

Effects of Income Tax Changes on Economic Growth

William G. Gale¹
Brookings Institution and Tax Policy Center

Andrew A. Samwick
Dartmouth College and NBER

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Abstract

This paper examines how changes to the individual income tax affect long-term economic growth. The structure and financing of a tax change are critical to achieving economic growth. Tax rate cuts may encourage individuals to work, save, and invest, but if the tax cuts are not financed by immediate spending cuts they will likely also result in an increased federal budget deficit, which in the long-term will reduce national saving and raise interest rates. The net impact on growth is uncertain, but many estimates suggest it is either small or negative. Base-broadening measures can eliminate the effect of tax rate cuts on budget deficits, but at the same time they also reduce the impact on labor supply, saving, and investment and thus reduce the direct impact on growth. However, they also reallocate resources across sectors toward their highest-value economic use, resulting in increased efficiency and potentially raising the overall size of the economy. The results suggest that not all tax changes will have the same impact on growth. Reforms that improve incentives, reduce existing subsidies, avoid windfall gains, and avoid deficit financing will have more auspicious effects on the long-term size of the economy, but may also create trade-offs between equity and efficiency.

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I. Introduction

Policy makers and researchers have long been interested in how potential changes to the personal income tax system affect the size of the overall economy. In 2014, for example, Representative Dave Camp (R-MI) proposed a sweeping reform to the income tax system that would reduce rates, greatly pare back subsidies in the tax code, and maintain revenue- and distributional-neutrality (Committee on Ways and Means 2014).

In this paper, we focus on how tax changes affect economic growth. We focus on two types of tax changes – reductions in individual income tax rates and “income tax reform.” We define the latter as changes that broaden the income tax base and reduce statutory income tax rates, but nonetheless maintain the overall revenue levels and the distribution of tax burdens implied by the current income system. Our focus is on individual income tax reform, leaving consideration of reforms to the corporate income tax (for which, see Toder and Viard 2014) and reforms that focus on consumption taxes for other analysis.

We examine impacts on the expansion of the supply side of the economy and of potential Gross Domestic Product (GDP). This expansion could be an increase in the annual growth rate, a one-time increase in the size of the economy that does not affect the future growth rate but puts the economy on a higher growth path, or both. Our focus on the supply side of the economy and the long run is in contrast to the short-term phenomenon, also called “economic growth,” by which a boost in aggregate demand, in a slack economy, can raise GDP and help align actual GDP with potential GDP.

The importance of the topics addressed here derive from the income tax’s central role in revenue generation, its impact on the distribution of after-tax income, and its effects on a wide variety of economic activities. The importance is only heightened by continued lackluster

economic performance, concerns about the long-term economic growth rate, and concerns about the long-term fiscal status of the federal government.

We find that, while there is no doubt that tax policy can influence economic choices, it is by no means obvious, on an ex ante basis, that tax rate cuts will ultimately lead to a larger economy. While the rate cuts would raise the after-tax return to working, saving, and investing, they would also raise the after-tax income people receive from their current level of activities, which lessens their need to work, save, and invest. The first effect normally raises economic activity (through so-called substitution effects), while the second effect normally reduces it (through so-called income effects). In addition, if they are not financed by spending cuts, tax cuts will lead to an increase in federal borrowing, which in turn, will further reduce long-term growth. The historical evidence and simulation analysis is consistent with the idea that tax cuts that are not financed by immediate spending cuts will have little positive impact on growth. On the other hand, tax rate cuts financed by immediate cuts in unproductive spending will raise output.

Tax reform is more complex, as it involves tax rate cuts as well as base-broadening changes. There is a theoretical presumption that such changes should raise the overall size of the economy in the long-term, though the effect and magnitude of the impact are subject to considerable uncertainty. One fact that often escapes unnoticed is that broadening the tax base by reducing or eliminating tax expenditures raises the effective tax rate that people and firms face and hence will operate, in that regard, in a direction opposite to rate cuts. But base-broadening has the additional benefit of reallocating resources from sectors that are currently tax-preferred to sectors that have the highest economic (pre-tax) return, which should increase the overall size of the economy.

A fair assessment would conclude that well designed tax policies have the potential to raise economic growth, but there are many stumbling blocks along the way and certainly no guarantee that all tax changes will improve economic performance. Given the various channels through which tax policy affects growth, a growth-inducing tax policy would involve (i) large positive incentive (substitution) effects that encourage work, saving, and investment; (ii) income effects that are small and positive or are negative, including a careful targeting of tax cuts toward new economic activity, rather than providing windfall gains for previous activities; (iii) a reduction in distortions across economic sectors and across different types of income and types of consumption; and (iv) minimal increases in the budget deficit.

Section II discusses the channels through which tax changes can affect economic performance. Section III explores empirical evidence from major income tax changes in the United States. Section IV discusses the results from simulation models. Section V discusses cross-country evidence. Section VI concludes.

II. Framework²

A. Reductions in income tax rates

Reductions in income tax rates affect the behavior of individuals and businesses through both income and substitution effects. The positive effects of tax rate cuts on the size of the economy arise because lower tax rates raise the after-tax reward to working, saving, and investing. These higher after-tax rewards induce more work effort, saving, and investment through substitution effects. This is typically the “intended” effect of tax cuts on the size of the economy. Another positive effect of pure rate cuts is that they reduce the value of existing tax

² Gravelle (2014) provides extensive discussion of the channels through which tax changes affect economic growth, revenues, and other factors.

distortions and induce an efficiency-improving shift in the composition of economic activity (even holding the level of economic activity constant) away from currently tax-favored sectors, such as health and housing. But pure rate cuts may also provide positive income (or wealth) effects, which reduce the need to work, save, and invest.

An across-the-board cut in income tax rates, for example, incorporates all of these effects. It raises the marginal return to work – increasing labor supply through the substitution effect. It reduces the value of existing tax subsidies and thus would likely alter the composition of economic activity. It also raises a household’s after-tax income at every level of labor supply, which in turn, reduces labor supply through the income effect. The net effect on labor supply is ambiguous. Similar effects also apply to the impact of tax rate cuts on saving and other activities.

The initial tax rate will affect the impact of a tax cut of a given size. For example, if the initial tax rate – on wages, say – is 90 percent, a 10 percentage point reduction in taxes doubles the after-tax wage from 10 percent to 20 percent of the pre-tax wage. If the initial tax rate is 20 percent, however, the same 10 percentage point reduction in taxes only raises the after-tax wage by one eighth, from 80 percent to 90 percent of the pre-tax wage. Although income effects would be the same in the two cases, the substitution effect on labor supply and saving would be larger when tax rates are higher, so that the net gain in labor supply from a tax cut would be larger (or the net loss would be smaller in absolute value) when tax rates are high. In addition, because the economic cost of the tax rises with the square of the tax rate, the efficiency gains from reducing tax rates are larger when tax rates are higher to begin with.

B. Tax Reform

Tax reform, as defined above, involves reductions in income tax rates as well as measures to broaden the tax base; that is, to reduce the use of tax expenditures or other items that narrow

the base.³ By removing the special treatment or various types of income or consumption, base-broadening will tend to raise the average effective marginal tax rates on labor supply, saving and investment. This has two effects: the average substitution effect will be smaller from a revenue-neutral tax reform than from a tax rate cut, because the lower tax rate raises incentives to work, etc. while the base-broadening reduces such incentives; and the average income effect from a truly revenue-neutral reform should be zero.

Base-broadening has an additional effect that should help expand the size of the economy. Specifically, it would also reduce the allocation of resources to sectors and industries that currently benefit from generous tax treatment. A flatter-rate, broader-based system would encourage resources to move out of currently tax-preferred sectors and into other areas of the economy with higher pre-tax returns. The reallocation would increase the size of the economy.

C. Financing

Besides their effects on private agents, tax changes also affect the economy through changes in federal finances. If the tax change is revenue-neutral, there is no issue with financing effects, since the reformed system would raise the same amount of revenue as the existing system.

However, any tax cut must be financed by some combination of future spending cuts or future tax increases – with borrowing to bridge the timing of spending and receipts. The associated, necessary policy changes are often not specified in the original tax cut legislation, but they have to be present in some form in order to meet the government's budget constraint. Because fiscally unsustainable policies cannot be maintained forever, the financing of a tax cut must be incorporated into analyses of the effect of the tax cut itself.

³ Personal exemptions, the standard deduction, and lower marginal tax rates at low incomes are not considered tax expenditures.

In the absence of spending changes, tax cuts are likely to raise the federal budget deficit.⁴ The increase in federal borrowing will likely reduce national saving, and hence the capital stock owned by Americans and future national income. In most economic environments, the increase in the deficit is also likely to raise interest rates. These changes – lower national saving and the associated increase in interest rates – create a fiscal drag on the economy’s ability to grow (Congressional Budget Office 2013; Economic Report of the President 2003; Gale and Orszag 2004a; Engen and Hubbard 2004; Laubach 2009).

D. Other governmental entities

Federal tax cuts can also generate responses from other governmental entities -- including the central bank, state governments, and foreign governments. The Joint Committee on Taxation (2014), for example, examines how different Federal Reserve Board policies would affect the impact of Representative Camp’s tax reform proposals on economic growth.

The potential responses of foreign governments are often overlooked. Cuts in U.S. taxes that induce capital inflows from abroad, for example, may encourage other countries to reduce their taxes to retain capital or attract U.S. funds. To the extent that other countries respond, the net effect of income tax cuts on growth will be smaller than otherwise.

E. Summary

The popular discussion of the link between tax cuts and economic growth often starts with the presumption that the compensated elasticity of economic activity, whether as labor supply or savings, is large. This generates a positive substitution effect. It is not at all clear that the presumption of large compensated elasticities is correct. However, even if it is, there are several obstacles to that substitution effect translating into higher observed economic growth.

⁴ There are potentially important differences on the size of the economy in the form of spending cuts that could finance tax reductions, but they are beyond the scope of this paper.

The first is the income effect that runs counter to the substitution effect. The second is, in the case of tax reform, the higher taxes on the other activities that are now included in the broadened tax base. The third is, in the case of tax cuts not paid for by reduced government spending, the offsetting effects of higher budget deficits and thus interest rates on economic activity.

For individuals, on the supply side of the economy, there are two key elasticities – labor supply and saving. Keane (2011) surveys the literature on labor supply and taxes and challenges the presumption that the elasticity of labor supply for males is close to zero, or in any case small enough that labor supply taxation generates negligible behavioral response and thus efficiency costs. He shows that modeling human capital – a positive effect of the current period’s labor supply on later periods’ wages – allows for modest labor supply elasticities to generate large efficiency costs of taxation. He further shows that for women, labor supply elasticities that allow for the dynamic effects of wages on fertility, marriage, education, and work experience are generally quite large. Thus, there remains the potential for some tax cuts to generate behavioral responses on labor supply that lead to higher economic activity.⁵

Bernheim (2002) surveys the literature on the response of savings to generic changes in the after-tax return and concludes that there is little evidence for a large effect. In the case of savings, there must also be a link between the behavioral response of higher savings to the tax cut and economic activity. Many studies have considered the causal link between savings and growth. The general conclusion in the literature, well articulated by Carroll and Weil (1994), is that the observed positive relationship reflects a causal pathway from growth to savings, rather than savings to growth.

⁵ See also Keane and Rogerson (2012) and Chetty, Guren, Manoli, and Weber (2011, 2013) on reconciliations of the (small) micro elasticities with (somewhat larger) macro labor supply elasticities.

III. Empirical Analyses

Ultimately, the impact of tax changes on the size of the economy is an empirical question. Rigorous empirical studies of actual U.S. tax changes are relatively rare, however, for several reasons. The U.S. has only had a few major tax policy changes over the past 50 years. Most major tax changes alter many features of the code simultaneously. It is difficult to isolate the impact of tax changes relative to other changes in policy and the economy. The recent debate between researchers at the Tax Foundation and the Center on Budget and Policy Priorities is emblematic of the difficulties of interpreting the evidence, with the authors reaching strongly different conclusions and interpretations of the literature (McBride 2012; Huang and Frenzt 2014). While we find the evidence presented in those studies as relatively unconvincing of the view that tax cuts promote growth, the larger problem is that, in the absence of clearly exogenous shifts in tax policy, it is often difficult to draw clear conclusions. In this section, we examine analysis of historical trends as well as studies of specific tax policy changes.

A. Historical Trends

U.S. historical data show huge shifts in taxes with virtually no observable shift in growth rates. From 1870 to 1912, the U. S. had no income tax, and tax revenues were just 3 percent of GDP. From 1913 to 1946, the economy experienced an especially volatile period, including two World Wars and the Great Depression, along with the introduction of the income and payroll taxes and expansion of estate and corporate taxes. By 1947, the economy had entered a new period with permanently higher taxes and government spending. From 1947 to 2000, the highest marginal income tax rate averaged 66 percent, and federal revenues averaged about 18 percent of GDP (Gale and Potter 2002). In addition, estate and corporate taxes were imposed at high marginal rates and state-level taxes rose significantly over earlier levels.

The vast differences between taxes before 1913 and after World War II can therefore provide at least a first-order sense of the importance tax policy on growth. However, the growth rate of real GDP per capita was identical – 2.2 percent – in the 1870-1912 period and between 1947 and 1999 (Gale and Potter 2002).

More formally, Stokey and Rebelo (1995) look at the significant increase in income tax rates during World War II and its effect on the growth rate of per capita real Gross National Product (GNP). Figure 1 shows the basic trends they highlight – namely, a massive increase in income tax and overall tax revenues during World War II that has persisted and since proven to be more or less permanent. There is, as shown in Figure 1, no corresponding break in the growth rate of per capita real GNP before or after World War II (though it is less volatile). A variety of statistical tests confirm formally what Figure 1 shows; namely, the finding that the increase in tax revenue around World War II had no discernible impact on the long-term per-capita GNP growth rate.

The pre- and post-World War II comparisons noted above focus on the growth rate, as opposed to one-time changes in the size of the economy that put the economy on a new growth path even without altering the annual long-term growth rate. GDP growth did spike downward immediately after the war, but that was related to a massive demilitarization effort. Overall, the economy grew massively during World War II (for reasons other than taxes, of course) and then maintained its former growth rate in the relatively-high-tax post-WWII period.

Hungerford (2012) plots the annual real per-capita GDP growth rate against the top marginal income tax rate and the top capital gains tax rate from 1945 to 2010 (see Figure 2), a period that spanned wide variation in the top rate. The fitted values suggest that higher tax rates are not associated with higher or lower real per-capita GDP growth rates to any significant

degree. In multivariate regression analysis, neither the top income tax rate nor the top capital gains tax rate has a statistically significant association with the real GDP growth rate. An obvious caveat to this result is that the share of households facing the top rate is generally quite small. However, historically, the highest several marginal tax rates were moved together, so that changes in the top rate per se proxy for changes in a broader set of higher tax rates that do affect many taxpayers. A second caveat is a potential concern about the power of a fairly short time series of annual data to distinguish alternative hypotheses.

There are two final concerns regarding the historical record of tax changes and economic growth. First, historical reforms do not represent “pure” textbook tax reform efforts, since they all took place in the real world, subject to the compromises that the political process imposes. However, future tax reforms will also be affected by political factors, so the history of reform efforts is relevant. Second, many factors affect economic growth rates. Nonetheless, if taxes were as crucial to growth as is sometimes claimed, the large and permanent historical increases in tax burdens and marginal tax rates that occurred by the 1940s and the historic reduction in marginal tax rates that has occurred since then might be expected to affect the aggregate statistics reflecting the growth rate of the economy.

B. Effects of Tax Cuts and Tax Increases

Several studies have aimed to disentangle the impact of the major tax cuts that occurred in 1981, 2001, and 2003, as well as the tax increases that occurred in 1990 and 1993. The Economic Recovery Act of 1981 (ERTA) included a 23 percent across-the-board reduction in personal income tax rates, a deduction for two-earner families, expanded IRAs, numerous reductions in capital income taxes, and indexed the income tax brackets for inflation. Many features of ERTA, particularly some of the subsidies for capital income, were trimmed back in

the 1982 and 1984 tax acts.

Feldstein (1986) provides estimates indicating that all of the growth of nominal GNP between 1981 and 1985 can be explained by changes in monetary policy. Of the change in real GNP during that period, he finds that only about 2 percentage points of the 15 percentage point rise cannot be explained by monetary policy. But he also notes that the data do not strongly support either the traditional Keynesian view that the tax cuts significantly raise aggregate demand or traditional supply-side claims that they significantly increase labor supply. He finds, rather, that exchange rate changes and the induced changes in net exports account for the small part of growth not explained by monetary policy. Feldstein and Elmendorf (1989) find that the 1981 tax cuts had virtually no net impact on economic growth. They find that the strength of the recovery over the 1980s could be ascribed to monetary policy. In particular, they find no evidence that the tax cuts in 1981 stimulated labor supply.

The Center on Budget and Policy Priorities looks at the relationship between the 1993 tax hikes and the 2001 tax cuts with respect to employment and GDP growth over the periods following the respective reforms (Huang 2012). As Figure 3 shows, job creation and economic growth were significantly stronger in the years following the marginal income tax increases enacted in 1993 (the top marginal tax rate went up from 31 percent to 39.6 percent) than they were following the 2001 tax cuts (described below). While correlation does not imply causation, and while the 1993 and 2001 tax changes occurred at different times in the business cycle, making comparisons between the two of them more difficult, the evidence presented above at the very least discredits the argument that higher growth cannot take place during a period of higher tax rates.

The tax cuts in 2001 (The Economic Growth and Tax Relief Reconciliation Act of 2001,

or EGTRRA) reduced income tax rates, phased out and temporarily eliminated the estate tax, expanded the child credit, and made other changes. The 2003 tax cut (The Jobs and Growth Tax Relief Reconciliation Act of 2003, or JGTRRA) reduced rates on dividends and capital gains. The impact on growth of these changes appears to have been negligible. First, a cursory look at growth between 2001 and 2007 (before the onset of the Great Recession) suggests that overall growth rate was both mediocre – real per-capita income grew at an annual rate of 1.5 percent during that period, compared to 2.3 percent from 1950 to 2001 – and was concentrated in housing and finance, two sectors that were not favored by the tax cuts. There is, in short, no first-order evidence in the aggregate data that these tax cuts generated growth.

As further evidence, Eissa (2008) tabulates the unconditional distribution of hours worked in the March Current Population Surveys over the 2000 – 2006 period. She shows that hours worked by prime-age males did not change over this period, while the distributions of hours worked for women – married women and particularly single mothers – shifted lower. The lack of a positive shift in the years following the Bush tax cuts occurred despite the economic recovery from the recession in the early part of the period, suggesting that any impact of tax cuts on average hours worked was minimal.

More careful microeconomic analyses give similar conclusions. Given the structure of the 2001 tax cut, researchers have generally found that the positive effects on future output from the impact of reduced marginal tax rates on labor supply, human capital accumulation, private saving and investment are outweighed by the negative effects of the tax cuts via higher deficits and reduced national saving. Gale and Potter (2002) estimate that the 2001 tax cut would have little or no net effect on GDP over the next 10 years and could have even reduced it; that is, they find that the negative effect of higher deficits and the decline in national saving would outweigh

the positive effect of reduced marginal tax rates.

Based on analysis in Gale and Potter (2002) and Gale and Orszag (2005a), the 2001 tax cut raised the cost of capital for investments in residential housing, sole proprietorships, and corporate structures because the higher deficits raised interest rates. By contrast, the cost of capital for corporate equipment fell slightly because the tax act also contained provisions for bonus depreciation that more than offset the rise in interest rates. It might also be thought that the 2003 tax cut would have more beneficial effects on investment, since it focused on dividend and capital gains tax cuts. But Desai and Goolsbee (2004) find that the 2003 tax cuts had little impact on investment. In addition, Gale and Orszag (2005b) show that the combined net effect of making EGTRRA and JGTRRA permanent would be to raise the cost of capital once the effect on higher deficits on interest rates are taken into account.

These findings imply that making all of the tax cuts permanent and continuing the deficit financing of those cuts would have reduced the long-term level of investment, which is consistent with a negative effect on national saving and growth (Gale and Orszag 2005b). As it stands, the American Tax Relief Act of 2012 (ATRA) made most of the tax cuts permanent, except those affecting only the top two income tax brackets. In summary, the 2001 and 2003 tax cuts contained several potentially pro-growth features – like lower high-income tax rates and lower rates on dividends and capital gains, but they also contained some anti-growth features. Most prominent among these were tax cuts that helped lower- and moderate-income households, such as the creation of the 10 percent bracket (which reduced incentives to work for people above the 10 percent bracket because of the income effect) and the expansion of the child credit (which created significant income effects but not substitution effects for labor supply). The tax cuts created large deficits, which burdened the economy with lower national saving and higher

interest rates, all other things equal. They provided only small reductions in marginal tax rates, blunting the potential positive incentive effects. They created positive income effects, but small or no substitution effects, for a substantial number of taxpayers, which discouraged labor supply and saving. They also created windfall gains for the owners of old capital, which further discourage productive supply-side responses.

The intuition behind these results is noteworthy. Gale and Potter (2002) do not show that reductions in tax rates have no effect, or negative effects, on economic behavior. Rather, the improved incentives of reduced tax rates – analyzed in isolation – increase economic activity by raising labor supply, human capital, and private saving. Indeed, these factors are estimated to increase the size of the economy in 2011 by almost 1 percent. But EGTRRA and JGTRRA were sets of tax incentives financed by increased deficits. The key point is that the tax cut reduced public saving (through higher deficits) by more than it increased private saving. As a result, national saving fell, which reduced the capital stock, even after adjusting for international capital flows, and lowered GDP and GNP. Thus, the effects on the deficit are central to the findings.⁶

In a novel study, Romer and Romer (2010) use the narrative record from Presidential speeches, executive-branch documents, and Congressional reports to identify the size, timing, and principal motivation for all major tax policy actions in the post-World War II United States. Focusing on tax changes made to promote long-run growth or to reduce an inherited budget deficit, rather than tax changes made for other reasons, they find that tax changes have large and

⁶ An earlier study by Engen and Skinner (1996) simulates that a generic 5 percentage point reduction in marginal tax rates would raise annual growth rates by 0.2-0.3 percentage points for a decade. But the tax cut that Engen and Skinner examine is financed by immediate reductions in government consumption, not deficits, and the 5 percentage point drop in effective marginal tax rates that they analyze is roughly 3 (10) times the size of the cut in effective economy-wide marginal tax rates on wages (capital income) induced by EGTRRA and JGTRRA. See Gale and Potter (2002) for additional discussion of the Engen and Skinner results and differences between the tax cuts they analyze and the 2001 and 2003 tax changes.

persistent effects, with a tax increase of 1 percent of GDP lowering real GDP by roughly 2 to 3 percent. The impacts are rapid enough – with effects taking place over the first few quarters – to suggest an aggregate demand response, but they are also long-lived enough – with the effects lasting through 20 quarters -- to suggest that supply-side responses are at work as well. However, subsequent work has questioned the robustness of these results.⁷

C. Tax Reform

If “tax reform” is defined as base-broadening, rate-reducing changes that are neutral with respect to the pre-existing revenue levels and distributional burdens of taxation, then tax reform is a rare event in modern U.S. history. While virtually every commission that looks at tax reform suggests proposals along these lines – see, for example, the Bowles-Simpson National Commission on Fiscal Responsibility and Reform (2010), the Domenici-Rivlin Debt Reduction Task Force (2010), and President Bush’s tax reform commission (President’s Advisory Panel 2005) – policy makers rarely follow through. Indeed, only the Tax Reform Act (TRA) of 1986 would qualify, among all legislative events in the last fifty years. Representative Camp’s recent proposal would also qualify, but of course it has not been enacted.

Auerbach and Slemrod (1997) address numerous features of TRA on economic growth and its components. They suggest that, although there may have been substantial impacts on the timing and composition of economic activity – for example, a reduction in tax sheltering activity – there was little effect on the overall level of economic activity. They conclude that there were small impacts on saving, labor supply, entrepreneurship and other productive activities.

⁷ Favero and Giavazzi (2009) suggest that the multipliers for the tax shocks identified by Romer and Romer are considerably smaller if one models the shocks as explanatory variables in a multivariate model rather than regressing output on the tax shocks. The source of this difference is not clear, although the authors suggest that their results reject the assumptions by Romer and Romer that such shocks are independent of other explanatory variables. In addition, Favero and Giavazzi (2009) split the sample by time period and show that the multiplier is less than one for the period before 1980 and is not significantly different from zero for the period after 1980.

Although they do not provide an overall estimate for the impact on economic growth, it seems clear from their conclusions about microeconomic impacts and from the lack of aggregate growth in the data that any growth impact of TRA was quite small. Evidence from one historical episode is always subject to qualification and one-time circumstances. Nevertheless, the Auerbach-Slemrod analysis is important to consider precisely because TRA considerably broadened the tax base and substantially reduced marginal income tax rates, consonant with the very notion of tax reform.

IV. Simulations

Given the various difficulties of empirically estimating the impacts of tax cuts and tax reform using historical data, economists have often turned to simulation analyses to pin down the impacts. The advantage of simulation analysis is the ability to hold other factors constant. The disadvantage is the need to specify a wide variety of features of the economy that may be tangential to tax policy or for which little reliable evidence is available.

A. Tax Cuts or Increases

Formal analyses confirm the intuition developed above that deficit-financed tax cuts are poorly designed to stimulate long-term growth and that tax cuts financed by spending cuts are more likely to have a positive impact on economic growth.

A simple extrapolation based on earlier published results from the Federal Reserve Board model of the U.S. economy implies that a cut in income tax rates that reduces revenues by one percent of GDP will raise GDP by just 0.1 percent after 10 years if the Fed follows a Taylor (1993) rule for monetary policy (Reifschneider et al. 1999).

Elmendorf and Reifschneider (2002) use a large-scale econometric model developed at

the Federal Reserve and find that a reduction in taxes that is somewhat similar to the personal income tax cuts in the 2001 law reduces long-term output and has only a slight positive effect on output in the first 10 years.

Auerbach (2002) estimates that a deficit-financed tax cut similar in structure to the 2001 tax cut (which originally was slated to last only until 2010) will reduce the long-term size of the economy if it is financed by tax rate increases after it expires. Even if the deficits are eventually offset partially or wholly by reductions in federal outlays (government consumption in the model), the tax cuts would either reduce the size of the per-capita capital stock or slightly raise it by 0.5 percent in the long-term.

The Congressional Budget Office (CBO) (2001) projected that the 2001 tax legislation may raise or reduce the size of the economy, but the net effect was likely to be less than 0.5 percent of GDP in either direction in 2011, again depending primarily on how the deficit was financed in the long run. Analysis of the 2003 capital gains tax cuts suggests that the net long-term growth effects are negative – that is, that the negative effects of deficits on capital accumulation outweigh the positive incentive effects of such policies (Joint Committee on Taxation 2003; Macroeconomic Advisers 2003). Similar effects for deficit-financed tax cuts have been found by the Congressional Budget Office (2010).

Diamond and Viard (2008) estimate the effects of a variety of deficit-financed tax cuts, concluding that even when the tax cuts do raise the size of the economy in the long-term, they nonetheless often lower the welfare of members of future generations.

The most comprehensive aggregate analysis of the long-term effects of deficit-financed tax cuts was undertaken by 12 economists at CBO (Dennis et al. 2004). This study examines the effects of a generic 10 percent statutory reduction in all income tax rates, including those

applying to dividends, capital gains, and the alternative minimum tax.⁸ As Dennis et al. (2004) note in their study, “the reduction in marginal tax rates is large compared with the overall budget cost.” Thus, the positive growth effects of better incentives are large relative the negative growth effects on higher deficits. The study uses three different models to examine the long-term effects: a closed- economy overlapping generations (OLG) model; an open economy OLG model; and the Ramsey model. The authors assume that the tax cuts are financed with deficits for 10 years; then the budget gaps are closed gradually with either by reductions in government consumption or increases in tax rates. Thus, deficits are allowed to build for the first decade of the tax cut and much of the second decade as well.

The results are reported in Table 1. In the three scenarios where the tax cuts are financed in the long run by increases in income taxes, the long-term effects are generally negative. In the Ramsey model and the closed economy overlapping generations (OLG) model, GDP (and GNP) falls significantly. In the open economy OLG model, GDP rises slightly, but GNP falls by even more than in the other models. The chain of events creating this outcome is that the tax cuts reduce national saving and hence increase capital inflows. The inflow, in conjunction with increased labor supply, is sufficient to slightly raise (by 0.2 percent) the output produced on American soil. The capital inflows, however, must eventually be repaid and doing so reduces national income (GNP) even though domestic production rises.

Ultimately, of course, future living standards of Americans depend on GNP, not GDP (Elmendorf and Mankiw 1999). In the three scenarios where the tax cuts are financed with cuts

⁸ The authors do not examine the 2001 and 2003 tax cuts per se. Because the CBO study focuses on “pure” rate cuts, rather than the panoply of additional credits and subsidies enacted in EGTRRA, the growth effects reported probably overstate the impact of making the 2001 and 2003 tax cuts permanent because in EGTRRA, many people did not receive marginal rate cuts and some received higher child credits, which should have induced reductions in labor supply via the income effect. In their analysis, every tax payer receives a reduction in marginal tax rates, so 100 percent of tax payers and taxable income is affected, whereas 20 percent of filers did not receive a tax cut under EGTRRA (Gale and Potter 2002).

in government consumption in the long run, the effects are less negative. In the closed-economy OLG model, there is virtually no effect on growth. In the open-economy OLG model, GDP rises by 0.5 percent in the long-run, but GNP falls by 0.4 percent.

A number of studies suggest that the greater the extent to which tax cuts are financed by contemporaneous spending cuts, the greater the likelihood that the policy change raises economic growth. Auerbach (2002) finds that the larger the share of a tax cut is financed by cuts in contemporaneous government purchases, the larger the impact is on national saving. Foertsch (2004) obtains similar results using Congressional Budget Office models. In the 12-author CBO study cited above, the sole exception to the result that tax cuts lower long-term size of the economy occurs when the tax cuts are financed by reductions in government purchases *and* the policy is run through the Ramsey model, in which case long-term GDP would rise by about 0.8 percent. However, as the authors note, the Ramsey model implies that the reduction in government saving due to the tax cuts in the first decade is matched one-for-one with increases in private saving (Dennis et al. 2004). Empirical evidence rejects this view (see Gale and Orszag 2004b).⁹

The analysis of tax cuts financed by reductions in government purchases is subject to an important caveat. The models assume that government purchases either represent resources that are destroyed or that government purchases enter utility in a separable fashion from private consumption. For some purposes, like national defense, the latter assumption might be appropriate. In those cases, the cut in spending would reduce households' utility and thus impose welfare costs but would not affect choices at the margin. However, in all of the analyses,

⁹ Jones et al. (1993) estimate that the removal of all taxes would raise growth substantially. However, Stokey and Rebelo (1995) show that the result is sensitive to a number of parameter choices and that the most defensible parameter values imply that flatter tax rates have little impact on growth. Lucas (1990) obtains a similar result to Stokey and Rebelo (1995).

it is assumed that there is no investment component of the government purchases – so the analysis would not be representative of the effects of cuts in, for example, education, research and development, or infrastructure investment.

B. Tax Reform

There is a cottage industry in economics of simulating the impact of broad-based income tax reform on growth. The analysis of tax reform can be broken up conceptually into two distinct parts – how the tax changes affect individual or firm choices regarding the level of work, saving, and investment, and how the changes affect the allocation of such activity across sectors of the economy. There is a long tradition of studies implying that the impact of tax reform on the changing sectoral allocation of resources can be important, starting from Harberger's (1962) classic analysis of the corporate tax and including Fullerton and Henderson (1987), Gravelle and Kotlikoff (1989), and Diamond and Zodrow (2008).¹⁰

Lim Rogers (1997) finds that a revenue-neutral shift to a flat-rate income tax with no deductions, exclusions, or credits other than a personal exemption of \$10,000 per filer plus \$5,000 per dependent would raise the long-term size of the economy by between 1.8 and 3.8 percent, depending on assumptions about the relevant behavioral elasticities.

Auerbach et al. (1997) find that moving to the same flat-rate income tax -- i.e., with the personal exemptions noted above -- would *reduce* the size of the economy by three percent in the long run. However, Altig et al. (2001) use a similar model to evaluate a more extreme policy reform – a revenue-neutral switch to a flat income tax – but with no personal deductions or exemptions. They find that this would raise output immediately by 4.5 percent, and then by

¹⁰ The Congressional Budget Office (2005; 2006) published estimates of how effective tax rates vary across types of capital assets. The studies do not report the welfare effects of tax reform, but do provide evidence that the tax code favors some sectors of the economy over others.

another one percent over the ensuing 15 years, although it would hurt the poor in current and future generations. The model illustrates two interesting results. First, tax reform can raise the overall size of the economy with a one-time change that puts the economy on a new growth path even if it does not affect the long-term growth *rate*. In this model, the one-time effect of tax reform on the size of the economy dominates the effect on the overall growth rate.

Second, there is often a trade-off between growth and progressivity in that model. However, more recent work has highlighted the role of uncertainty in tax reform, noting that a progressive income tax system provides insurance against fluctuating income by making the percentage variation of after-tax income less than the percentage variation in pre-tax income (Kneiser and Ziliak 2002; Nishiyama and Smetters 2005). This finding may change the terms of the trade-off between progressivity and growth effects.

The most recent example of simulation of comprehensive tax reform is the Joint Committee on Taxation's (2014) analysis of the Camp plan. The JCT offers eight different scenarios depending on how the Federal Reserve responds, the underlying model of the economy used, and assumptions about behavioral elasticities. They find that Camp's plan would raise the size of the economy from 0.1 percent to 1.6 percent over the next 10 years.

V. Cross-Country Evidence

Cross-country studies generally find very small long-term effects of taxes on growth among developed countries (Slemrod 1995). Countries vary, of course, not just in their level of revenues and spending, but also in the composition of taxes and outlays. Nevertheless, a large literature has developed aiming to compare tax effects across countries.

Evidence shows that pooling data from developed and developing countries is

inappropriate because the growth processes differ (Garrison and Lee 1992; Grier and Tullock 1989) and that taxes have little or no effect on economic growth in developed countries.

Mendoza et al. (1997) and Garrison and Lee (1992) find no tax effects on growth in developed countries. Padovano and Galli (2001) find that a 10 percentage point reduction in marginal tax rates raises the growth rate by 0.11 percentage points in OECD countries. Engen and Skinner (1992) find significant effects of taxes on growth in a sample of 107 countries, but the tax effects are tiny and insignificant when estimated only on developed countries.

Piketty, Saez, and Stantcheva (2011) look at evidence from 18 OECD countries on tax rates and economic growth for the 1960-2010 time period. The authors find no evidence of a correlation between growth in real GDP per capita and the drop in the top marginal rate for the 1960-2010, as shown by Figure 4. The lack of robust results showing a positive impact of tax rates and growth in a cross-section of countries may not be surprising. Economic growth is driven by increases in the supply of factors of production like capital and labor and increases in the productivity of those factors. Whatever discouragement high tax rates have for the supply of these factors or their productivity, they will only impede growth if these negative effects compound over time. It is harder to determine one-time impacts of tax changes using cross-country data.

A related literature considers the relationship between economic growth and the mix of taxes used to finance government expenditures. Arnold et al. (2011) use a panel dataset of 21 OECD countries over the 1971 – 2004 period to compare growth rates based on the revenue shares of different tax instruments, such as corporate income taxes, personal income taxes, consumption taxes, and property taxes. They estimate an error correction model in which the explanatory variables are included both in levels and in first differences to pick up transitional

dynamics. The regression also includes the overall tax burden of tax revenues relative to GDP, so that the findings pertain to shifts among tax instruments rather than a cut in revenues. The main results are that both corporate and personal income taxes have the most negative consequences for the growth of GDP per capita, with consumption taxes and property taxes less harmful. This ranking of personal income taxes relative consumption taxes and property taxes is confirmed by Acosta-Ormaechea and Yoo (2012), who use similar methods and a broader dataset of 69 countries over the 1970 – 2009 period. Shifts from income taxes to property, value added, or sales taxes are associated with higher growth. As in the case, discussed above, of income tax cuts that are financed by reductions in government spending rather than budget deficits, the growth potential of income tax cuts is higher when the income tax cuts are financed by increases in other taxes that have lesser disincentives for work, saving, and investment.

VI. Conclusion

Both changes in the level of revenues and changes in the structure of the tax system can influence economic activity, but not all tax changes have equivalent, or even positive, effects on long-term growth.

The argument that income tax *cuts* raise growth is repeated so often that it is sometimes taken as gospel. However, theory, evidence, and simulation studies tell a different and more complicated story. Tax cuts offer the potential to raise economic growth by improving incentives to work, save, and invest. But they also create income effects that reduce the need to engage in productive economic activity, and they may subsidize old capital, which provides windfall gains to asset holders that undermine incentives for new activity. In addition, tax cuts as a stand-alone policy (that is, not accompanied by spending cuts) will typically raise the federal

budget deficit. The increase in the deficit will reduce national saving -- and with it, the capital stock owned by Americans and future national income -- and raise interest rates, which will negatively affect investment. The net effect of the tax cuts on growth is thus theoretically uncertain and depends on both the structure of the tax cut itself and the timing and structure of its financing.

Several empirical studies have attempted to quantify the various effects noted above in different ways and used different models, yet mostly come to the same conclusion: Long-persisting tax cuts financed by higher deficits are likely to reduce, not increase, national income in the long term. By contrast, cuts in income tax rates that are financed by spending cuts can have positive impacts on growth, according to the simulation models. In modern United States history, however, major tax cuts (in 1964, 1981, and 2001/2003) have been accompanied by increases in federal outlays rather than cutbacks.

The effects of income tax *reform* – revenue- and distributionally-neutral base-broadening, rate-reducing changes – build off of the effects of tax cuts, but are more complex. The effects of reductions in rates are the same as above. Broadening the base in a revenue-neutral manner will eliminate the effect of rate cuts on budget deficits. It will also reduce the impact of the rate cuts on effective marginal tax rates and thus reduce the impact on labor supply, saving, and investment. However, broadening the base will have one other effect as well; by reducing the extent to which the tax code subsidizes alternative sources and uses of income, base-broadening will reallocate resources toward their highest-value economic use and hence will raise the overall size of the economy and result in a more efficient allocation of resources.

These effects can be big in theory and in simulations, especially for extreme policy reforms such as eliminating all personal deductions and exemptions and moving to a flat-rate tax.

But there is little empirical analysis of broad-based income tax reform in the United States, in part because there has only been one major tax reform in the last fifty years. Still, there is a sound theoretical presumption – and substantial simulation results – indicating that a base-broadening, rate-reducing tax reform can improve long-term performance. The key, however, is not that it boosts labor supply, saving or investment – since it raises the same amount of revenue from the same people as before – but rather that it leads to be a better allocation of resources across sectors of the economy by closing off targeted subsidies.

An admittedly less than fully scientific source of evidence is simply asking economists what they think. In a survey of 134 public finance and labor economists, the estimated median effect of the Tax Reform Act of 1986 on the long-term size of the economy was one percent (Fuchs et al. 1998). Note that TRA 86 did not reduce public saving, so the growth effect was entirely due to changes in marginal tax rates and the tax base. The median response also suggested that the 1993 tax increases had no effect on economic growth. The 1993 act raised tax rates on the highest income households, but also reduced the deficit and thereby increased national saving.

One strong finding from all of the analysis is that not all tax changes will have the same impact on growth. Reforms that improve incentives, reduce existing subsidies, avoid windfall gains, and avoid deficit financing will have more auspicious effects on the long-term size of the economy, but in some cases may also create trade-offs between equity and efficiency.

These findings illustrate both the potential benefits and the potential perils of income tax reform on long-term economic growth.

References

- Acosta-Ormaechea, Santiago and Yoo, Jiae. 2012. "Tax Composition and Growth: A Broad Cross-Country Perspective." IMF Working Paper No. 12/257.
- Altig, David, Alan J. Auerbach, Laurence J. Kotlikoff, Kent A. Smetters, and Jan Walliser. 2001. "Simulating U.S. Tax Reform." *American Economic Review* 91 (3): 574 – 95.
- Arnold, Jens Matthias, Bert Brys, Christopher Heady, Åsa Johansson, Cyrille Schwellnus, and Laura Vartia. 2011. "Tax Policy for Economic Recovery and Growth." *The Economic Journal* 121 (550): F59 – F80.
- Auerbach, Alan J. 2002. "The Bush Tax Cut and National Saving." Berkeley: University of California, Berkeley and NBER.
- Auerbach, Alan J., Laurence J. Kotlikoff, Kent A. Smetters and Jan Walliser. 1997. "Fundamental Tax Reform and Macroeconomic Performance." Washington, D.C: Congressional Budget Office.
- Auerbach, Alan J., and Joel Slemrod. 1997. "The Economic Effects of the Tax Reform Act of 1986." *Journal of Economic Literature* 35 (2): 589 – 632.
- Bernheim, B. Douglas. 2002. "Taxation and Saving." *Handbook of Public Economics* 3: 1173 – 1249.
- Carroll, Christopher D., and David N. Weil. 1994. "Saving and Growth: A Reinterpretation." *Carnegie-Rochester Conference Series on Public Policy* 40: 133 – 192.
- Chetty, Raj, Adam Guren, Day Manoli, and Andrea Weber. 2011. "Are Micro and Macro Labor Supply Elasticities Consistent? A Review of Evidence on the Intensive and Extensive Margins." *American Economic Review* 101(3): 471 – 75.
- Chetty, Raj, Adam Guren, Day Manoli, and Andrea Weber. 2013. "Does Indivisible Labor

- Explain the Difference between Micro and Macro Elasticities? A Meta-Analysis of Extensive Margin Elasticities.” *NBER Macroeconomics Annual* 27 (1): 1 - 56.
- Committee on Ways and Means. 2014. “Tax Reform Act of 2014: Discussion Draft.” Washington, D.C: 113th Congress. 2nd Session.
- Congressional Budget Office. 2001. “The Budget and Economic Outlook: An Update.”
- Congressional Budget Office. 2005. “Taxing Capital Income: Effective Rates and Approaches to Reform.”
- Congressional Budget Office. 2006. “Computing Effective Tax Rates on Capital Income.”
- Congressional Budget Office. 2010. “The Budget and Economic Outlook: An Update.”
- Congressional Budget Office. 2013. “The 2013 Long-Term Budget Outlook.”
- Dennis, Robert, et al. 2004. “Macroeconomic Analysis of a 10 Percent Cut in Income Tax Rates.” Technical Paper Series. Washington, D.C: Congressional Budget Office.
- Debt Reduction Task Force. 2010. “Restoring America’s Future: Reviving the Economy, Cutting Spending and Debt, and Creating a Simple, Pro-Growth Tax System.” Washington, D.C: Bipartisan Policy Center.
- Desai, Mihir A., and Austan D. Goolsbee. 2004. “Investment, Overhang, and Tax Policy.” *Brookings Papers on Economic Activity* 2004 (2): 285 – 355.
- Diamond, John W., and Alan D. Viard. 2008. “Welfare and Macroeconomic Effects of Deficit-Financed Tax Cuts: Lessons from CGE Models.” In Alan D. Viard (ed.) *Tax Policy Lessons from the 2000s*. Washington, D.C: The AEI Press: 145 – 193.
- Diamond, John W., and George Zodrow. 2008. “Consumption Tax Reform: Changes in Business Equity and Housing Prices” *Fundamental Tax Reform: Issues, Choices and Implications*. Cambridge: MIT Press

- Economic Report of the President. 2003. Washington, D.C: United States Government Printing Office.
- Eissa, Nada. 2008. "Evidence on Labor Supply and Taxes, and Implications for Tax Policy." In Alan D. Viard (ed.) *Tax Policy Lessons from the 2000s*. Washington, D.C: The AEI Press: 45 – 91.
- Elmendorf, Douglas W., and N. Gregory Mankiw. 1999. "Government Debt." *Handbook of Macroeconomics* 1C. Edited by John B. Taylor and Michael Woodford. Amsterdam: Elsevier Science B.V.
- Elmendorf, Douglas W., and David Reifschneider. 2002. "Short Run Effects of Fiscal Policy with Forward-Looking Financial Markets." *National Tax Journal* 55 (3): 357-86.
- Engen, Eric, and R. Glenn Hubbard. 2004. "Federal Government Debts and Interest Rates." Cambridge: National Bureau of Economic Research Working Paper 10681.
- Engen, Eric M., and Jonathan Skinner. 1992. "Fiscal Policy and Economic Growth." Cambridge: National Bureau of Economic Research Working Paper 4223.
- Engen, Eric M., and Jonathan Skinner. 1996. "Taxation and Economic Growth." *National Tax Journal* 49 (4): 617-42.
- Favero, Carlo, and Francesco Giavazzi. 2009. "How Large Are The Effects of Tax Changes?" Cambridge: National Bureau of Economic Research Working Paper 15303.
- Feldstein, Martin. 1986. "Supply Side Economics: Old Truths and New Claims." *American Economic Review* 76 (2): 26-30.
- Feldstein, Martin, and Douglas W. Elmendorf. 1989. "Budget Deficits, Tax Incentives, and Inflation: A Surprising Lesson from the 1983-1984 Recovery." Edited by Lawrence H. Summers. *Tax Policy and the Economy* (3). Cambridge: National Bureau of Economic

Research.

- Foertsch, Tracy. 2004. "Macroeconomic Impacts of Stylized Tax Cuts in an Intertemporal Computable General Equilibrium Model." Washington, D.C: Congressional Budget Office.
- Fuchs, Victor R., Alan B. Krueger, and James M. Poterba. 1998. "Economists' Views About Parameters, Values, and Policies: Survey Results in Labor and Public Economics." *Journal of Economic Literature* 36 (3): 1387-1425.
- Fullerton, Don, and Y.K. Henderson. 1987. "The Impact of Fundamental Tax Reform on the Allocation of Resources" in M. Feldstein, ed., *The Effects of Taxation on Capital Accumulation*, Chicago: The University of Chicago Press
- Gale, William G., and Peter R. Orszag. 2004a. "Budget Deficits, National Saving, and Interest Rates." *Brookings Papers on Economic Activity* 2004 (2): 101-187.
- Gale, William G., and Peter R. Orszag. 2004b. "Tax Cuts, Interest Rates, and the User Cost of Capital." Washington, D.C: The Brookings Institution.
- Gale, William G., and Peter R. Orszag. 2005a. "Deficits, Interest Rates, and the User Cost of Capital: Reconsidering the Effects of Tax Cuts on Investment". *National Tax Journal* 58 (3): 409-426.
- Gale, William G., and Peter R. Orszag. 2005b "Economic Effects of Making the 2001 and 2003 Tax Cuts Permanent." *International Tax and Public Finance*. 12 (2): 193-232.
- Gale, William G., and Samara Potter. 2002. "An Economic Evaluation of the Economic Growth and Tax Relief Reconciliation Act." *National Tax Journal* 55 (1): 133-86.
- Garrison, Charles B., and Feng-Yao Lee. 1992. "Taxation, Aggregate Activity and Economic Growth: Further Cross-country Evidence on Some Supply-Side Hypotheses." *Economic*

- Inquiry* 30 (1): 172-76.
- Gravelle, Jane G. 2014. "Dynamic Scoring for Tax Legislation: A Review of Models." Washington, D.C: Congressional Research Service.
- Gravelle, Jane G., and Laurence J. Kotlikoff. 1989. "Corporate Taxation and the Efficiency Gains of the 1986 Tax Reform Act." Cambridge: National Bureau of Economic Research.
- Grier, Kevin B., and Gordon Tullock. 1989. "An Empirical Analysis of Cross-National Economic Growth, 1951-80." *Journal of Monetary Economics* 24 (2): 259-76.
- Harberger, Arnold. 1962. "The Incidence of the Corporation Income Tax." *Journal of Political Economy* 70 (3): 215-40.
- Huang, Chye-Ching. 2012. "Recent Studies Find Raising Taxes on High-Income Households Would Not Harm the Economy: Policy Should Be Included in Balanced Deficit-Reduction Effort." Washington, D.C: Center on Budget and Policy Priorities.
- Huang, Chye-Ching, and Nathaniel Frentz. 2014. "What *Really* is the Evidence on Taxes and Growth." Washington, D.C: Center on Budget and Policy Priorities.
- Hungerford, Thomas. 2012. "Taxes and the Economy: An Economic Analysis of the Top Tax Rate Since 1945." Washington, D.C: Congressional Research Service.
- Joint Committee on Taxation. 2003. "Macroeconomic Analysis of H.R. 2, The Jobs and Growth Reconciliation Tax Act of 2003." Washington D.C: 108th Congress.1st session.
- Joint Committee on Taxation. 2014. "Macroeconomic Analysis of the Tax Reform Act of 2014." Washington, D.C: 113th Congress. 2nd Session.
- Jones, Larry E., Rodolfo E. Manuelli, and Peter E. Rossi. 1993. "Optimal Taxation in Models of Endogenous Growth." *Journal of Political Economy* 101 (3): 485–517.
- Keane, Michael P. 2011. "Labor Supply and Taxes." *Journal of Economic Literature* 49 (4): 961

– 1075.

Keane, Michael P., and Richard Rogerson. 2012. “Micro and Macro Labor Supply Elasticities: A Reassessment of Conventional Wisdom.” *Journal of Economic Literature* 50 (2): 464 – 476.

Kneiser, Thomas J., and James P. Ziliak. 2002. “Tax Reform and Automatic Stabilization.” *The American Economic Review* 92 (36): 590-612

Laubach, Thomas. 2009. “New Evidence on the Interest Rate Effects of Budget Deficits and Debt.” *Journal of the European Economic Association* 7 (4): 858-85.

Lim Rogers, Diane (Now Diane Lim). 1997. “Assessing The Effects of Fundamental Tax Reform With The Fullerton-Rogers General Equilibrium Model.” Washington, D.C: Congressional Budget Office

Lucas, Robert E. 1990. “Supply-Side Economics: An Analytical Review.” *Oxford Economic Papers* 42 (2): 293-316.

Macroeconomic Advisors. 2003. “A Preliminary Analysis of the President’s Jobs and Growth Proposals.” Washington, D.C.

McBride, William. 2012. “What Is The Evidence on Taxes and Growth.” Special Report No. 207. Washington, D.C: The Tax Foundation.

Mendoza, Enrique G., Gian-Maria Milesi-Ferretti, and Patrick Asea. 1997. “On the Ineffectiveness of Tax Policy in Altering Long-Run Growth: Harberger's Superneutrality Conjecture.” *Journal of Public Economics* 66 (1): 99-126.

National Commission on Fiscal Responsibility and Reform. 2010. “The Moment of Truth.” Washington, D.C: The White House

Nishiyama, Shinichi, and Kent Smetters. 2005. “Consumption Taxes and Economic Efficiency

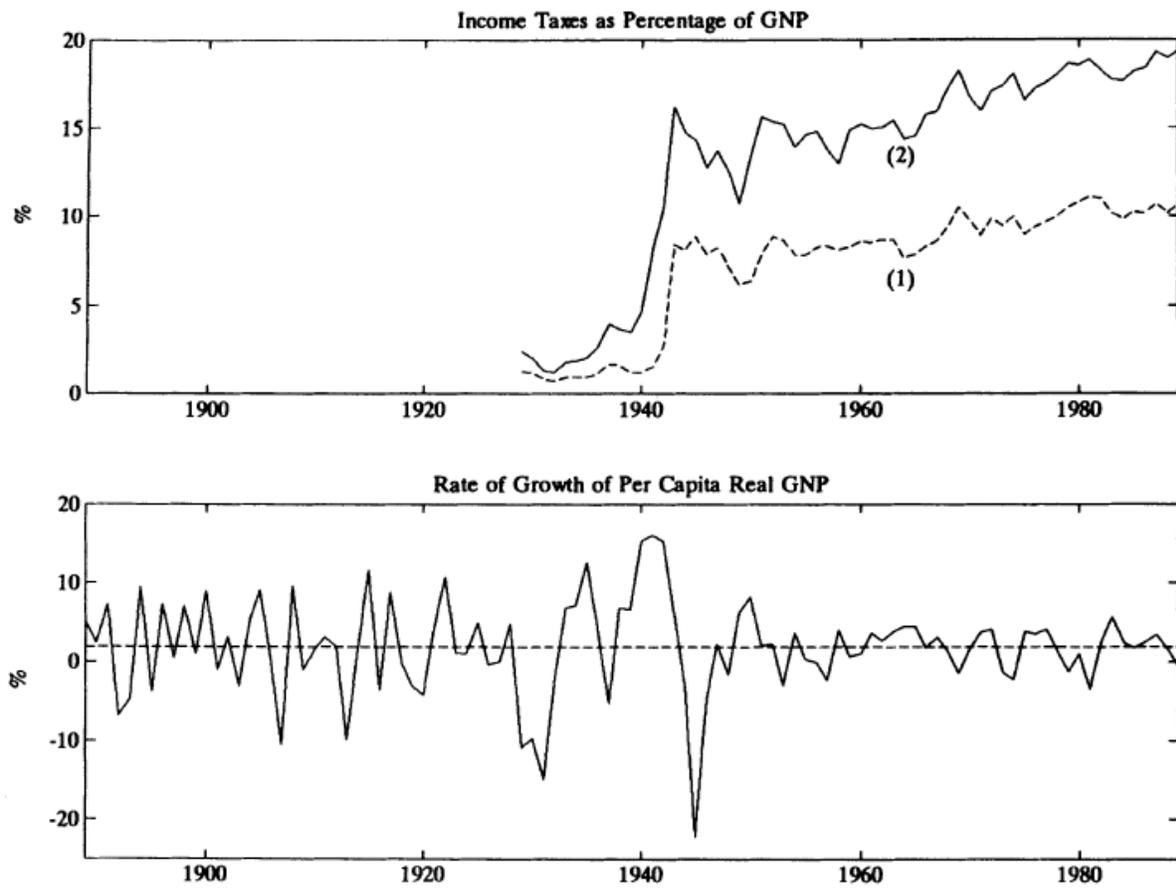
- with Idiosyncratic Wage Shocks.” *Journal of Political Economy* 113 (5): 1088-115.
- Padovano, Fabio, and Emma Galli. 2001. “Tax Rates and Economic Growth in the OECD Countries (1950-1990).” *Economic Inquiry* 39 (1): 44-57.
- Piketty, Thomas, Emmanuel Saez, and Stefanie Stantcheva. 2011. “Optimal Taxation of Top Labor Incomes: A Tale of Three Elasticities.” Cambridge: National Bureau of Economic Research Working Paper 17616
- President’s Advisory Panel on Federal Tax Reform. 2005. “Simple, Fair, and Pro-Growth: Proposals to Fix America’s Tax System.” Washington, D.C.
- Reifschneider, David, Robert Tetlow, and John Williams. 1999. “Aggregate Disturbances, Monetary Policy, and the Macroeconomy: The FRB/US Perspective.” *Federal Reserve Bulletin* 1999 (January): 1-19.
- Romer, Christina D., and David H. Romer. 2010. “The Macroeconomic Effects of Tax Changes: Estimates Based on a New Measure of Fiscal Shocks.” *American Economic Review*. 100 (3): 763-801
- Slemrod, Joel. 1995. “What Do Cross-Country Studies Teach About Involvement, Prosperity, and Economic Growth?” *Brookings Papers on Economic Activity* 1995 (2): 373-415.
- Stokey, Nancy L., and Sergio Rebelo. 1995. “Growth Effects of Flat-Rate Taxes.” *Journal of Political Economy* 103(3): 519-50.
- Taylor, John. 1993. “Discretion versus policy rules in practice.” *Carnegie-Rochester Conference Series on Public Policy* (39): 195–214.
- Toder, Eric, and Alan D. Viard. 2014. “Major Surgery Needed: A Call for Structural Reform of the U.S. Corporate Income Tax.” Washington, D.C.

Table 1

Long-Term Effects of a Deficit-Financed 10 Percent Cut in Income Tax Rates (Percentage Change in GDP and GNP)				
Model	Financed in the long-run by:			
	Cuts in Spending		Increase in Income Tax Rates	
	GDP	GNP	GDP	GNP
OLG - Closed*	-0.1	-0.1	-1.5	-1.5
OLG - Open	0.5	-0.4	0.2	-2.1
Ramsey*	0.8	0.8	-1.2	-1.2

Source: Dennis et al. (2004).
 *GNP and GDP are the same in these models.

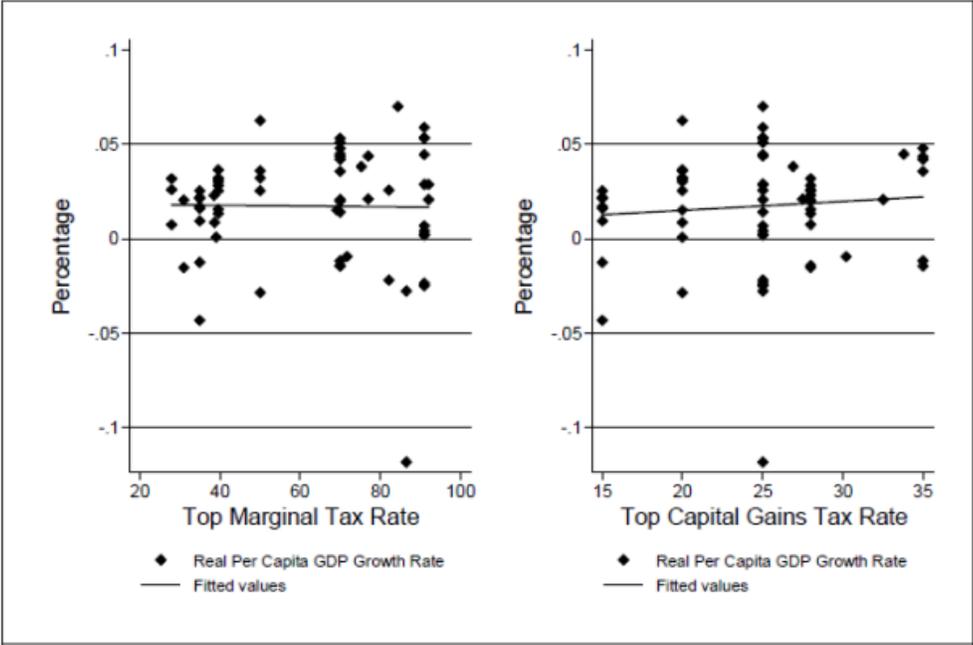
Figure 1. Taxes as a Share of GNP and Growth of Real GNP per Capita, 1889-1989



Source: Stokey and Rebelo (1995)

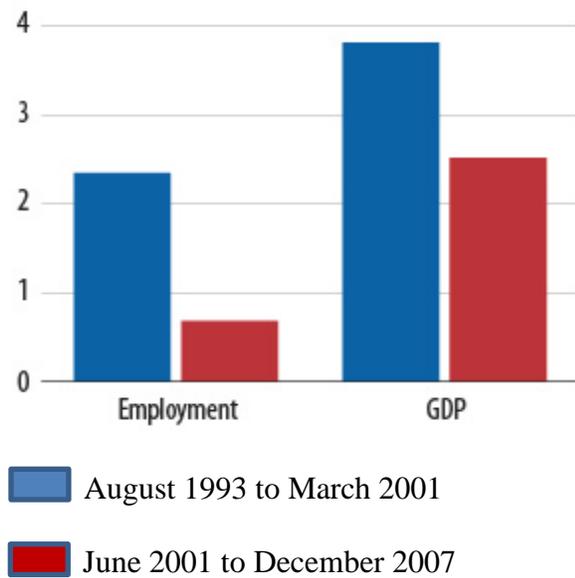
Note: In the top graph, line 1 consists of federal, state, and local individual income taxes. Line 2 adds social security and retirement taxes as well as federal corporate taxes.

Figure 2. Real Per Capita GDP Growth Rate and Top Tax Rates, 1945-2010



Source: Hungerford (2012)
Note: The vertical axis is the real per capita GDP growth rate.

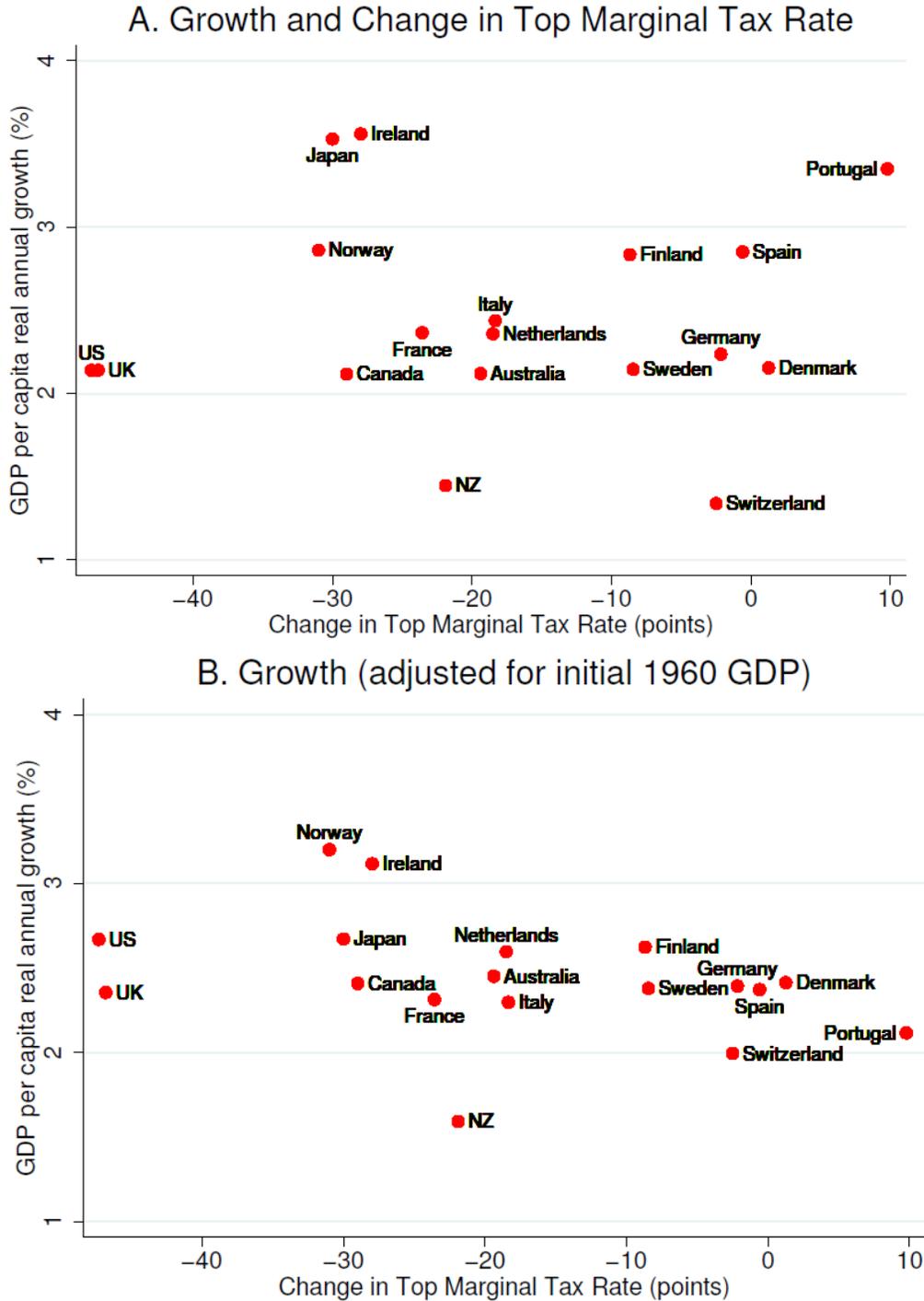
Figure 3. Employment and GDP Growth Following the 1993 Tax Increases and the 2001 Tax Cuts



Source: Huang (2012)

Note: The vertical axis is the average annual growth rate during the time period

Figure 4. Economic Growth Rates and Top Marginal Tax Rates, 1960-2010



Source: Piketty, Saez, and Stantcheva (2011)

Note: The figure depicts the average real GDP per capita annual growth rate from 1960-1964 to 2006-2010 against the change in the top marginal tax rate. Panel A considers the raw growth rate while panel B adjusts the growth rate for initial real GDP per capita as of 1960.