect the ranges for some key inputs (such as how changes to government borrowing affect saving and investment) that are intended to cover roughly the middle two-thirds of the likely values.

For the transitional period between the short term and the long term, CBO uses a blend of its estimates of the short-term and long-term effects that assigns increasing weight to the long-term estimates over the course of that period. Some recent research suggests that, under certain circumstances, changes in fiscal policies that affect the demand for goods and services in the short term can have significant effects on potential output in the long term apart from the impact of the change in government borrowing; CBO's current analyses do not incorporate such effects.

How Changes in Fiscal Policies Affect Potential Output

Increases in federal budget deficits affect the economy in the long run by reducing national saving and, hence, the funds that are available for private investment in productive capital. Deficits thus “crowd out” private investment in the long run, and less investment leads to a smaller stock of capital and lower potential output. However, households typically offset some of that decline in national saving by increasing their own saving. In addition, net inflows of foreign capital (foreign purchases of U.S. assets minus U.S. purchases of foreign assets) also typically increase, which lessens the effects of the reduction in national saving on investment. Thus, the amount of crowding out caused by an increase in the federal budget deficit depends on the magnitude of the resulting increases in private saving and net inflows of foreign

8. For examples of long-term analyses, see Congressional Budget Office, *The 2014 Long-Term Budget Outlook* (July 2014), Chapter 6, www.cbo.gov/publication/45471; Congressional Budget Office, *The Economic Effects of the President's 2015 Budget* (July 2014), p. 12, www.cbo.gov/publication/45540; and Congressional Budget Office, *Macroeconomic Effects of Alternative Budgetary Paths* (February 2013), pp. 6–10, www.cbo.gov/publication/43769.

capital. Similarly, decreases in federal budget deficits affect the economy in the long run by increasing national saving and, thereby, the funds that are available for private investment—by an amount that depends on the magnitude of the changes in private saving and capital inflows.

Changes in specific tax and spending policies can also affect potential output. Changes in tax rates on income can influence people's willingness to work and save as well as businesses' incentive to invest and, in turn, the amounts of available labor and capital resources in the economy. For example, higher marginal tax rates on labor income lessen the incentive to work by reducing the after-tax return from work, and lower marginal tax rates have the opposite effect. Similarly, changes in transfer payments can affect people's willingness to work. For instance, an increase in transfer payments reduces the recipients' need to work. Moreover, changes in the amount of public investment—such as improvements to roads and highways, spending for education and training, and support for research and development—may affect the economy's potential output as well.⁹

How CBO's Solow-Type Growth Model Works

In CBO's Solow-type model, output is determined by the number of hours of labor that workers supply, the size and composition of the capital stock, and total factor productivity.¹⁰ The model is built on the assumption that people base their decisions about working and saving primarily on current economic conditions—especially wage levels, interest rates, and government policies. The model also incorporates the assumption that people respond to current developments as they have, on average, in the past; as a result, the estimated responses reflect people's anticipation of policies in a general way but not their responses to specific developments that may occur in the future. For example, according to the model, people increase their saving somewhat in response to an increase in federal budget deficits (for several reasons, including a reaction to higher interest rates and the anticipation that taxes may be increased or spending may be cut in the future to cover the cost of paying interest on the

additional federal debt). However, they do not perfectly anticipate the details of future changes in government policies. CBO's analyses using the Solow-type model generally focus on four types of effects (or their opposites): the effects of increased federal borrowing, increased marginal tax rates, increased transfer payments, and increased federal investment.

Effects of Increased Federal Borrowing. Increased borrowing by the federal government crowds out private investment in productive capital in the long run because the portion of people's savings used to buy government securities is not available to finance private investment. The result is a smaller stock of capital and lower output in the long run than would otherwise be the case (all else being equal).

Two factors offset part of that crowding-out effect. One is that additional federal borrowing tends to lead to greater private saving, which increases the total funds available to purchase federal debt and finance private investment. That response occurs for several reasons:

- Additional federal borrowing tends to raise interest rates, which boosts the return on saving;
- Some people anticipate that policymakers will raise taxes or cut spending in the future to cover the cost of paying interest on the additional accumulated debt, so those people increase their own saving to prepare for paying higher taxes or receiving less in benefits; and
- The policies that give rise to deficits (such as tax cuts or increases in government transfer payments) put more money in private hands, some of which is saved.

Because the crowding out of domestic investment reduces the capital stock, it alters before-tax wages and rates of return on saving, which in turn change the incentives to work and save. Specifically, the reduction in the capital stock makes workers less productive and decreases before-tax wages relative to what they would be otherwise. Those lower wages reduce people's incentive to work. However, the productivity of each unit of capital—for example, each computer, piece of machinery, or structure—is greater because more workers make use of each unit, and that greater productivity raises the return on capital. A higher return on capital boosts the return on equity shares in the ownership of capital and boosts the return on other investments (such as interest rates on federal debt) that are competing for people's savings. The

9. For further discussion, see Congressional Budget Office, *Federal Investment* (December 2013), www.cbo.gov/publication/44974.

10. For a detailed description of CBO's Solow-type growth model, see Congressional Budget Office, *CBO's Method for Estimating Potential Output: An Update* (August 2001), www.cbo.gov/publication/13250.

resulting increase in the return on saving, in turn, strengthens people's incentive to save.

Overall, however, the rise in private saving is generally considerably smaller than the increase in federal borrowing, so greater federal borrowing leads to less national saving. CBO's central estimate, based on the agency's reading of the research literature on this topic, is that private saving rises by 43 cents for every dollar increase in federal borrowing, leaving a net decline of 57 cents in national saving. (Similarly, CBO's central estimate is that private saving falls by 43 cents for every dollar decrease in federal borrowing.)

A second factor offsetting part of the crowding-out effect is that higher interest rates tend to increase net inflows of capital from other countries—by attracting more foreign capital to the United States and inducing U.S. savers to keep more of their savings at home. Those additional net inflows prevent investment in this country from declining as much as national saving does in the face of more federal borrowing. CBO's central estimate, again drawn from the research literature on the topic, is that net inflows of capital rise by 24 cents for every dollar increase in federal borrowing. (Similarly, CBO's central estimate is that net inflows of capital fall by 24 cents for every dollar decrease in federal borrowing.)

However, an increase in inflows of capital from other countries also means that more profits and interest payments will flow overseas in the future. Therefore, although flows of capital into the United States can help moderate a decline in domestic investment, part of the income resulting from that additional investment does not accrue to U.S. residents. The result is that greater net inflows of capital keep gross domestic product (GDP) from declining as much as it would otherwise but are less effective in mitigating the decline in gross national product (GNP), which includes the income that U.S. residents earn abroad and excludes the income that foreigners earn in this country. Other things being equal, increases in federal borrowing cause a greater reduction in GNP (and the well-being of U.S. households) than GDP, and reductions in federal borrowing lead to a greater increase in GNP than GDP.¹¹

With those two offsets taken together, when the deficit goes up by one dollar, private saving rises by 43 cents (so national saving falls by 57 cents), and net capital inflows

rise by 24 cents, ultimately leaving a decline of 33 cents in investment, according to CBO's central estimates. To reflect the wide range of estimates in the economics literature that assesses how federal borrowing affects national saving and domestic investment, CBO also uses a likely range of effects. At the low end of that range, for each dollar that deficits rise, national saving is reduced by 39 cents and domestic investment is reduced by 15 cents. At the high end of that range, national saving is reduced by 71 cents and domestic investment is reduced by 50 cents.¹²

Effects of Increased Marginal Tax Rates. Increases in marginal tax rates on labor and capital income reduce saving and the labor supply—and, thus, output and income—relative to what would be the case with lower rates (all else being equal).

A higher marginal tax rate on capital income decreases the after-tax rate of return on saving, weakening people's incentive to save. However, because that higher marginal tax rate also decreases people's return on their existing savings, they need to save more to have the same future standard of living, which tends to increase the amount of saving. CBO concludes, as do most analysts, that the former effect outweighs the latter, such that a higher marginal tax rate on capital income decreases saving. Specifically, CBO estimates that an increase in the marginal tax rate on capital income that decreases the after-tax return on saving by 1 percent results in a decrease in

11. The extent to which an increase in federal debt affects GDP and GNP differently depends on the net amount of additional capital invested in the United States from abroad and the rate of return received on investments in this country relative to investments in other countries: The greater the net increase in investment in this country and the higher the relative rate of return, the larger will be the difference in the effects on GNP and GDP. In CBO's analyses of fiscal policy, average rates of return earned by foreign investors in the United States are estimated to move with changes in the rate of return on capital. However, that response is less than one-for-one, as has been the case in the United States in recent decades. By contrast, the rate of return earned on investments in foreign countries by U.S. citizens and companies based in the United States is estimated to be unaffected by changes in the rate of return they earn in the United States.

12. For a review of evidence about the effects of deficits on investment, see Jonathan Huntley, *The Long-Run Effects of Federal Budget Deficits on National Saving and Private Domestic Investment*, Working Paper 2014-02 (Congressional Budget Office, February 2014), www.cbo.gov/publication/45140.

private saving of 0.2 percent. (A lower marginal tax rate on capital income is estimated to have the opposite effect.)¹³

Similarly, a higher marginal tax rate on labor income decreases people's incentive to work. However, because that higher marginal tax rate also decreases people's after-tax income from the work they are already doing, they need to work more to maintain their standard of living, which tends to increase the supply of labor. Again, CBO concludes, as do most analysts, that the former effect outweighs the latter and that an increase in the marginal tax rate on labor income decreases the labor supply. (A lower marginal tax rate on labor income is estimated to have the opposite effect.)

To reflect the high degree of uncertainty about the effect of the marginal tax rate on the labor supply, CBO uses a likely range of values for the amounts by which people would adjust the number of hours they work in response to changes in marginal tax rates (and changes in before-tax wages as well). The responsiveness of the labor supply to taxes is often expressed as the total wage elasticity (the change in total labor income caused by a 1 percent change in after-tax wages). The total wage elasticity, in turn, has two components: a substitution elasticity, which measures the effect of changes in marginal tax rates, and an income elasticity, which measures the effect of changes in a person's income after taxes. CBO's central estimate for the labor supply response corresponds to a total wage elasticity of about 0.19 (composed of a substitution elasticity of 0.24 and an income elasticity of 0.05). The low end of CBO's likely range for that response is a total wage elasticity of about 0.06 (composed of a substitution elasticity of 0.16 and an income elasticity of 0.10), and the high end of the range is a total wage elasticity of about 0.32 (composed of a substitution elasticity of 0.32 and an income elasticity of zero).¹⁴

Effects of Increased Transfer Payments. Increases in transfer payments to working-age people reduce the labor

supply through two channels. First, such increases raise people's after-tax income. As a result, people need to work less to maintain their standard of living, which decreases the supply of labor. That effect corresponds to the effect of changes in marginal tax rates as measured by the income elasticity. Second, increases in transfer payments to working-age people generally reduce the reward for working because such payments tend to be reduced for people with higher income. That reduction in the reward for working also decreases the supply of labor, corresponding to the effect of changes in marginal tax rates as measured by the substitution elasticity. (Decreases in transfer payments to working-age people have the opposite effects.)

To estimate the effects of changes in transfer payments, CBO applies the same income elasticities that the agency uses to estimate the effects of changes in tax rates. CBO is developing the capability to apply substitution elasticities as well, but it does not currently have that capability for all transfer payments (although the agency has incorporated substitution elasticities in some specific analyses).

Effects of Increased Federal Investment. Increases in federal nondefense investment can promote long-term economic growth by raising the productivity of labor and private capital. Spending for education can help develop a skilled workforce, support for research and development can prompt innovation, and spending on infrastructure (such as roads and airports) can facilitate commerce.¹⁵ For example, if not for receiving a public education (funded in part by federal spending), many workers would have lower wages than they do. If the Internet had not been initially funded through federal research and development, whole segments of the economy might not exist. And without federal funding for public highways, the cost to the trucking industry of delivering goods could be much higher.

Considerable uncertainty exists, however, about the size and timing of the increase in potential output that results

13. Potential output is affected not only by the average of the marginal rates at which capital investments are taxed but also by the variation in those marginal tax rates. If some capital investments receive more favorable tax treatment than others, additional resources will be directed to those investments even if other investments would be more productive. Changes in policies that tend to equalize the tax treatment of different investments reduce that effect, shifting investment to more productive uses and therefore increasing output, while changes in policies that generate greater variation in tax rates increase it. CBO's analyses of changes in fiscal policies include estimates of changes in that effect.

14. For details on CBO's estimates of the responsiveness of the supply of labor to changes in the after-tax wage rate, see Congressional Budget Office, *How the Supply of Labor Responds to Changes in Fiscal Policy* (October 2012), www.cbo.gov/publication/43674; and Robert McClelland and Shannon Mok, *A Review of Recent Research on Labor Supply Elasticities*, Working Paper 2012-12 (Congressional Budget Office, October 2012), www.cbo.gov/publication/43675.

15. See Congressional Budget Office, *Federal Investment* (December 2013), www.cbo.gov/publication/44974.

from an additional dollar of federal investment. Some past federal investments have generated much higher returns than others. For example, in a previous study of transportation and water infrastructure, CBO concluded that the returns varied significantly among projects in different time periods as well as among different projects during the same time periods.¹⁶ Moreover, an increase in federal investment can reduce investment by private entities or state and local governments by raising the price of investment goods and by allowing those governments to redirect their own funds to other purposes.¹⁷

For analyses of changes in overall federal investment, CBO's central estimate is that additional federal investment yields half of the typical return on investment completed by the private sector, with an average delay of five years. The low end of CBO's range of estimates is that federal investment has a rate of return of zero—that is, it has no effect on potential output—and the high end is that federal investment yields the same return as average investment completed by the private sector. The actual rate of return for a particular investment could lie outside that range; the project might have a negative return or, alternatively, yield a greater return than average investment completed by the private sector.

How CBO's Life-Cycle Growth Model Works

CBO's life-cycle growth model is a general-equilibrium model in the sense that people make decisions in response to prices—such as wages and rates of return on saving—that are determined by the decisions they make. The model includes different cohorts of households, also known as “overlapping generations,” that are forward-looking in their behavior.¹⁸ As in the Solow-type model, people in the life-cycle model are assumed to make choices about working and saving in response to current after-tax wages, after-tax rates of return, and transfer payments. However, in contrast to the Solow-type model,

people in the life-cycle model are assumed to make those choices also in anticipation of the future paths of those factors. The extent to which households can correctly anticipate those factors varies: They are assumed to know precisely how fiscal policy and the economy as a whole will evolve in the future, but they face uncertainty about their own future before-tax income. In addition, households in the life-cycle model can become “credit-constrained” if their current income falls significantly below their expected future income—that is, borrowing limits may prevent them from borrowing enough to maintain their desired level of consumption given their expected lifetime income.

As in the Solow-type model, the estimated effects of changes in fiscal policies in the life-cycle growth model depend on the degree to which net inflows of foreign capital, the labor supply, and private saving respond to those policy changes.¹⁹ To consider a broad range of possibilities about net capital inflows, CBO analyzes the effects of fiscal policy changes under two alternative assumptions: Net capital inflows are unaffected by changes in fiscal policies (equivalently, that the country has, in effect, a so-called closed economy); and net capital inflows change by the full amount necessary to offset any effect of changes in fiscal policies on interest rates (equivalently, that the country has, in effect, a so-called small, open economy).²⁰

The responses of the labor supply and private saving to changes in fiscal policies are more complicated. Both variables are influenced by the current values and future anticipated values of the after-tax rate of return on saving, the after-tax wage, and households' disposable income, among other factors.²¹ Because of the uncertainty that

16. See Congressional Budget Office, *Public Spending on Transportation and Water Infrastructure* (November 2010), p. 14, www.cbo.gov/publication/21902.

17. States and localities can reduce their investment in response to an increase in the federal grants they receive for investment (such as an increase in federal grants for transportation or education) or in response to an increase in federal investment in some other form (such as an increase in federal loans to students).

18. For a detailed description of the life-cycle model, see Shinichi Nishiyama, *Fiscal Policy Effects in a Heterogeneous-Agent Overlapping-Generations Economy With an Aging Population*, Working Paper 2013-07 (Congressional Budget Office, December 2013), www.cbo.gov/publication/44941.

19. The effects of increased federal investment and more-equal tax treatment of different investments are essentially the same in the life-cycle model as in the Solow-type model; the effects of other changes in fiscal policies differ because of the differences in people's responses discussed in this section.

20. The responses of net capital inflows to changes in fiscal policies that CBO uses in its Solow-type model (which are described above) lie between the extremes used here: In the Solow-type model, changes in net inflows of foreign capital offset some but not all of the effect of changes in fiscal policies on interest rates.

21. For a discussion of CBO's estimates of how the supply of labor responds to changes in after-tax wages in the life-cycle growth model, see Felix Reichling and Charles Whalen, *Review of Estimates of the Frisch Elasticity of Labor Supply*, Congressional Budget Office Working Paper 2012-13 (October 2012), www.cbo.gov/publication/43676.

households face about their future income, households in the life-cycle model take the precaution of holding additional savings as a buffer against potential drops in income. That precautionary motive to save is not strongly affected by changes in the after-tax rate of return on saving; as a result, in that model, households' saving does not respond as much to changes in marginal tax rates on capital income as it responds in models without a precautionary motive of that sort.²²

The life-cycle model also incorporates the assumption that people decide how much to work and save to make themselves as well off as possible over their lifetime but do not consider the well-being of their children. Therefore, older generations know that they could retire or die before a policy change occurs and tend to be less responsive to future policy changes than younger generations are.

Given the forward-looking behavior of households in the life-cycle model, producing estimates of the effects of changes in fiscal policies requires CBO to make assumptions about future policies—not only during the period when the proposed changes in policies are explicitly in effect but also into the distant future. Moreover, the assumed policy must put federal debt on a sustainable path over the long run because forward-looking households would not hold government bonds if the households expected that debt as a percentage of GDP would rise without limit. In its analysis of the President's budgetary proposals for 2015, for example, CBO chose two illustrative alternatives for what people believed would happen to fiscal policies beyond the period for which the policies were specified.²³ Under the first alternative, government transfer payments and government purchases of goods and services would be reduced by equal amounts to balance the budget; under the second alternative, government revenues would be raised (in equal measure) by increases in effective marginal tax rates and increases in revenues that did not arise from increasing marginal tax rates (but from broadening

the tax base, for instance). In CBO's analysis, those changes in policy were assumed to phase in slowly and only after the period for which the President's proposals were specified, and the changes were sufficient to make federal debt sustainable in the long term.

The Transition Between the Short Term and the Long Term

Economic theory does not offer much guidance for modeling the year-by-year effects of changes in fiscal policies between the short term and the long term. Therefore, during a transitional period, CBO uses a weighted average of the estimated short-term effects of changes in fiscal policies (discussed in the first part of this report) and the estimated long-term effects of changes in fiscal policies as derived from the Solow-type growth model. For example, in an analysis conducted in early 2013, CBO combined results from its modeling approaches as follows: Estimates for 2013 and 2014 were based entirely on the effects of changes in fiscal policies on the demand for goods and services; estimates for 2015, 2016, and 2017 placed weights of 0.75, 0.50, and 0.25, respectively, on the effects on demand and the remaining weights (0.25, 0.50, and 0.75, respectively) on the effects on potential output in the Solow-type model; and estimates after 2017 were based entirely on the effects on potential output in the Solow-type model.²⁴

In CBO's analyses, most changes in fiscal policies that have favorable economic effects in the short term have adverse economic effects in the long term. That phenomenon occurs because policies that increase the demand for goods and services in the short term typically do so by increasing government spending or reducing taxes. That boost to demand tends to increase short-term output and income, and therefore tax revenues, but not usually by enough to offset the direct increase in the deficit; consequently, such policies tend to increase government borrowing. The increase in borrowing ultimately reduces the nation's saving and capital stock, and therefore output and income, compared with what they would be otherwise. Similarly, most changes in fiscal policies that reduce the demand for goods and services decrease output and income in the short term but, by reducing government borrowing, increase output and income in the long term. As a result, most changes in fiscal policies involve a trade-off between the effects on economic output in the short

22. In the presence of uncertainty, households' responses to changes in fiscal policies tend to be strongly influenced by their aversion to risk. The degree of risk aversion used in CBO's model is consistent with existing estimates, although such estimates vary widely; see Raj Chetty, "A New Method of Estimating Risk Aversion," *American Economic Review*, vol. 96, no. 5 (December 2006), pp. 1821–1834, <http://tinyurl.com/qj9ksc8>.

23. See Congressional Budget Office, *The Economic Effects of the President's 2015 Budget* (July 2014), www.cbo.gov/publication/45540.

24. See Congressional Budget Office, *Macroeconomic Effects of Alternative Budgetary Paths* (February 2013), www.cbo.gov/publication/43769.

term and the long term. (However, changes in fiscal policies could be designed that would have a variety of effects in the short term and the long term.)²⁵

By contrast, some recent research suggests that, under certain circumstances, changes in fiscal policies that boost demand for goods and services in the short term may have positive economic and budgetary effects in the long term because the increase in demand raises the economy's long-term potential by enough to offset the negative effects on potential of higher government borrowing.²⁶ Consider, for example, that increases in long-term unemployment since 2007 have raised CBO's projection of the natural rate of unemployment for the next decade, owing to the stigma and erosion of skills that can stem from long-term unemployment (that lasting more than 26 weeks). If a short-term increase in overall demand boosted hiring of the long-term unemployed, the result might be a reduction in the natural rate of unemployment over the next decade and thus an increase in labor income and tax revenues in the long term (holding all else equal). Similarly, that logic suggests that changes in fiscal policies that lower demand for goods and services in the short term may have negative economic and budgetary effects in the long term because the decrease in demand

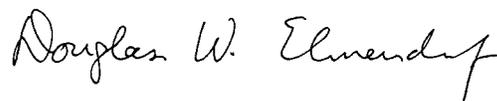
lowers the economy's long-term potential by enough to offset the positive effects on potential of lower federal borrowing.

However, the significance of the channels (apart from the amount of federal borrowing) through which changes in policies that boost demand in the short term can affect potential output in the long term is unclear. Therefore, CBO does not currently incorporate such channels in its analyses, although the agency continues to investigate the issue.

In certain reports and for some major pieces of legislation, the Congressional Budget Office (CBO) analyzes the short-term and longer-term effects on the overall economy of changes in federal fiscal (tax and spending) policies. This report, which is part of the agency's ongoing effort to make its analyses transparent, explains the methods that CBO uses in such analyses. In keeping with CBO's mandate to provide objective, impartial analysis, this report makes no recommendations.

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25. For further discussion, see Testimony of Douglas W. Elmendorf, Director, Congressional Budget Office, before the Joint Select Committee on Deficit Reduction, U.S. Congress, *Confronting the Nation's Fiscal Policy Challenges* (September 13, 2011), pp. 33–34; www.cbo.gov/publication/42761.

26. For more on that research, see J. Bradford DeLong and Lawrence H. Summers, "Fiscal Policy in a Depressed Economy," *Brookings Papers on Economic Activity* (Spring 2012), pp. 233–290, <http://tinyurl.com/ccu2sgb>; and David Reifschneider, William Wascher, and David Wilcox, *Aggregate Supply in the United States: Recent Developments and Implications for the Conduct of Monetary Policy*, Finance and Economics Discussion Series Paper No. 2013-77 (Board of Governors of the Federal Reserve System, November 2013), <http://go.usa.gov/vmad>.