ECONOMIC GROWTH AND TAX POLICY

Scheduled for a Public Hearing
Before the
SENATE COMMITTEE ON FINANCE
on February 24, 2015

Prepared by the Staff
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INTRODUCTION AND SUMMARY

The Senate Committee on Finance has scheduled a public hearing on February 24, 2015, titled "Tax Reform, Growth, and Efficiency." This document,[1] prepared by the staff of the Joint Committee on Taxation, includes an overview of economic growth and the impact that taxes may have on economic growth.

Part I of this document discusses four principal determinants of economic growth that tax policy may be able to influence. These are labor supply, capital investment, technological progress, and human capital. In general, output (the real value of goods and services) is a function of labor supplied, and the productivity of that labor. Growth, *i.e.*, increases in output, can occur through the replication of existing capital and technologies and the supply of greater hours of work. However, growth will also occur if workers are made more productive, which in turn will improve wages and living standards in contrast to mere replication of existing technologies and capital. Workers will be made more productive if their human capital is improved through greater education and skills acquisition. It will also occur if workers have access to better capital, which can result from development of new technologies.

Tax policy may have an influence on growth because it can affect these inputs to production. Taxes on labor will reduce the returns to supplying additional labor, and capital income taxes will reduce the returns to supplying additional capital, thus potentially reducing economic output. Tax policy might mitigate any negative growth effects from taxes by selective subsidies that support formal education and job training, and that promote investments in research and new technologies.

Part II of this document provides some historical data on productivity growth, real GDP growth, the growth of the labor force and changing labor force participation rates, and growth in workers' real compensation per hour.

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[1] This document may be cited as follows: Joint Committee on Taxation, *Economic Growth and Tax Policy* (JCX-47-15), February 20, 2015. This document can also be found on the Joint Committee on Taxation website at www.jct.gov.

I. ECONOMIC GROWTH

A. Overview

Determinants of economic growth

One goal that policymakers often pursue when designing tax policy—and economic policy in general—is promoting economic growth. A country's gross domestic product ("GDP") is a common measure of its economic performance and is defined as the market value of final goods and services produced by labor and property within a country during a given time period. Economic growth typically refers to increases in GDP, although economists have proposed broader measures of economic well-being.[2] Economists have identified a number of factors that affect economic growth, including geography, political institutions, property rights, mechanisms for technology diffusion, and financial markets.[3] This document, however, will focus on four specific channels that are particularly relevant for tax policy: labor supply, physical capital (*e.g.*, equipment, buildings, and infrastructure), human capital (*e.g.*, education and health), and technological innovation. One review of the growth literature concludes that differences in physical capital account for 20 percent of cross-country differences in income, while differences in human capital and total factor productivity ("TFP") accounted for 10 to 30 percent and 50 to 70 percent, respectively.[4] TFP encompasses factors that impact growth through channels other than physical capital and human capital, such as technology and the efficiency of resource allocation in the economy, and has been the subject of much study in the growth literature.[5]

Tax policy and economic growth

To understand how tax policy may impact GDP through labor supply, physical capital, human capital, and technological innovation, it is useful to think of GDP as being the product of the amount of labor supplied in the economy and the average productivity of that labor. The productivity of workers in the economy is a reflection of a number of factors, including workers' human capital, the physical capital with which they have to work, and the technology available to them.

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[2] For example, see Joseph E. Stiglitz, Amartya Sen, and Jean-Paul Fitoussi, "Report by the Commission on the Measurement of Economic Performance and Social Progress," Commission on the Measurement of Economic Performance and Social Progress, 2009. Among other things, the report advocates the incorporation of more subjective measures of economic well-being. The report is available at http://www.stiglitz-sen-fitoussi.fr/documents/rapport_anglais.pdf.

[3] For a discussion of these factors, see Daron Acemoglu, *Introduction to Modern Economic Growth*, Princeton University Press, 2009.

[4] Chang-Tai Hsieh and Peter J. Klenow, "Development Accounting," *American Economic Journal: Macroeconomics*, vol. 2, no. 1, January 2010, pp. 207-223.

[5] See Daron Acemoglu, *Introduction to Modern Economic Growth*, Princeton University Press, 2009.

Tax policy can directly influence the level of labor supply, physical capital, human capital, and technology in an economy by changing the after-tax returns to certain economic activities or changing the cost of pursuing them. Lowering individual tax rates on wages, for example, can increase labor supply by raising the after-tax returns to labor. Reductions in business income tax rates increase the after-tax return to capital and can encourage businesses to invest in physical capital, which could make workers more productive. Policies that lower the cost of education can encourage individuals to invest in their human capital, and policies that subsidize research may promote technological innovation. To the extent that these policies increase labor supply, raise physical and human capital, and promote technological innovation, they will increase economic output.

While these policies encourage economic activities that, by themselves, can promote economic growth, they have a budgetary cost. If they increase Federal budget deficits, the resulting decrease in national savings and private domestic investment may offset at least some of the growth effects of these policies in the long run.[6]

Tax policy and economic efficiency

While the discussion above provides a general framework for understanding how taxes may increase economic output directly by promoting certain economic activities, taxes may further impact output levels more indirectly by influencing how efficiently resources, such as labor and capital, are directed to their most productive use in the economy. Average labor productivity increases as economic resources are allocated more efficiently. Taxes generally lead to economy-wide distortions that reduce economic efficiency, but in some cases taxes can correct for market failures and thereby increase economic efficiency. The impact of taxes on economic efficiency is situation-specific and depends on the nature of the tax and the economic activity being taxed.

Taxes and reductions in economic efficiency: distortions in labor and capital markets

In general, any system of raising revenue alters the prices that taxpayers face with respect to consumption of goods, or the supply of labor or capital, and distorts economic decision-making. These distortions generally lead to economic inefficiencies to the extent that the tax system is not correcting for market failures.[7] In analyzing tax systems, economists often emphasize the importance of marginal tax rates because, they argue, it is marginal tax rates that

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[6] Jonathan Huntley, "The Long-Run Effects of Federal Budget Deficits on National Saving and Private Domestic Investment," CBO Working Paper 2014-02, February 2014.

[7] An exception to this is a "head tax" or "lump sum" tax, which imposes a fixed tax on all individuals without regard to any behavior. Such a tax reduces the after-tax resources available to the individual, but does not change prices and thus does not distort choices a consumer faces in the absence of the tax. For a review of measures of the efficiency cost of taxation, see Alan J. Auerbach and James R. Hines, "Taxation and Economic Efficiency," in Alan J. Auerbach and Martin Feldstein (eds.), *Handbook of Public Economics*, vol. 3, pp. 1347-1421.

affect incentives for taxpayers to work, to save, or to take advantage of various tax preferences.[8] These incentives may distort taxpayer choice, which in turn may promote an inefficient allocation of society's labor and capital resources. A less efficient allocation of labor and capital resources leaves society with a lower level of output of goods and services than it would enjoy in the absence of distortions caused by the tax system.

Economists have shown that the efficiency loss from taxation increases as the marginal tax rate increases. That is, a one percentage point increase in a marginal tax rate from 40 percent to 41 percent creates a greater efficiency loss per dollar of additional tax revenue than a one percentage point increase in a marginal tax rate from 20 percent to 21 percent.[9] Thus, to minimize economic inefficiency, economists in general have long recommended a broad base of taxation to keep marginal tax rates as low as possible to raise a given level of revenue.

Taxes and increases in economic efficiency: correcting for market failures

While taxes may have distortionary effects, tax policy can lead to a more efficient allocation of resources when they are used to correct for market failures. A common economic rationale for government intervention in certain markets (including many aspects of energy markets and the market for innovation) is that often there exist "externalities" in the consumption or production of certain goods. The externalities lead to "market failures," wherein either too little or too much of certain economic activity occurs relative to what is the socially optimal level of activity. An externality exists when, in the consumption or production of a good, there is a difference between the cost (or benefit) to the participants in the market for the good from its consumption or production and the cost (or benefit) to society as a whole. When the economy-wide, or "social," costs of a certain economic activity (*i.e.*, production or consumption of a certain good) exceed the private costs of that activity, a negative externality exists, and the level of that activity is above that which is socially optimal. In contrast, when the social benefits from a certain activity exceed the private benefits, a positive externality exists, and the level of that activity is below that which is socially optimal.

The reason the level of economic activity is either above or below that which is socially optimal in markets with externalities is that individuals and firms generally take into account the personal, or private, benefits and costs of their decisions, and ignore the benefits received, and

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[8] The marginal tax rate is the rate applied to income in a particular tax bracket. The highest marginal rate typically applies to the last dollar earned. As a result of phase-outs phase-ins of tax preference items (such as income exclusions or deductions and credits), a taxpayer's effective marginal tax rate may differ from the taxpayer's statutory marginal tax rate. By contrast with marginal tax rates, a taxpayer's average tax rate is the taxpayer's total tax paid as a percentage of the taxpayer's total income.

[9] The magnitude of the efficiency loss from taxation depends upon a measure of the taxpayer's behavioral response, or the elasticity, and the square of the total effective marginal tax rate. Hence, a small change in an effective tax rate can create an efficiency loss that is large in relation to the change in revenue. For a detailed discussion of this point, see Joint Committee on Taxation, *Methodology and Issues in Measuring Changes in the Distribution of Tax Burdens* (JCS-7-93), June 14, 1993, pp. 20–31 and Harvey S. Rosen, *Public Finance*, McGraw-Hill, 2004.

costs incurred, by other market participants. Thus, they engage in economic activity up to the point where their private marginal benefit equals the private marginal cost that they face. But from an economy-wide perspective, economic activity should occur up to the point where the social marginal benefit (*i.e.*, the benefits accruing to the entire economy and not only to the individual or firm engaged in the activity) equals the social marginal cost (*i.e.*, the costs incurred by individuals and firms in the economy as a whole and not only by the individual or firm engaged in the activity). Privately optimal economic decisions may not be socially optimal. Absent some intervention, only when there are no externalities do private actions lead to the socially optimal level of consumption or production, because only in this case are private costs and benefits equal to social costs and benefits.

Taxes are one tool that policymakers can use to correct for market failures. For example, policymakers can promote activities that create positive externalities through a tax subsidy to lower the after-tax price of the good to the consumer or increase the after-tax profit to the producer. In addition, they can discourage activities that lead to negative externalities by taxing those activities to raise the after-tax price to the consumer or decrease the after-tax profit to the producer.

B. Labor Supply

Labor supply and economic growth

The amount of labor supplied in the economy is a fundamental determinant of how much economic output can be produced. Increases in labor supply, holding average labor productivity constant, increase economic output. Figure 4 in Part II charts the increase in the U.S. labor force over time. A number of factors—including labor market regulations and the size and demographic profile of the population—can influence the total amount of labor supplied in the economy. Tax policy can also impact labor supply by changing the after-tax returns to working.

In the basic economic model of labor supply, an individual decides how to allocate time between two activities—labor and leisure. One important determinant of this choice is the wage that an individual receives from working (*i.e.*, the return to labor). An increase in wages has two countervailing effects on an individual's labor supply decision. On the one hand, an increase in wages increases the opportunity cost of leisure (*i.e.*, forgone wages) and encourage individuals to consume less leisure and work more (the "substitution effect"). On the other hand, an increase in wages increases individual income, which will lead to an increase in the consumption of goods and activities that typically rise with income, including leisure (the "income effect"). Economists generally find that the substitution effect outweighs the income effect, so an increase in wages increases labor supply.[10]

Taxes affect labor supply by determining the after-tax return to labor. Increases in the tax rate on labor will reduce the after-tax return to labor and lead individuals to work less. This can have two effects on economic output. First, reductions in labor supply lead to reductions in economic output (holding average labor productivity constant). Second, a tax on labor may reduce economic output indirectly by distorting work effort and occupational choice (lowering average labor productivity). A large economics literature, summarized below, has studied the effect of taxes on hours worked, while fewer studies have been conducted on the effect of taxes on work effort and occupational choice.[11] A number of studies separately identify the impact of

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[10] These studies are described below. It is important to note that the responsiveness of labor supply (*i.e.*, hours worked) to taxes depends on a number of factors, including the institutional features of the labor market. For example, if workers have difficulty adjusting the amount of hours they work (*e.g.*, they have a generally fixed 40-hour work-week), their labor supply may be less responsive to changes in taxes than would be the case if they had more flexibility in choosing the number of hours they work. For a discussion of how these adjustment costs, and other factors, may affect estimates of the responsiveness of labor supply to tax changes, see Raj Chetty, "Bounds on Elasticities with Optimization Frictions: A Synthesis of Micro and Macro Evidence on Labor Supply," *Econometrica*, vol. 80, no. 3, May 2012, pp. 969-1018.

[11] Research on the responsiveness of taxable income to changes in tax rates partly accounts for the possible distortions of tax on work effort and occupational choice, to the extent that taxable income is determined by work effort and occupational choice. For example, if individual income tax rates are lowered, and work effort increases without any change in hours worked, that may increase the amount of income a worker receives (*e.g.*, bonuses) but does not affect hours worked (*i.e.*, labor supply). For a discussion of the literature on responsiveness of taxable income to change in tax rates, as well as the limitations in this line of research, see Emmanuel Saez, Joel Slemrod,

taxes on the hours worked by those individuals who are already employed (the "intensive margin" or "hours margin"), and the effect of taxes on the decision to work or not (the "extensive margin" or "participation margin"). Responses on the intensive and extensive margin both affect the amount of labor supplied in the economy. Figure 6 of Part II depicts the rise, and relatively recent decline, in labor force participation rates among women between 1948 and 2014, and the general downward trend in labor force participation rates among men in the same period.

Empirical studies

The empirical literature relating tax and labor supply studies the labor supply decision for a variety of subgroups of the population, as well as labor supply in the economy as a whole.[12] Although labor supply estimates for even the same population subgroup may vary across studies, general qualitative conclusions have been developed for the responsiveness of certain population subgroups relative to others; these conclusions are described below.

Gender and marital status

The economics literature generally finds that the labor supply decisions of men and single women are less responsive to taxes than the labor supply decisions of married women.[13] Married women tend to be more responsive than men and single women on both the hours margin and participation margin. That is, higher taxes on wages are more likely to cause married women than men or single women to reduce their hours worked or exit the labor force entirely. In contrast, lower taxes on wages are more likely to cause married women, relative to men or single women, to increase hours work or participate in the labor force. Studies have also found that labor supply of prime-age males is particularly unresponsive to taxes.[14]

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and Seth H. Giertz, "The Elasticity of Taxable Income with Respect to Marginal Tax Rates: A Critical Review," *Journal of Economic Literature*, vol. 50, no. 1, pp. 3-50, March 2012.

[12] For reviews, see Robert McClelland and Shannon Mok, "A Review of Recent Research on Labor Supply Elasticities," Congressional Budget Office Working Paper 2012-12, October 2012; Michael P. Keane, "Labor Supply and Taxes," *Journal of Economic Literature*, vol. 49, no. 4, December 2011, pp. 961-1075; and Richard Blundell and Thomas MaCurdy, "Labor Supply: A Review of Alternative Approaches," in Orley Ashenfelter and David Card (eds.), *Handbook of Labor Economics*, vol. 3, North-Holland Publishing Co., 1999, pp. 1559-1695. The literature discussed in this document refers primarily to studies that rely on variation in labor supply at the micro-level (in contrast to variation in aggregate labor supply) in response to taxes to estimate the sensitivity of labor supply to taxes. For a discussion of comparison of the micro- and macro-based literatures, see Raj Chetty, Adam Guren, Dayanand Manoli, and Andrea Weber, "Does Indivisible Labor Explain the Difference between Micro and Macro Elasticities? A Meta-Analysis of Extensive Margin Elasticities," in Daron Acemoglu, Jonathan Parker, and Michael Woodford (eds.), *NBER Macroeconomics Annual*, vol. 27, no. 1, 2012, University of Chicago Press, pp 1-56.

[13] Robert McClelland and Shannon Mok, "A Review of Recent Research on Labor Supply Elasticities," Congressional Budget Office Working Paper 2012-12, October 2012.

[14] Emmanuel Saez, Joel Slemrod, and Seth H. Giertz, "The Elasticity of Taxable Income with Respect to Marginal Tax Rates: A Critical Review," *Journal of Economic Literature*, vol. 50, no. 1, pp. 3-50, March 2012. Prime-age males are defined as males ages 25 to 54.

Income level

Most empirical studies find that the labor supply decisions of low-income individuals are generally more responsive to taxes than the labor supply decisions of high-income individuals.[15] In particular, a number of papers studying the effect of the earned income tax credit find that it has a substantial effect on labor force participation among single mothers (the participation margin), although it has a negligible impact on the number of hours worked among those single mothers who were already employed (the hours margin).[16]

[15] Robert McClelland and Shannon Mok, "A Review of Recent Research on Labor Supply Elasticities," Congressional Budget Office Working Paper 2012-12, October 2012.

[16] Nada Eissa and Hilary W. Hoynes, "Behavioral Responses to Taxes: Lessons from the EITC and Labor Supply," in James M. Poterba (ed.), *Tax Policy and the Economy*, vol. 20, 2006, pp. 73-110.

C. Capital Investment

Capital investment and economic growth

When one breaks down economic output into the product of labor supply and average labor productivity, capital investment affects economic output by influencing average labor productivity. Capital investment takes on a variety of forms—such as equipment, buildings, factories, and transportation infrastructure—and is undertaken by both businesses and the government.[17] Although economists recognize the importance of the role of capital in determining the amount of output a country produces, it is difficult to disentangle the contribution of the quantity of capital from the quality of capital (*i.e.*, the technology embodied in capital) to economic growth. Nonetheless, the general consensus is that capital-output ratios—a measure of an economy's investment intensity—explain approximately 20 percent of cross-country differences in economic output.[18]

Tax policy and capital investment

A primary channel through which tax policy can promote investment is by lowering the user cost of capital, which is the opportunity cost that the firm (user) incurs as a consequence of owning a capital asset.[19] A firm will purchase an asset only if the value of the goods produced by the asset meets or exceeds the user cost of capital. If the marginal return exceeds the user cost of capital, a firm can increase its profits by undertaking the investment. If the marginal return is less than the user cost, the firm decreases profits by undertaking the investment. Firms invest up to the point where the marginal return to capital assets just equals the user cost of capital. Thus, the user cost of capital is the return that equates the discounted present value of the investment's expected cash flow with the investment's cost, *i.e.*, it is the real before-tax internal rate of return on a marginally profitable investment.[20] If a firm can choose between production technologies, for example between one that is labor-intensive and another that is capital-intensive, then a key variable for the firm to consider in its choice of production technology is the user cost of capital. If the user cost of capital is relatively high, the firm may choose a less capital-intensive technology and vice versa.

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[17] This document focuses on capital investment made by businesses. The government also makes capital investments, including in infrastructure. For a discussion of investment by the Federal government in infrastructure, and the role of tax policy, see Congressional Budget Office and Joint Committee on Taxation, *Subsidizing Infrastructure Investment with Tax-Preferred Bonds*, October 2009.

[18] For a discussion, see Francesco Caselli, "Accounting for Cross-Country Income Differences, Phillipe Aghion and Steven N. Durlauf (eds.), *Handbook of Economic Growth*, vol. 1A, 2005, pp. 680-741. The measure of capital used in constructing capital-output measures typically includes both public and private investment.

[19] Harvey Rosen, *Public Finance*, Richard D. Irwin, Inc., 1985, p. 436.

[20] James B. Mackie, III, "Unfinished Business of the 1986 Tax Reform Act: An Effective Tax Rate Analysis of Current Issues in the Taxation of Capital Income," *National Tax Journal*, vol. 55, June 2002, pp. 293-337.

The user cost of capital is a function of a number of tax and non-tax variables, including: the statutory corporate tax rates, the present value of tax depreciation deductions, the nominal corporate discount rate, inflation, the present value of economic depreciation, investment tax credits (if any), and the appreciation or revaluation in the asset.[21]

Higher financing costs, represented by the nominal corporate discount rate, increase the cost of capital. The user cost of capital is higher the faster an asset wears out with age (*i.e.*, the higher the rate of economic depreciation. Higher inflation-adjusted appreciation or revaluation in the asset reduces the user cost of capital. Higher investment tax credits and more generous tax depreciation deductions also reduce the cost of capital. A higher tax rate increases the user cost of capital as the firm must give a greater portion of its return to the government.

There are tradeoffs in tax policy that affect the user cost of capital. For example, if to achieve a revenue neutral tax change, the corporate tax rate were reduced at the same time that tax depreciation were made less generous, these two changes would have offsetting effects on the user cost of capital. The net impact could increase, decrease, or have no net effect on the user cost of capital. Economists on the staff of the Joint Committee on Taxation have studied the issue and have published a study simulating the macroeconomic effects of a number of hypothetical proposals that would reduce the top statutory corporate tax rate from 35 percent to 30 percent.[22] One of the proposals involved financing a revenue neutral reduction in the corporate tax rate with a partial repeal of the Modified Accelerated Cost Recovery System ("MACRS").[23] The study found that the proposal would lower the economy's long-run capital stock by between 0.2 and 0.4 percentage points. These simulation results suggest that slowing down cost recovery methods could reduce investment even if the corporate tax rate is reduced at the same time.

Effective marginal tax rates on investment

In general

One way to measure the potential inefficiency in the allocation of capital is to calculate the effective marginal tax rate on investment. The effective marginal tax rate is the rate that would offer the same incentives implied by various features of the tax code, if that rate were applied directly to economic income.[24] The effective marginal tax rate may be calculated from

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[21] For a more detailed discussion of the user cost of capital, see Joint Committee on Taxation, *Background and Present Law Relating to Manufacturing Activities Within the United States* (JCX-61-12), July 17, 2012.

[22] See Nicholas Bull, Timothy A. Dowd, and Pamela Moomau, "Corporate Tax Reform: A Macroeconomic Perspective," *National Tax Journal*, vol. 64, no. 4, December 2011, pp. 923-941.

[23] *Ibid.*

[24] While useful for measuring marginal incentive effects, effective marginal tax rates are not relevant for purposes of comparing tax burdens on investors in particular activities or industries. The calculation of effective marginal tax rates depends on a concept of long-run equilibrium in which all investors earn the same risk-adjusted after-tax rate of return; therefore, differences in effective marginal tax rates do not reflect differences in investor

the user cost of capital.[25] The effective marginal tax rate is the rate that would leave an after-tax real rate of return sufficient to cover the real financing costs of the investment and economic depreciation. Effective marginal tax rates are often used as a measure of investment incentives in lieu of the user cost of capital upon which they are based. Tax changes that increase the user cost of capital also increase the effective marginal tax rate. Similarly, tax changes that reduce the user cost of capital also reduce the effective marginal tax rate. Increases (decreases) in the effective marginal tax rate tend to decrease (increase) investment in the long run, and thus decrease (increase) the size of the aggregate capital stock.

Economic output, however, depends not only on the size of the capital stock but also on its composition. In the absence of taxes, the operation of a competitive economy causes capital to flow to sectors where it is expected to earn the highest rate of return. This results in an allocation of investment that produces the largest amount of national income. However, if effective marginal tax rates differ across sectors of the economy, more capital may accumulate in lightly taxed sectors, and less capital may be invested in highly taxed sectors. This may result in an inefficient allocation of capital to sectors in which it earns a lower pre-tax rate of return, reducing total productivity and potential output across all sectors. Thus, the effect of a reduction in the economy-wide effective marginal tax rate on investment could be partially offset if the disparity in effective marginal tax rates across sectors increases.

Table 1, below, reports recent estimates from the Congressional Budget Office ("CBO") of effective marginal tax rates on capital income.[26] The overall effective marginal tax rate on capital income is 18 percent. However, the rate varies significantly depending on the form of business organization, the source of financing, and the type of investment. This variation contributes to distortions in the allocation of capital, which may reduce economic output.

Distortions by organizational form

Table 1, below, shows that the effective marginal tax rate on all business investment is 29 percent, with a higher rate in the corporate sector (31 percent) than in the noncorporate sector (27 percent). This difference is due in part to the presence of a separate corporate income tax and in part to most noncorporate income being taxed at relatively lower marginal rates. However, this difference is partially offset by the relatively greater share of corporate income relative to noncorporate income that is received by tax-favored retirement accounts.

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returns. See James B. Mackie, III, "Unfinished Business of the 1986 Tax Reform Act: An Effective Tax Rate Analysis of Current Issues in the Taxation of Capital Income," *National Tax Journal*, vol. 55, June 2002, pp. 293-337.

[25] For a detailed description of the methodology and calculations involved, see Congressional Budget Office, *Computing Effective Tax Rates on Capital Income*, December 2006, available at http://www.cbo.gov/ftpdocs/76xx/doc7698/12-18-TaxRates.pdf.

[26] For a detailed description of the assumptions and calculations involved, see Congressional Budget Office, *Taxing Capital Income: Marginal Tax Rates Under 2014 Law and Selected Policy Options,* December 2014, available at http://www.cbo.gov/sites/default/files/cbofiles/attachments/49817-Taxing_Capital_Income_0.pdf.

Table 1.−Effective Marginal Tax Rates on Capital Income (2014)

Overall	18
Business	29
Corporate	31
Debt financed	-6
Equity financed	38
Noncorporate	27
Debt financed	8
Equity financed	30
Housing	
Tenant occupied	24
Owner occupied	-2
Debt financed	1
Equity financed	-3

Source: Congressional Budget Office.

Distortions by source of investment financing

The effective marginal tax rates shown in Table 1, above, are computed based on the mix of debt and equity financing observed in the corporate sector. To show the sensitivity of rates to the source of financing, effective marginal tax rates are recomputed assuming either all debt or all equity financing. The marginal tax rate on income from an all-debt-financed corporate investment is -6 percent versus 38 percent for an all-equity-financed corporate investment. The negative rate on income from an all-debt-financed corporate investment is attributable in part to deductions for both accelerated depreciation and interest expense which, in combination, exceed taxable income. This is partially offset by individual taxes on the interest income received; however, much of that interest income is generally taxed at individual marginal tax rates lower than the corporate marginal tax rate at which the interest paid is deductible, or is not taxed because it is received by tax-favored accounts (individual retirement accounts or tax-exempt holdings by pension funds and endowments).

The marginal tax rate on income from an all-equity-financed corporate investment (38 percent) is higher than the top statutory corporate tax rate (35 percent) due to individual income taxation of dividends and capital gains, mitigated by the share of such income received by tax-favored accounts. Without considering these individual-level taxes, the rate on equity-financed corporate investment is lower than the statutory rate due to accelerated depreciation.

Preference for investment in housing

Table 1, above, shows that investment for both tenant-occupied and owner-occupied housing is tax-favored relative to business investment as a whole, with effective marginal tax rates of 24 percent and -2 percent, respectively. Rental housing is taxed at a lower rate than other business investment because of relatively generous depreciation schedules and other tax preferences, and the large portion of rental housing investment that occurs outside of the corporate sector. The negative rate on owner-occupied housing reflects the deductibility of mortgage interest and real property taxes and the exclusion of implicit net rental income and certain capital gains from gross income.[27]

Distortions in investment across asset classes

Variation in effective marginal taxes rates on investment may lead to distortions in the pattern of investment in the economy by favoring investment in certain types of assets over others. Table 2, below, provides a list of effective marginal tax rates on capital income of C corporations for a subset of assets analyzed by CBO, as well as MACRS recovery periods where available. The wide range in effective marginal tax rates among those assets listed generally arises because of differences between tax depreciation—the tax rules specifying how the costs of certain assets are recovered over time—and economic depreciation, which reflects the actual rate at which income-producing property declines in value over time.[28]

Table 2, below, shows that the effective marginal tax rates on certain assets—such as pre-packaged software (39.7 percent), inventories (39.0 percent), and office and accounting equipment (39.0 percent)—can exceed the top statutory corporate tax rate.[29] Other relatively heavily taxed assets listed in the table include computers and peripheral equipment (38.6 percent), manufacturing buildings (36.4 percent), and commercial buildings (34.2 percent). Among those assets listed in the table, relatively lower rates apply to communications equipment

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[27] See discussion of tax incentives for owner-occupied housing in Joint Committee on Taxation, *Present Law, Data, and Analysis Relating to Tax Incentives for Homeownership* (JCX-50-11), September 30, 2011.

[28] For a more detailed discussion of economic depreciation, see Joint Committee on Taxation, *Background and Present Law Relating to Manufacturing Activities Within the United States* (JCX-61-12), July 17, 2012. In its analysis, CBO used economic depreciation rates estimated by the Bureau of Economic Analysis. See Department of Commerce, Bureau of Economic Analysis, *Fixed Assets and Consumer Durable Goods in the United States, 1925–97,* September 2003, Table B, p. M-30; Table C, pp. M-31–M-32; available at http://www.bea.gov/bea/dn/Fixed_Assets_1925_97.pdf. This methodology for measuring depreciation rates is different from depreciation represented by ADS.

[29] Research suggests that current tax depreciation schedule for computers measures their actual loss in value in a zero-inflation environment. However, because the tax code is not indexed for inflation, the present value of depreciation allowances may be too small for positive inflation rates. Mark E. Doms, *et al.,* "How Fast Do Personal Computers Depreciate? Concepts and New Estimates," in James M. Poterba (ed.), *Tax Policy and the Economy*, vol. 18, MIT Press, 2004, pp. 37-80.

(23.2 percent), communication structures (21.5 percent), petroleum and natural gas structures (18.7 percent), and mining structures (14.7 percent).

Table 2.−Effective Marginal Tax Rates on Capital Income of C Corporations by Asset Type and MACRS Recovery Periods (2014)

Asset Type	Effective Marginal Tax Rate	MACRS Recovery Periods*
Pre-Packaged Software	39.7	3
Inventories	39.0	nondepreciable
Office and Accounting Equipment	39.0	5 or 7
Computers and Peripheral Equipment	38.6	5
Manufacturing Buildings	36.4	39
Commercial Buildings	34.2	39
Land	34.0	nondepreciable
Office Buildings (Including Medical)	33.8	39
Educational Buildings	32.3	39
Medical Equipment and Instruments	30.6	
Construction Machinery	30.3	5
Electric Transmission and Distribution	28.1	20
Automobiles	27.9	5
Residential Buildings	27.9	27.5
Agricultural Machinery	25.9	7
Farm Buildings	25.2	10 or 20
General Industrial Equipment	24.5	7
Special Industrial Machinery	23.5	
Communications Equipment	23.2	5, 7, or 10
Communication Structures	21.5	5 or 7
Petroleum and Natural Gas Structures	18.7	
Mining Structures	14.7	7

* MACRS recovery periods may not be available for certain asset categories because, among other reasons, the asset categories include a range of assets with varying recovery periods based on either the specific asset type or the business activity in which the asset is used.
Source: Congressional Budget Office.

Evidence on the effect of tax policy on investment

The impact of the tax system on investment depends on how sensitive investment is to changes in the user cost of capital. If investment is relatively responsive to the user cost of capital, then policymakers can influence the level of investment by enacting changes in the corporate tax rate, depreciation allowances, investment tax credits, and/or taxation of returns to investment at the individual level.[30]

On balance, the economic literature on tax policy and investment supports the conclusion that changes in taxes have a noticeable impact on investment. One survey of the literature, for example, concludes that investment is highly responsive to changes in the cost of capital.[31] One study looking at the impact of the various tax reforms occurring between 1962 and 1988 finds that tax policy had a strong influence on the level of equipment investment.[32] Another study looks at the impact of changes in taxes on capital spending, instead of only investment in equipment, and finds substantially smaller (although still noticeable) effects, suggesting that equipment investment is more sensitive to changes in taxes than investment in other assets, such as structures.[33] The authors also provide evidence that that tax policy has a stronger influence on the investment behavior of financially constrained firms, which suggests that firms with less access to capital markets are particularly sensitive to changes in tax incentives for investment. This conclusion is consistent with the results of a recent paper relying on more comprehensive data drawn from administrative tax records.[34] The general hypothesis that financially constrained firms respond more to tax incentives for investment than less financially constrained firms, however, is still the subject of some debate.[35] Another paper studied the relationship

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[30] The discussion in this document does not discuss estimates of the user cost of capital derived from changes in the taxation of capital income earned by individuals. For an example of this analysis, see Danny Yagan, "Capital Tax Reform and the Real Economy: The Effects of the 2003 Dividend Tax Cut," working paper, February 2013, available at http://eml.berkeley.edu/~yagan/DividendTax.pdf.

[31] Kevin A. Hassett and R. Glenn Hubbard, "Tax Policy and Business Investment," *Handbook of Public Economics*, Volume 3, (eds. Alan J. Auerbach and Martin Feldstein), North-Holland Publishing Co., 2002, pp. 1293-1343.

[32] Jason G. Cummins, Kevin A. Hassett, and R. Glenn Hubbard, "A Reconsideration of Investment Behavior Using Tax Reforms as a Natural Experiment," *Brookings Papers on Economic Activity*, vol. 2, 1994, pp. 1-74.

[33] Robert S. Chirinko, Steven M. Fazzari, and Andrew P. Meyer, "How Responsive Is Business Capital Formation to Its User Cost? An Exploration with Micro Data," *Journal of Public Economics*, vol. 74, no. 1, 1999, pp. 53-80.

[34] Eric Zwick and James Mahon, "Do Financial Frictions Amplify Fiscal Policy? Evidence from Business Investment Stimulus," working paper, June 2014, available at http://ericzwick.com/stimulus/stimulus.pdf. The paper provides estimates of the responsiveness of investment to changes in the user cost of capital that are significantly greater than many previous studies.

[35] See, for example, Steven Kaplan and Luigi Zingales, "Do Financing Constraints Explain Why Investment Is Correlated with Cash Flow?" *Quarterly Journal of Economics*, vol. 112, no. 1, 1997, pp. 169-215.

between taxes and investment in 14 OECD countries, including France, Germany, Japan, the United Kingdom, and the United States.[36] The authors find that tax changes had a strong effect on equipment investment, although the evidence is less conclusive for investment in structures.

While economic research suggests that tax policy, in a broad sense, can have an impact on investment, conclusions concerning the impact of changes in cost recovery methods in particular are more nuanced. For example, the impact of bonus depreciation on investment depends on the recovery period for a particular type of property. One paper finds that the bonus depreciation provisions enacted in 2002 and 2003 had a positive impact on capital investment, although the increase was concentrated in long-lived business equipment.[37] Along similar lines, other research finds that utilization rates for the bonus depreciation measures were higher for industries, such as telecommunications, where the long-lived investments by a small number of firms accounts for the bulk of investment.[38] Another paper, which focuses more on investments in assets with shorter recovery periods, finds that bonus depreciation had no effect on investment.[39] A study of the bonus depreciation provisions of 2002 and 2003, as well as legislation enacted in 2003 that increased the maximum section 179 deduction from $25,000 to $100,000, finds that the fraction of small businesses claiming 179 expensing changed little between 2001 or 2002, and 2003, when the limitation on deductions was raised.[40] Among small businesses, 39 percent of individuals and 54 percent of corporations claimed bonus depreciation in 2002, compared to 33 percent of individuals and 49 percent of corporations in 2003, when bonus depreciation was made more generous.[41] These results could have arisen for a number of reasons. For example, the benefit of bonus depreciation is generally smaller, in present value terms, for investments in property with shorter recovery periods than longer recovery periods. In addition, bonus depreciation and expensing provisions have little value for firms in significant net operating loss ("NOL") positions, since they do not receive any current cash tax savings

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[36] Stephen Bond and Jing Xing, "Corporate Taxation and Capital Accumulation: Evidence from Sectoral Panel Data for 14 OECD Countries," Oxford University Centre for Business Taxation working paper, August 2014, available at http://www.sbs.ox.ac.uk/sites/default/files/Business_Taxation/Docs/Publications/Working_Papers/Series_10/WP1015_2014.pdf.

[37] Christopher House and Matthew Shapiro, "Temporary Investment Tax Incentives: Theory with Evidence from Bonus Depreciation," *American Economic Review*, vol. 98, June 2008, pp. 737-768.

[38] Matthew Knittel, "Corporate Response to Accelerated Tax Depreciation: Bonus Depreciation for Tax Years 2002-2004," Office of Tax Analysis Working Paper 98, May 2007.

[39] Darrel Cohen and Jason Cummins, "A Retrospective Evaluation of the Effects of Temporary Partial Expensing," *Board of Governors of the Federal Reserve System Finance and Economics Discussion Series*: 2006-19.

[40] Matthew Knittel, "Small Business Utilization of Accelerated Tax Depreciation: Section 179 Expensing and Bonus Depreciation," *National Tax Journal Proceedings-2005, 98th Annual Conference*, 2005, pp. 273-286.

[41] *Ibid*., p. 284.

under the provisions if they do not have a tax liability in the current year or an ability to carry back the additional loss generated through bonus depreciation or expensing.[42]

[42] These companies often choose to forego bonus depreciation to avoid increasing NOL carryforwards. NOLs are only allowed to be carried forward 20 years, so by deferring the depreciation deductions otherwise eligible under the bonus regime, taxpayers effectively extend the 20-year window.

D. Technological Progress

Technological progress and economic growth

One of the central findings in the literature on growth is that technological progress is the main driver of long-run economic growth.[43] While increases in labor supply and the capital stock may increase the level of economic output, technological progress—which, among other things, improves how labor and capital can be combined to produce goods and services—is the most important determinant of long-run growth rates in economic output.

The knowledge generated from research activities forms the foundation on which technological progress is built.[44] One important economic feature of this knowledge, and knowledge in general, is that it is "nonrival" in consumption: one firm's consumption of knowledge does not preclude another firm from consuming it. An implication of this feature is that the results of research conducted by one firm may, absent market restrictions, benefit other firms, which may profit from the commercialization of those results. In other words, costly scientific and technological advances made by one firm may be cheaply copied by its competitors. Since an individual firm may not capture the full "spillover" benefits of its research activities, a market failure may exist because the social benefits of research conducted by the firm can exceed its private benefits. Economists have generally found that the social return to research can be substantially greater than its private return.[45] Therefore, firms may underinvest in research relative to what is socially optimal.[46]

Some institutions—such as a patent system—address the market failure by giving a firm the exclusive right to commercialize the results of its research for a fixed period of time. The firm therefore has a temporary monopoly on the commercial application of its research results and can capture at least some of the spillover benefits of its research. Under such a system, a

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[43] See Francesco Caselli, "Accounting for Cross-Country Income Differences," in Phillipe Aghion and Steven N. Durlauf (eds.), *Handbook of Economic Growth*, vol. 1A, North-Holland Publishing Co., 2005, pp. 679-741; and Charles I. Jones, "Growth and Ideas," in Philippe Aghion and Steven N. Durlauf (eds.), *Handbook of Economic Growth*, vol. 1B, North-Holland Publishing Co., 2005, pp. 1063-1111.

[44] Research findings typically need to be translated into some form of commercial application before they can contribute to the production of economic output. In other words, knowledge, by itself, is typically insufficient to improve how goods and services are produced.

[45] For a survey of these studies, see Bronwyn H. Hall, Jacques Mairesse, and Pierre Mohnen, "Measuring the Returns to R&D," in Bronwyn H. Hall and Nathan Rosenberg (eds.), *Handbook of the Economics of Innovation*, vol. 1, North-Holland Publishing Co., 2010, pp. 1033-1081.

[46] Economists have also identified channels through which firms may overinvest in research. For example, multiple firms may pursue parallel lines of research with the goal of being the first to create and patent a new good. In this case, research expenditures may be duplicative. However, some studies find that, even when accounting for some of the channels through which firms may overinvest in research, optimal investment in research is significantly greater than actual investment. See Charles I. Jones and John C. Williams, "Measuring the Social Returns to R&D," *Quarterly Journal of Economics*, vol. 113, no. 4, Nov. 1998, pp. 1119-1135.

firm generally invests in more research than it would in the absence of a patent system. In addition to granting patent protection, governments have also addressed this market failure through direct spending, research grants, and favorable anti-trust rules.

Tax policy and innovation

If it is believed that too little research is being undertaken, a tax subsidy is one method of offsetting the private-market bias against research, so that research projects undertaken approach the optimal level. The effect of tax policy on research activity is largely uncertain because there is relatively little consensus regarding the magnitude of the responsiveness of research to changes in taxes and other factors affecting its price.

The United States provides two types of tax benefits to taxpayers who undertake research activities: tax credits for research activity and current expensing of research-related expenditures.[47] These two types of benefits each carry different incentives with potentially different effects on research activity. For example, the research credit is incremental and only benefits research expenditures above a base level. The incentive effects of incremental credits per dollar of revenue loss may be larger than the incentive effects in expensing policies which are not incremental. To the extent that research activities are responsive to the price of research activities, the research and experimentation tax credit should increase research activities beyond what they otherwise would be. However, the present law research credit contains certain complexities and compliance costs that could affect this result. Therefore, after accounting for potentially lower administrative and compliance costs, expensing of research costs may be preferable to incremental credits.

The responsiveness of research expenditures to research tax credits

As with any other commodity, economists expect the amount of research expenditures a firm incurs to respond positively to a reduction in the price paid by the firm. Economists often refer to this responsiveness in terms of price elasticity, which is measured as the ratio of the percentage change in quantity to a percentage change in price. For example, if demand for a product increases by five percent as a result of a 10-percent decline in price paid by the purchaser, that commodity is said to have a price elasticity of demand of -0.5.[48] One way of

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[47] For more detail on federal tax benefits for research activities, see Joint Committee on Taxation, *Background and Present Law Relating to Manufacturing Activities Within the United States* (JCX-61-12), July 17, 2012. In the case of expensing, amounts are expended to create an asset with a future benefit. In most other instances this would result in the capitalization and recovery through amortization of such costs. The inherent issue with expenses incurred in research and development is whether or not an asset of any value is being (or will be) created. At the time the amounts are expended, such a determination is often impossible. Further, research and development costs usually are incurred with the goal of creating a new or improved product, service, process or technique, but more often than not, the efforts do not result in success. As such, U.S. Generally Accepted Accounting Principles ("GAAP") does not require the capitalization and amortization of research and development costs.

[48] For simplicity, this analysis assumes that the product in question can be supplied at the same cost despite any increase in demand (*i.e.*, the supply is perfectly elastic). This assumption may not be valid, particularly over

reducing the price paid by a buyer for a commodity is to grant a tax credit upon purchase. A tax credit of 10 percent (if it is refundable or immediately usable by the taxpayer against current tax liability) is equivalent to a 10-percent price reduction. If the commodity granted a 10-percent tax credit has an elasticity of -0.5, the amount consumed will increase by five percent. Thus, if a flat research tax credit were provided at a 10-percent rate, and research expenditures had a price elasticity of -0.5, the credit would increase aggregate research spending by five percent.[49]

While most, if not all, published studies report that the research credit induces increases in research spending, some initial empirical analyses of the elasticity of research spending to changes in the cost of research activities generally indicates that the price elasticity for research is less than one.[50] However, a subsequent review of empirical studies of the research credit suggests that an additional dollar of the research credit generates an additional dollar of investment in research.[51]

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short periods of time, and particularly when the commodity−such as research scientists and engineers−is in short supply.

[49] It is important to note that not all research expenditures need be subject to a price reduction to have this effect. Only the expenditures that would not have been undertaken otherwise−so called marginal research expenditures−need be subject to the credit to have a positive incentive effect.

[50] One author has suggested that the variability in estimates of the price elasticity of research highlights the dependence of the estimates on the choice of dataset and the precise estimating methodology. For example, the results yield a range of estimates for the effect of tax incentives on research expenditures, with a larger elasticity in data sets drawn from tax returns than in those drawn from publicly available data. See Nirupama Rao, "Do Tax Credits Stimulate R&D Spending? The R&D Credit in Its First Decade," March 8, 2014, available at http://wagner.nyu.edu/files/faculty/publications/RD032014.pdf.

[51] Bronwyn Hall and John Van Reenen, "How Effective Are Fiscal Incentives for R&D? A Review of the Evidence," *Research Policy*, vol. 29, May 2000, p. 449-469. This survey reports that more recent empirical analyses have estimated higher elasticity estimates. One recent empirical analysis of the research credit has estimated a short-run price elasticity of 0.8 and a long-run price elasticity of 2.0. The author of this study notes that the long-run estimate should be viewed with caution for several technical reasons. In addition, the data utilized for the study cover the period 1980 through 1991, containing only two years under the revised credit structure. This makes it empirically difficult to distinguish short-run and long-run effects, particularly as it may take firms some time to appreciate fully the incentive structure of the revised credit. See Bronwyn H. Hall, "R&D Tax Policy During the 1980s: Success or Failure?" in James M. Poterba (ed.), *Tax Policy and the Economy*, vol. 7, MIT Press, 1993, pp. 1-35. Another recent study examined the post-1986 growth of research expenditures by 40 U.S.-based multinationals and found price elasticities between 1.2 and 1.8. However, the estimated elasticities fell by half after including an additional 76 firms that had initially been excluded because they had been involved in merger activity. See James R. Hines, Jr., "On the Sensitivity of R&D to Delicate Tax Changes: The Behavior of U.S. Multinationals in the 1980s" in Alberto Giovannini, R. Glenn Hubbard, and Joel Slemrod (eds.), *Studies in International Taxation*, University of Chicago Press 1993. Also see M. Ishaq Nadiri and Theofanis P. Mamuneas, "R&D Tax Incentives and Manufacturing-Sector R&D Expenditures," in James M. Poterba, (ed.), *Borderline Case: International Tax Policy, Corporate Research and Development, and Investment*, National Academy Press, 1997. While their study concludes that one dollar of research tax credit produces 95 cents of research, they note that time series empirical work suffers from poor measures of the price deflators used to convert nominal research expenditures to real expenditures.

However, this survey notes that most of this evidence is not drawn directly from tax data. For example, effective marginal tax credit rates are inferred from publicly reported financial data and may not reflect limitations imposed by operating losses or the AMT. The study notes that because most studies rely on "reported research expenditures," a "relabeling problem" may exist whereby preferential tax treatment for an activity gives firms an incentive to reclassify expenditures as qualifying expenditures. If this occurs, reported expenditures increase in response to the tax incentive by more than the underlying real economic activity. Thus, reported estimates may overestimate the true response of research spending to the tax credit.[52]

A more recent analysis of changes to the research credit enacted in the Omnibus Budget Reconciliation Act of 1989 ("OBRA89")[53] finds a larger elasticity for research expenditures.[54] These changes redefined the base amount used to calculate qualified incremental research expenditures that determine the amount of the credit. Fewer firms overall were eligible for the credit as a result of these changes, but a greater percentage of eligible firms had sufficient positive tax liability to utilize the credit. This study finds that the research credit "induced approximately $2.08 of additional research and development spending per revenue dollar foregone by the U.S. Treasury in the post-OBRA89 period."[55]

Studies on the effectiveness of the research credit generally look at its impact on research expenditures, and not on the effect of those research expenditures on growth. Those studies that do attempt to quantify the effect of research expenditures on growth are subject to a significant amount of uncertainty.[56] For example, it is difficult to find objective measures of productivity, and of the stock of knowledge created by research expenditures, that can be used for empirical analysis.[57] It is also difficult to establish links between research expenditures within certain firms, or within industries, or even within specific countries, because other firms or industries

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Other research suggests that many of the elasticity studies may overstate the efficiency of subsidies to research. Most R&D spending is for wages and the supply of qualified scientists is small, particularly in the short run. Subsidies may raise the wages of scientists, and hence research spending, without increasing actual research. See Austan Goolsbee, "Does Government R&D Policy Mainly Benefit Scientists and Engineers?," *American Economic Review*, vol. 88, May 1998, pp. 298-302.

[52] Bronwyn Hall and John Van Reenen, "How Effective Are Fiscal Incentives for R&D? A Review of the Evidence," *Research Policy*, vol. 29, May 2000, p. 463.

[53] Pub. L. No. 101-239.

[54] Sanjay Gupta, Yuhchang Hwang, and Andrew P. Schmidt, "Structural Changes in the Research and Experimentation Credit: Success or Failure?," *National Tax Journal*, vol. 64, June 2011, pp. 285-322.

[55] *Ibid*, p. 316.

[56] For a discussion of the sources of this uncertainty, see Bronwyn H. Hall, Jacques Mairesse, and Pierre Mohnen, "Measuring the Returns to R&D," in Bronwyn H. Hall and Nathan Rosenberg (eds.), *Handbook of the Economics of Innovation*, vol. 1, North-Holland Publishing Co., 2010, pp. 1033-1081.

[57] *Ibid.*

may also benefit from technological development produced by those expenditures.[58] Moreover, it is difficult to separate out the effects of research expenditures from other possible influences on productivity.[59]

"Patent boxes"

Outside the United States, a number of countries have enacted "patent box" regimes under which income attributable to intellectual property is taxed at a lower, preferential rate. Policymakers have adopted patent boxes to (1) increase domestic investment in research and development and (2) encourage companies to locate intellectual property in their countries, among other goals.[60]

Patent boxes may promote domestic investment in research and development by lowering the tax burden on the returns to intellectual property, thereby increasing the after-tax returns to research and development activities. However, some of the patent box regimes adopted by countries do not require that the intellectual property benefiting from the patent box be the product of research and development undertaken in that country. As a result, the benefits of the patent box in these cases are not targeted to domestic investment in research and development, which limits the effectiveness of the patent box at promoting this type of investment.

Policymakers have also pursued patent boxes under the premise that the location where intellectual property is held also influences where companies make investments related to the intellectual property. For example, it may be the case that scientists who are making further developments to a piece of intellectual property are best located where the intellectual property is being held. Although there are a number of studies showing that innovation is spatially concentrated—research and development activities can cluster in particular geographic areas—there are few studies that examine whether investments related to a particular piece of intellectual property are also concentrated where its rights are being held.[61]

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[58] *Ibid.*

[59] *Ibid.*

[60] For details on the patent boxes adopted by other countries, see Joint Committee on Taxation, *Present Law and Background Related to Proposals to Reform the Taxation of Income of Multinational Enterprises* (JCX-90-14), July 21, 2014.

[61] Maryann P. Feldman and Dieter F. Kogler, "Stylized Facts in the Geography of Innovation," in Bronwyn H. Hall and Nathan Rosenberg (eds.), *Handbook of the Economics of Innovation*, vol. 1, North-Holland Publishing Co., 2010, pp. 381-410.

E. Human Capital

Education, skill acquisition, and growth

Human capital, i.e., intangible capital represented by the level of knowledge, skills, and health[62] of the labor force, has long been recognized as an important factor in economic growth as well as a strong determinant of the earnings of individuals. One review of the economics literature indicates an additional year of schooling is associated with an increase in individual earnings on the order of 10 percent.[63] Education does not only include formal education, but includes skills acquisition through on-the-job training.

Education can impact growth in a number of ways. At the most basic level, education increases the human capital of the individual, raising his or her labor productivity, thereby increasing the aggregate level of output in an economy for a given amount of labor input. Many studies of cross-country growth comparisons find a positive association between economic growth and measures of schooling obtained.[64] In addition to increasing the level of output of an economy, it is also thought that education can influence the rate of growth of an economy by spurring technological change and process innovations.[65]

It is also thought that education influences growth by facilitating the transmission of the knowledge to understand and implement new technologies. One study in this regard posits that human capital externalities could explain the long-run income differences between rich and poor countries.[66] The sharing of knowledge and skills across workers is thought to be the mechanism for these spillover externalities. Another recent study of manufacturing plants found that these plants were significantly more productive in cities with higher human capital, holding constant the level of human capital employed at the individual plant.[67] Most of this effect was found in high-tech manufacturing plants, and little in non-high tech producers. The study estimated that human capital spillovers were accounted for an average of one-tenth of a percent increase in

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[62] While health is considered an aspect of human capital, this document does not focus on the impacts of health on economic growth.

[63] Alan Krueger and Mikael Lindahl, "Education for Growth: Why and For Whom?," *Journal of Economic Literature*, vol. 39, no. 4, December, 2001, p. 1101.

[64] For a review of this literature, see B. Sianesi and J. Van Reenen, "The Returns to Education: Macroeconomics" *Journal of Economic Surveys*, Volume 17(2), 2003, pp 157-200.

[65] R. R. Nelson and E. Phelps, "Investment in Humans, Technology Diffusion and Economic growth," *American Economic Review*, Vol. 56 (2), 1966.

[66] See R. E. Lucas, "On the Mechanics of Economic Development," *Journal of Monetary Economics,* 1998, Vol. 22; and P. Aghion and P. Howitt, *Endogenous Growth Theory*, (Cambridge, MA. The MIT Press), 1998.

[67] Enrico Moretti, "Workers' Education, Spillovers and Productivity: Evidence from Plant-Level Production Functions," *American Economic Review*, vol. 94, no. 3, 2004, pp. 656-690.

output per year in the 1980s. Other studies have documented that, holding individual human capital constant, wages are higher in cities with higher human capital. One such study finds that a one percentage point increase in the share of college graduates in the labor force increases the wages of high school dropouts, high school graduates, and college graduates by 1.9 percent, 1.6 percent, and 0.4 percent, respectively.[68]

Recent work recognizes that time in school does not produce the same level of cognitive skills everywhere, and that the quality of schooling (as measured by, for example, performance on achievement tests) is important in determining the true impact of education on growth. These studies tend to find that the level of cognitive skills, rather than years of schooling per se, has the stronger association with economic growth.[69]

Many factors beside education also play a role in economic growth, such as the institutional environment of a country.[70] The general health of the population may influence economic growth as well. However, it has been suggested that education itself may foster these institutional factors that impact growth.[71] Research shows that education likely confers benefits for the larger community in addition to its impacts on productivity growth, including lower

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[68] Enrico Moretti, "Estimating the Social Return to Higher Education: Evidence from Longitudinal and Repeated Cross-Sectional Data," *Journal of Econometrics*, vol. 121, no. 1-2, July-August 2004, pp. 175–212

[69] See, for example, R.J. Barro, "Human Capital and Growth" *American Economic Review* Vol. 91 (2), 2001; Eric A. Hanushek, and L. Woessmann, "The Role of Cognitive Skills in Economic Development," *Journal of Economic Literature,* vol. 46, no. 3, 2008; Eliot A. Jamison, Dean T. Jamison, and Eric A. Hanushek, "The Effects of Education Quality on Income Growth and Mortality Decline," *Economics of Education Review*, vol. 26, no. 6, December 2007; S. Coulombe, and J.F. Tremblay, "Literacy and Growth," *The B.E. Journal of Macroeconomics*, vol. 6, no. 2, 2006.

[70] D. Acemoglu, S. Johnson, and J. A. Robinson, "Institutions as a Fundamental Cause of Long-Run Growth," in P. Aghion and S. N. Durlauf (eds.), *Handbook of Economic Growth*, 2005 pp 385-472.

[71] For a discussion of the relationship between education, institutional factors, and economic growth, see Edward L. Glaeser, Rafael La Porta, Florencio Lopez-de-Silanes, and Andrei Shleifer, "Do Institutions Cause Growth?," *Journal of Economic Growth*, Volume 9, no. 3, September 2004.

crime;[72] a more informed, civic-minded electorate;[73] increased social mobility;[74] and better community health.[75]

Taxes and education

The private benefits of investments in education include the higher wages and better health that accrue to the individual with higher educational attainment.[76] However, as discussed above, education has many benefits that accrue to society at large in addition to those that accrue directly to the individual. Because an individual chooses to invest in education based on the private benefits he expects to accrue, in the absence of government intervention he may choose a level of investment that is lower than socially optimal. In addition, investments in education differ from other types of investments in that they are neither collateralizable (students are often unable to offer potential lenders collateral for a loan) nor diversifiable (a given student can only invest in his own education). Because such investments in education are neither collateralizable nor diversifiable,, levels of investment in education are expected to be lower than optimal for economic growth.[77] Governmental subsidies for education may correct this underinvestment in the private market by increasing investment to levels that are consistent with the existence of both private and public benefits of education.

The role of the Federal government in education finance

While the majority of governmental support for education occurs on the expenditure side of the budget, and most of this occurs at the State and local level, the Federal government also supports all levels of education through the provision of a variety of tax preferences. The Federal government subsidizes the cost of elementary, secondary, and post-secondary education

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[72] Lance Lochner and Enrico Moretti, "The Effect of Education on Crime: Evidence from Prison Inmates, Arrests, and Self-Reports," *The American Economic Review*, vol. 94, no.1, 2004 pp. 155-189.

[73] Kevin Milligan, Enrico Moretti, and Philip Oreopoulos, "Does Education Improve Citizenship," *Journal of Public Economics*, vol. 88, no. 9-10, 2004, pp. 1667-1695; Thomas Dee, "Are There Civic Returns to Education?" *Journal of Public Economics*, vol. 88, no. 9, 2004, pp. 1697-1720.

[74] Daniel Aronson and Bhash Mazumder, "Intergenerational Economic Mobility in the U.S.: 1940 to 2000," *Journal of Human Resources,* vol. 43, no. 1, 2008 pp. 139-172.

[75] Michael Grossman, "Education and Non-Market Outcomes," in *Handbook of Health Economics*, vol. 1A, 2006, pp. 577-633.

[76] David Card, "The Causal Effect of Education on Earnings," in *Handbook of Labor Economics*, vol. 3, 1999, pp. 1801-1863; David Cutler and Lleras Muney, "Education and Health: Evaluating Theories and Evidence," in Robert F. Schoeni *Making American Healthier: Social and Economic Policy as Health Policy*; Chinhui Juhn, Kevin M. Murphy, and Brooks Pierce, "Wage Inequality and the Rise in Returns to Skill," *Journal of Political Economy*, vol. 101, no. 3, 1993, pp. 410-442.

[77] Caroline M. Hoxby, "Tax Incentives for Higher Education," in James M. Poterba (ed.), *Tax Policy and the Economy*, vol. 12, 1998, pp. 49-82.

through tax policies such as the preferential tax treatment of charitable contributions and the exclusion of interest on State and local government bonds. In 2015, these two Federal tax expenditures for education are estimated to be $6.2 and $2.6 billion respectively.[78] For post-secondary students, the Federal government provides subsidies for education in three ways: through tax benefits to individuals to be used for tuition, fees, and other educational expenses; through preferred tax treatment of student loans; and through tax subsidies for education savings plans. The largest of these programs are the tax credits for higher education in the form of the Lifetime Learning Credit and the Hope Scholarship Credit. These credits account for a Federal tax expenditure of an estimated $24.3 billion in 2015. The deduction of interest on student loans accounts for an estimated Federal tax expenditure of $1.8 billion in 2015. Coverdell education savings accounts and qualified tuition programs account for an estimated 2015 tax expenditure of approximately $1.1 billion. [79]

Existing studies exploring the effect of Federal tax credits on post-secondary enrollment rates are few and somewhat mixed. One such study demonstrates no effect of tax credits on enrollment decisions of students who would not attend college in the absence of tax-based aid,[80] and another study suggests a small positive effect on these students.[81] Several studies which examine the effect of other types of aid on enrollment may provide some insight into the expected effect of tax-based aid. These other studies generally find that significant increases in funding, such as with the Georgia HOPE scholarship program,[82] Social Security student benefits,[83] and State and institutional grants,[84] lead to increases in enrollment.

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[78] Joint Committee on Taxation, *Estimates of Federal Tax Expenditures for Fiscal Years 2014-2018* (JCX-97-14), August 5, 2014.

[79] *Ibid*.

[80] Bridget Long. "The Impact of Federal Tax Credits for Higher Education," In Hoxby, Caroline M. (ed.), *College Choices: The Economics of Which College, When College, and How to Pay For It,* 101-168. University of Chicago Press, Chicago, IL (2004).

[81] Nicholas Turner, "The Effect of Tax-Based Federal Student Aid on College Enrollment," *National Tax Journal*, Col. 64, No. 3, 2011, pp. 839-362.

[82] Christopher Cornwell, David Mustard, and Deepa Sridhar, "The Enrollment Effect of Merit Based Financial Aid: Evidence from Georgia's HOPE Program," *Journal of Labor Economics*, Vol. 24, No. 4, 2006, pp. 761-786.

[83] Susan M. Dynarski, "Does Aid Matter? Measuring the Effect of Student Aid on College Attendance and Completion," *American Economic Review*, Vol. 93, No. 1, 2003, pp. 279-288.

[84] Thomas J. Kane, "A Quasi-Experimental Estimate of the Impact of Financial Aid on College-Going," *NBER Working Paper No. 9703*, 2003. National Bureau of Economic Research, Cambridge, MA; Van der Klaauw, Wilbert, "Estimating the Effect of Financial Aid Offers on College Enrollment: A Regression-Discontinuity Approach," *International Economic Review*, Vol. 43, No. 4, 2002, pp. 1249-1287.

II. BACKGROUND DATA

Growth in economic output can generally be thought of as having two components. There can be more labor and/or labor can be more productive. Labor productivity may be further decomposed into the contribution of capital deepening, labor composition, and multifactor productivity.[85]

Labor productivity is defined as output (the real value of goods and services sold to final consumers) per hour worked by all persons. Multifactor productivity measures the value-added ouptut per combined unit of labor and capital inputs. Combined inputs per hour represent capital services per hour and labor inputs per hour (where labor input accounts for the age, education, and gender composition of the workforce). The contribution of capital deepening to labor productivity is related to the capital services per hour worked, weighted by the share of capital income in total capital and labor costs. It reflects both the quality and quantity of capital. The contribution of labor composition to labor productivity measures the effect of shifts in the age, education, and gender composition of the workforce, weighted by the share of labor compensation in total capital and labor costs.[86]

Figure 1, below, presents the growth of the U.S. private nonfarm business sector and allocates this growth between increases in labor and increases in average labor productivity. It further shows the source of changes in average labor productivity. The top black line shows average annual growth rates in nonfarm real value output. These rates are the sum of the growth rate in labor and growth rate in average labor productivity. For the period from 1948 through 2013, shown in the first column, private nonfarm business sector output grew at an average annual rate of 3.4 percent, comprised of 1.1 percent growth in hours worked and 2.3 percent growth in average labor productivity. Multifactor productivity growth is responsible for about half of the change in labor productivity, contributing as much to overall economic growth as average annual increases in hours worked. Capital deepening contributed about 0.9 percentage points to labor productivity and economic growth, while changes in the composition of the labor force were responsible for the remaining approximately quarter-percentage point of growth.

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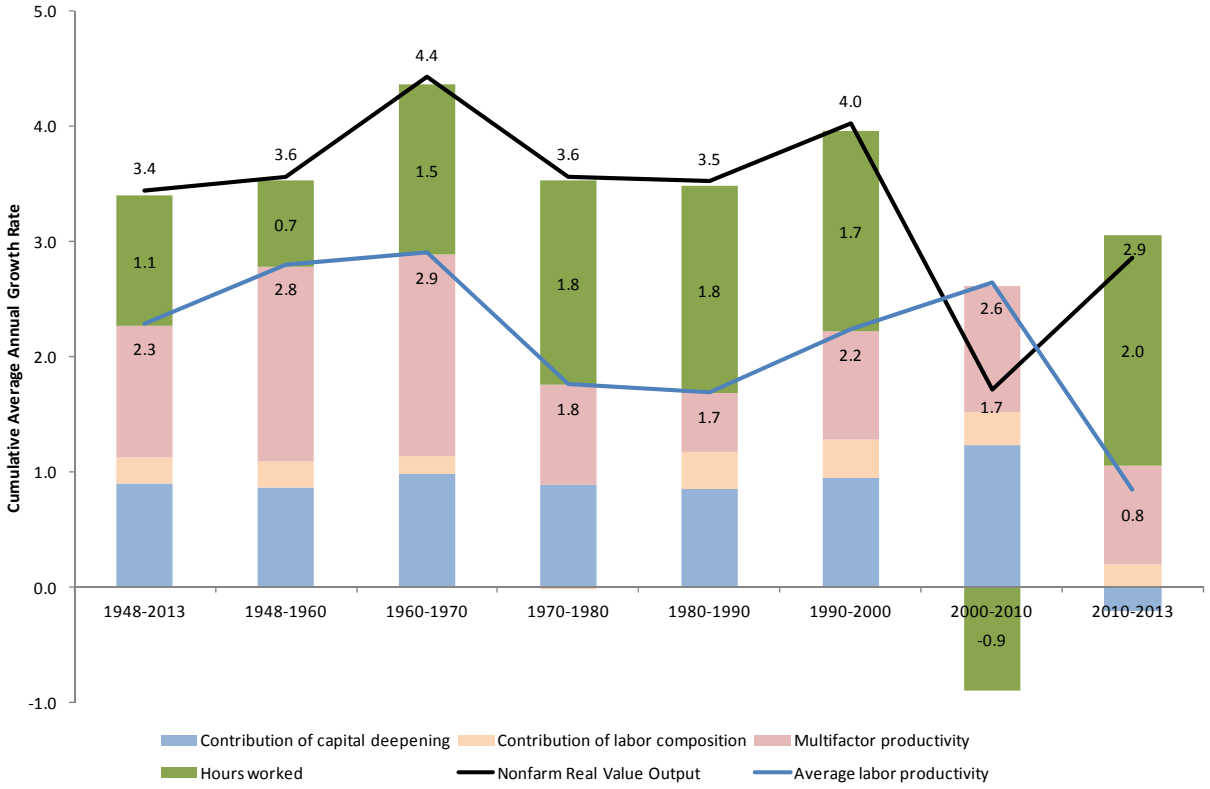
[85] Other decompositions of growth are possible. For a discussion, see Charles R. Hulten, "Growth Accounting," in Bronwyn H. Hall and Nathan Rosenberg (eds.), *Handbook of the Economics of Innovation*, vol. 1, North-Holland Publishing Co., 2010, pp. 987-1031.

[86] For a detailed description of the methods and data underlying these measures, see Bureau of Labor Statistics, "Technical Information about the BLS Multifactor Productivity Measures," September 26, 2007, available at http://www.bls.gov/mfp/mprtech.pdf.

Figure 1.—U.S. Private Nonfarm Business Sector Sources of Output and Productivity Growth



Source: Department of Labor (Bureau of Labor Statistics), and calculations by the staff of the Joint Committee on Taxation.

These components of growth vary over the period. The second through eighth columns of the figure show the growth rates for each decade in the period.[87] Private nonfarm business sector output growth was strongest in the 1960s and the 1990s and weakest in the period since 2000. From 2000-2010, a decline in hours worked offset above average growth in labor productivity. Since 2010, hours worked have increased at nearly twice the post-war average annual rate, accelerating at a faster rate than even during the 1970s and 1980s when women and baby boomers were entering the labor force and expanding total labor hours. However, since 2010, labor productivity has been especially weak (0.8 percent per year) due to negative effects of capital inputs and below average multifactor productivity, resulting in below average economic growth.

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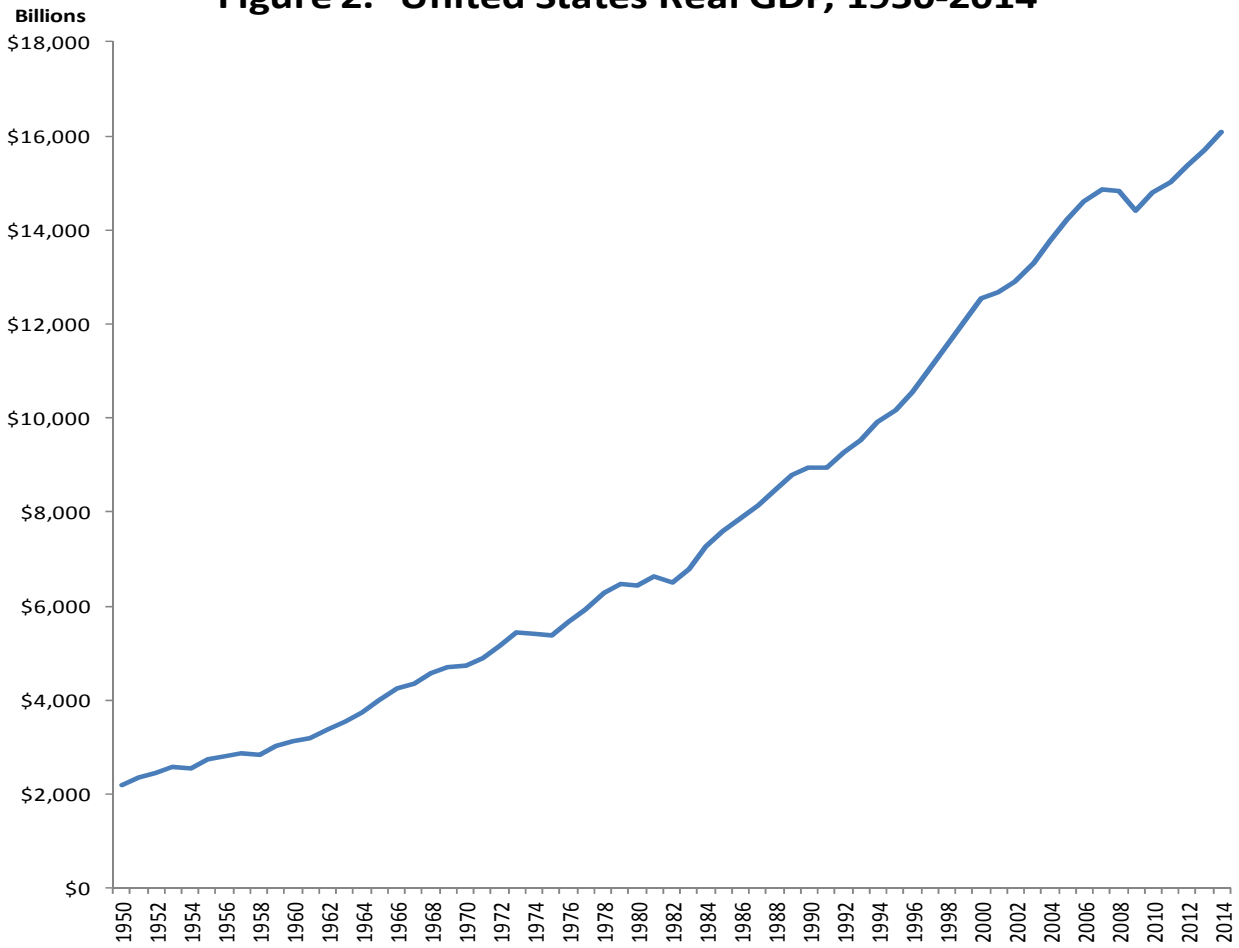
[87] Cumulative average annual growth rates are sensitive to the beginning and ending points of each period. Choice of beginning and ending points is somewhat arbitrary. While others have tried to identify inflection points in productivity data (see, *e.g.*, Dale W. Jorgenson, Mun S. Ho, and Kevin J. Stiroh, "A Retrospective Look at the U.S. Productivity Growth Resurgence," *Journal of Economic Perspectives*, vol. 22 no. 1, Winter 2008, pp. 3-24.), the purpose here is more modestly to show that the components vary over time.

Overall labor productivity growth was strongest in the 1960s led by the highest growth rates of multifactor productivity and above average capital deepening. Changes in the composition of the labor force have improved productivity steadily throughout the decades, except for the 1970s, when it had virtually no effect on labor productivity or overall growth.

Capital deepening added the most to labor productivity and economic growth in the early 2000s, surpassing the previous high rates in the 1960s, increasing more than a third faster than the post-war average. The trend of more capital deepening that had begun in the 1990s, however, reversed itself since 2010, when changes in capital have subtracted from overall growth.

Figure 2, below, shows the cumulative effect of input (labor and capital) and productivity growth on output, as measured by real GDP, since 1950. Over this period, real GDP grew at an average annual rate of 3.17 percent.

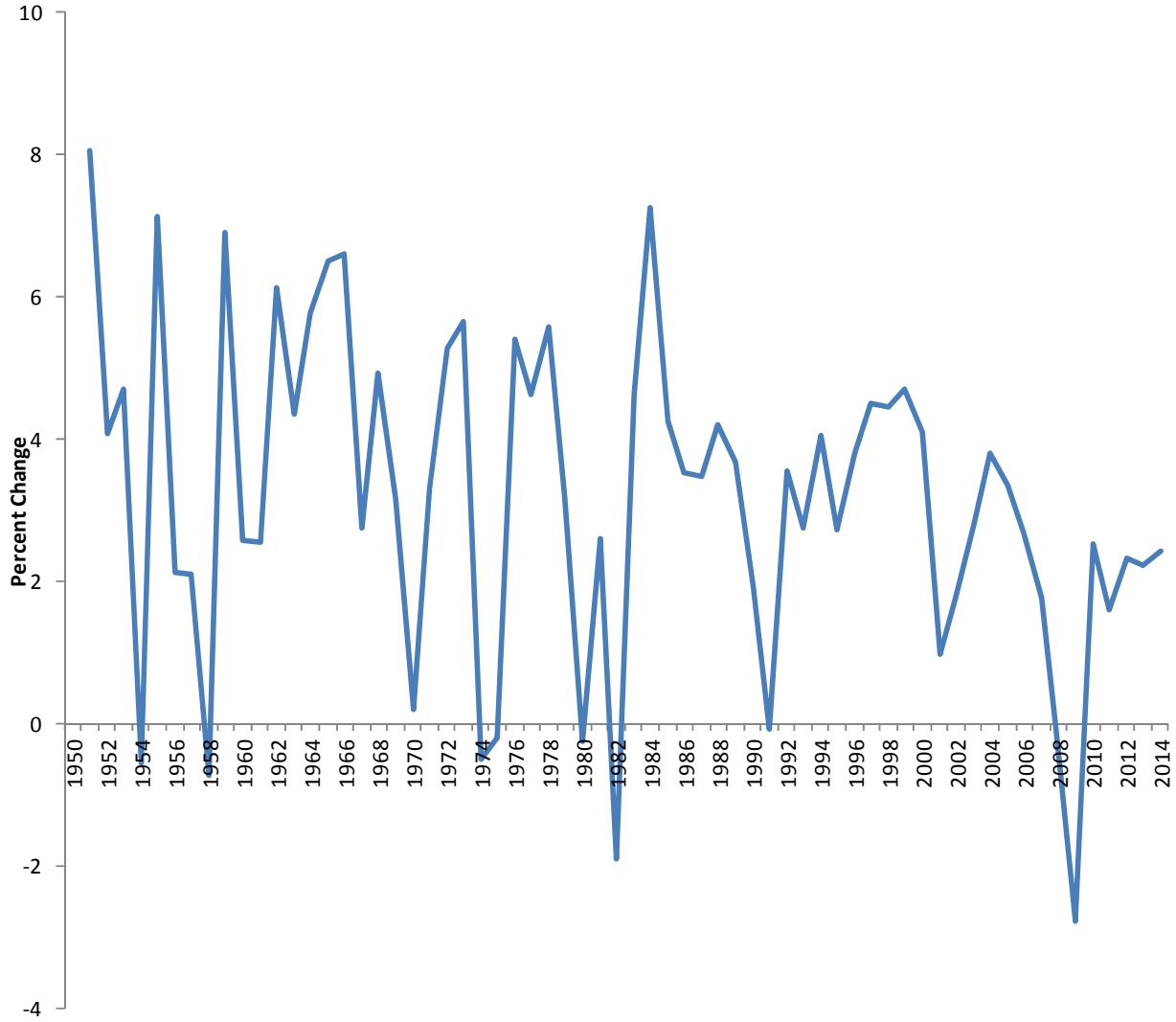
Figure 2.—United States Real GDP, 1950-2014



Source: Department of Labor (Bureau of Labor Statistics), and calculations by the staff of the Joint Committee on Taxation.

Figure 3, below, shows the annual percent change in real GDP growth over the same period.

Figure 3.–Annual Percent Change Real GDP, 1950-2014

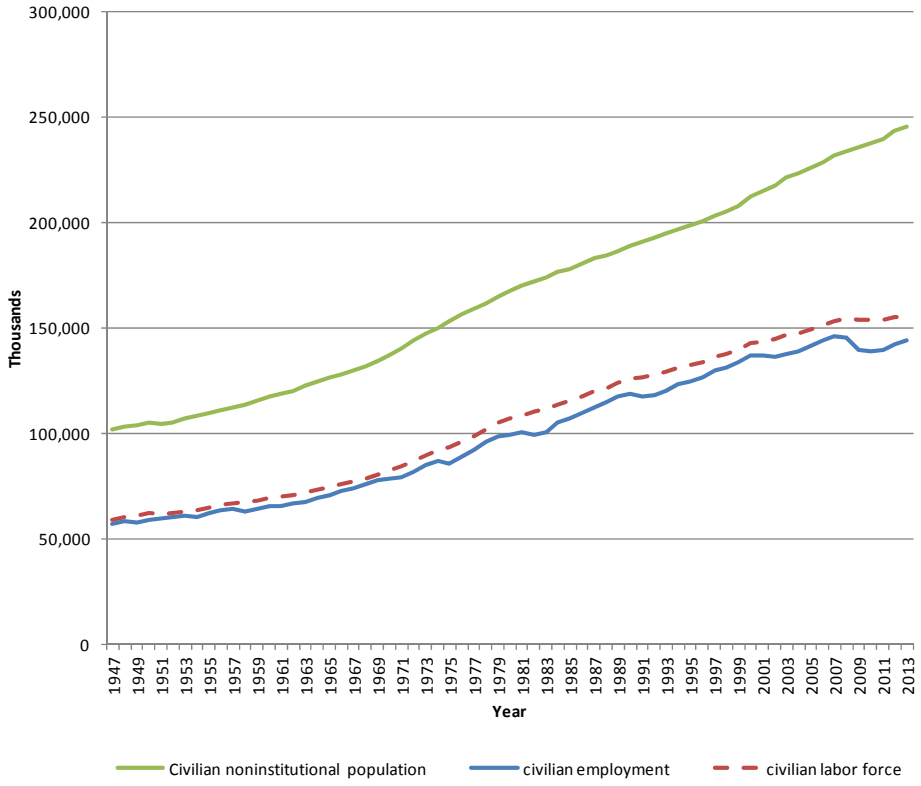


Source: Department of Labor (Bureau of Labor Statistics), and calculations by the staff of the Joint Committee on Taxation.

As discussed earlier, economic output grows with hours worked, and hours worked will be a reflection of the growth in population and the employment to population ratios.

Figure 4, below, shows the growth in the U.S. civilian noninstitutional population, the growth in the total civilian labor force (which includes those employed as well as those unemployed but seeking work), and the growth of total employment, from 1947- 2013. Over this period the civilian noninstitutional population grew 141 percent, with the total labor force and total employment growing further, by 162 percent and 152 percent, respectively.[88]

Figure 4.–Civilian Population, Labor Force, and Employment (Persons 16 Years of Age or Older), 1947-2013



Source: Department of Labor (Bureau of Labor Statistics), and calculations by the staff of the Joint Committee on Taxation.

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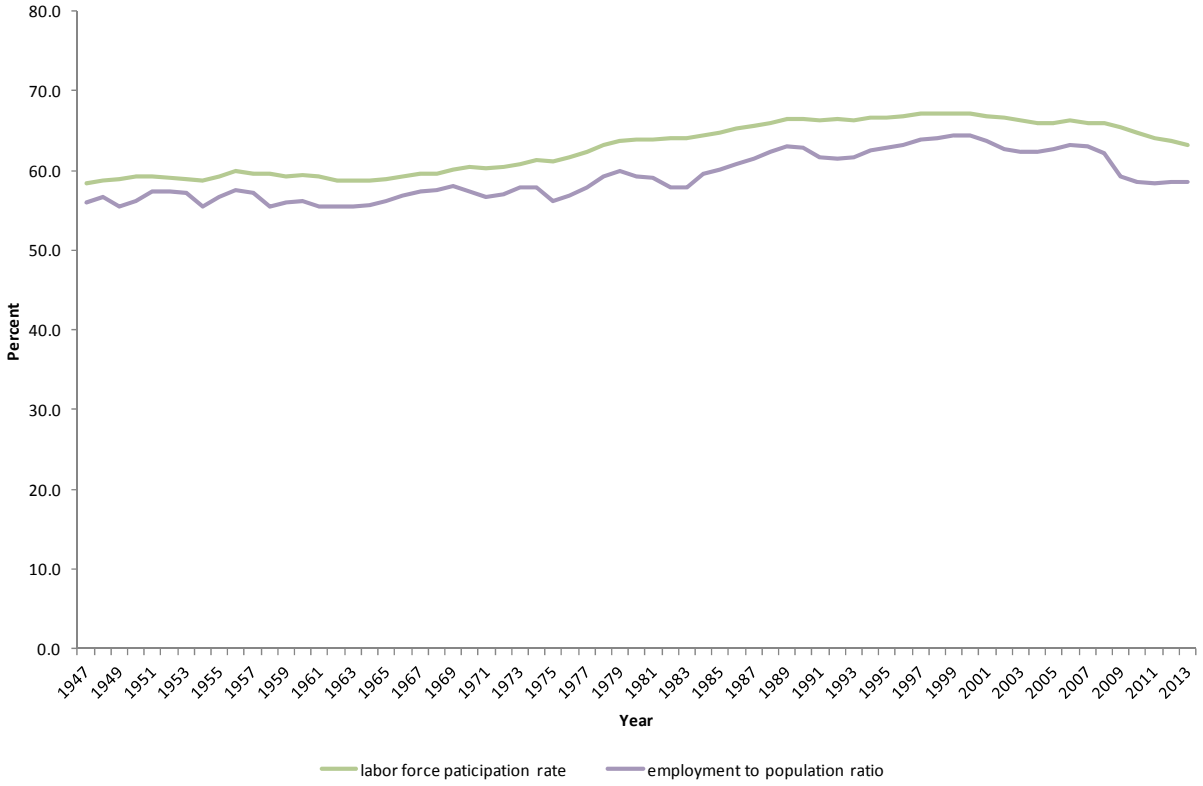
[88] Over one less year, from 1948 to 2013, data from the Bureau of Labor Statistics show that total hours worked in the private nonfarm business sector grew from 89.5 billion hours to 185.645 billion hours. This shows an increase of hours worked in this sector of 107 percent. While the nonfarm business sector does not reflect the entire economy, the lower growth in hours in this sector a

s compared to the economy wide employment figures above likely reflects growth in part-time employment over this period. Indeed, Bureau of Labor Statistics data show for the period 1968-2013 that while full time employment grew 89 percent, part-time employment grew 78 percent (see BLS series time series LNU02500000 and LNU02600000).

Figure 5, below, shows the civilian employment to population ratio and the labor force participation rate (the labor force as a percent of the civilian noninstitutional population over age 16). These figures reflect the numbers above, showing an increase in the labor force participation rate over this period from 58.3 percent to 63.2 percent, and a growth in the civilian employment to population ratio of 56 percent to 58.6 percent. This growth has not been uniform, however. Both the labor force participation rate and the civilian employment to population ratio peaked in 2000 at 67.1 and 64.4 percent respectively, and have since declined to their current levels, which were last seen in the late 1970s and early 1980s.

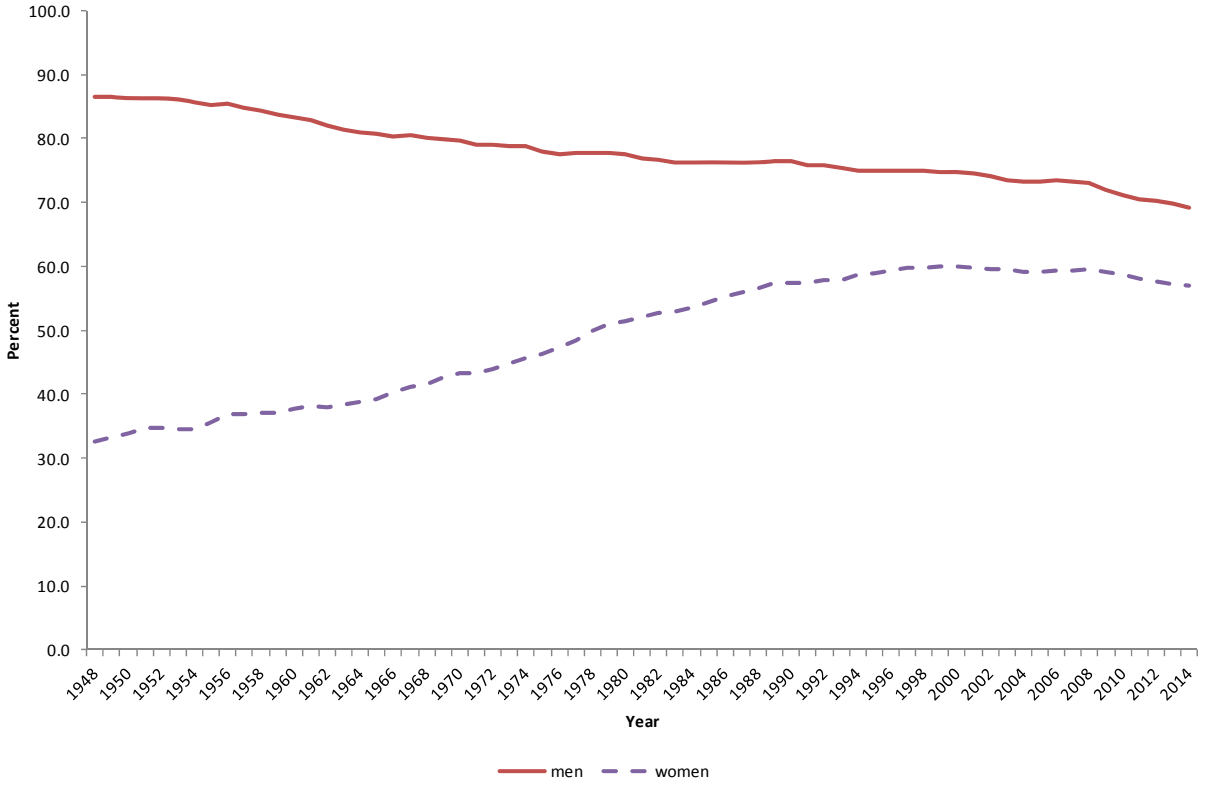
Figure 5.–Civilian Employment/Population Ratio and Labor Force Participation Rate, 1947-2014



Source: Department of Labor (Bureau of Labor Statistics), and calculations by the staff of the Joint Committee on Taxation.

Figure 6, below, shows the labor force participation rates of men and women from 1948 to 2014. The labor force participation rate of men declined from 86.6 percent in 1948 to 69.2 percent in 2014, while over the same period the labor force participation rate of women rose from 32.7 percent to 57 percent.

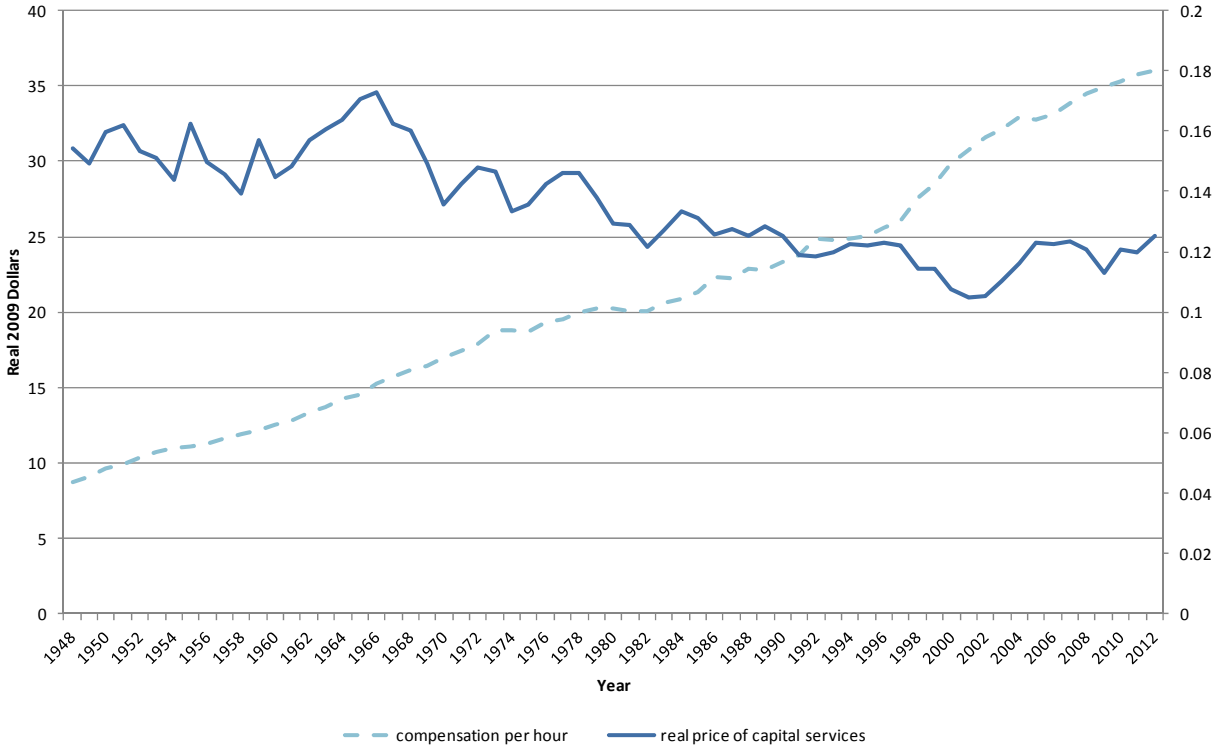
Figure 6.–Civilian Labor Force Participation Rates by Gender, 1948-2014



Source: Department of Labor (Bureau of Labor Statistics), and calculations by the staff of the Joint Committee on Taxation.

Figure 7, below shows the cumulative effect of productivity growth on compensation per hour in the private nonfarm business sector. Compensation includes wages and salaries of employees plus employers' contributions for social insurance and private benefit plans, and all other fringe benefits. Since 1948, real compensation per hour has risen from under $9 per hour to over $36 per hour in real 2009 dollars. A comparable measure for capital, the price of capital services, is shown in Figure 6 on the right axis. The price of capital services is defined as aggregate capital income divided by a unit of capital services. The price of capital services shows a modest downward trend over the same period.

Figure 7.–Real Compensation Per Hour and Price of Capital Services, 1948-2012
(private nonfarm business sector)



Source: Department of Labor (Bureau of Labor Statistics), and calculations by the staff of the Joint Committee on Taxation.