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The Economic Effects of Changes in Personal Income Tax Rates

We apply an empirical perspective to understand the macroeconomic consequences of changes in personal income taxes.

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The views expressed in this article are not necessarily those of the Federal Reserve.

The personal federal income tax as we know it today was adopted in 1913 after a protracted political and judicial process that culminated in the ratification of the 16th Amendment.[1] Within 60 years, most U.S. states had implemented a personal state income tax as well, and the federal government had added the Social Security payroll tax.[2] Throughout this process and ever since, personal income taxation has been an intensely debated issue in policy and academic circles. But even after all these debates, experts still disagree about exactly how personal income tax rates affect individual economic behavior and macroeconomic outcomes.

Some empirical studies find that economic activity responds to cuts in marginal tax rates but not to cuts in average tax rates. Other studies find that both marginal and average tax rates affect the economy. Likewise, some empirical evidence shows that tax cuts for workers with high earnings lead to sizable changes in personal income, and also that such cuts are more effective in stimulating economic activity in the near term than tax cuts for workers with lower earnings. Other research, however, argues the opposite.[3]

This lack of consensus in the empirical literature complicates the design of not only fiscal policy reforms aimed at achieving long-run economic growth but also fiscal policy actions aimed at stimulating short-run economic activity.

*See **Marginal vs. Average Personal Income Tax Rates**.* →

To address these issues, we need to tackle a few

questions. Do changes in tax policy operate by means of supply side effects associated with marginal tax rates—by, for example, fostering incentives to work or to take on entrepreneurial opportunities? Or do they operate through demand effects associated with average tax rates—by, for example, fostering consumption among individuals who now have more after-tax income to spend? Does tax policy operate through trickle-down effects, whereby cutting marginal tax rates for those at the top of the income distribution leads to broad economic gains? Or does it operate through bottom-up effects by stimulating people outside the top of the income distribution to work longer hours or join the labor force, raising their incomes and inducing economic growth?

In this article, I examine these questions from an empirical perspective and analyze how changes in personal income taxes affect economic activity.

Economic Consequences of Changes in Marginal Rates

Assessing the economic consequences of changes in marginal tax rates is challenging due to two features of income taxation. First, the marginal tax rate paid by an individual depends on their level of income. Second, there are three types of personal income taxes: federal income taxes, state income taxes, and Social Security payroll taxes.

Because marginal tax rates depend on the level of income, there is no one marginal tax rate for everyone. Instead, there's a distribution of rates across the population. And because we have three types of income taxes, there are three distributions: one for federal income marginal tax rates, one for state income marginal tax rates, and one for payroll marginal tax rates. But, to analyze the aggregate effects of tax changes, it is useful to rely on a single, succinct measure that allows us to study what happens within the economy when any of these distributions change.

Economists' primary summary indicator of marginal tax rates is the overall average marginal tax rate—that is, the sum of federal, state, and payroll tax rates across taxpayers weighted by their income relative to the total income of the population.[6] This rate corresponds to

Marginal vs. Average Personal Income Tax Rates

The marginal tax rate is the tax rate imposed on an additional dollar of adjusted gross income.

Adjusted gross income is defined as gross income (which includes wages and other forms of income, such as dividends, capital gains, and business income) minus adjustments such as interest paid on student loans and contributions to a retirement account.

Under the current federal tax code, the marginal tax rate is graduated, increasing with each higher level of income (Figure 1). The same holds for most state income taxes, albeit the rates are lower and differ by states. In contrast, the marginal rate on the Social Security payroll tax, though graduated, decreases with income.[4]

For ease of exposition, let's ignore state income and payroll taxes. Now imagine an individual with an income of $72,400 (corresponding to the tax year 2020) who uses the standard deduction (which is $12,400). If we ignore other components of the tax code, such as tax credits and exemptions, that taxpayer has a taxable income of $60,000 and pays a tax rate equal to 10 percent on their first $9,875 of income, 12 percent on income between $9,875 and $40,125, and 22 percent on income above $40,125.

Consequently, this individual faces a marginal tax rate of 22 percent: If they make an additional dollar of income, they effectively receive 78 cents. Notice that the marginal tax rate can be transformed into a net-of-tax marginal rate, which is defined as 1 minus the marginal tax rate. In our example, the net-of-tax marginal rate is 0.78. The net-of-tax marginal rate is a key concept for gauging how individuals respond to changes in marginal rates, because ultimately what matters for an individual is the amount that they take home from each additional dollar of income.

The average tax rate is the total amount of taxes paid by a taxpayer divided by their adjusted gross income. Our hypothetical taxpayer pays a total of $8,990 in taxes, and hence their average tax rate is 12.4 percent.[5]

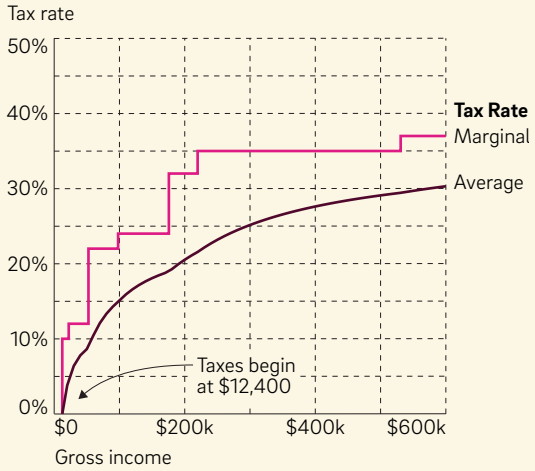
While this example is useful for distinguishing marginal from average tax rates, in reality individuals face lower net-of-tax marginal rates and higher average tax rates. This is because in addition to the federal income tax, they pay state income taxes and payroll taxes. When I assess the economic consequences of personal income taxation elsewhere in this article, unless stated otherwise, the measures of marginal and average tax rates that I use take into account federal, state, and (individual and employer) payroll taxes.

FIGURE 1

Two Ways to Measure Taxes

The marginal tax rate is graduated, increasing with each higher level of income.

Marginal tax rate (the tax paid on each additional dollar of adjusted gross income) and average tax rate (total taxes divided by total income at each level of adjusted gross income)



Source: Author's calculations based on the IRS marginal tax rates for a single individual filing in the tax year 2020.

Structural Vector Autoregressions

A structural vector autoregression (SVAR) is an econometric model that characterizes the joint behavior of economic variables. An SVAR is made up of equations designed to represent different sectors of the economy. Some equations describe the production side of the economy, others the demand side, and others the behavior of policymakers.

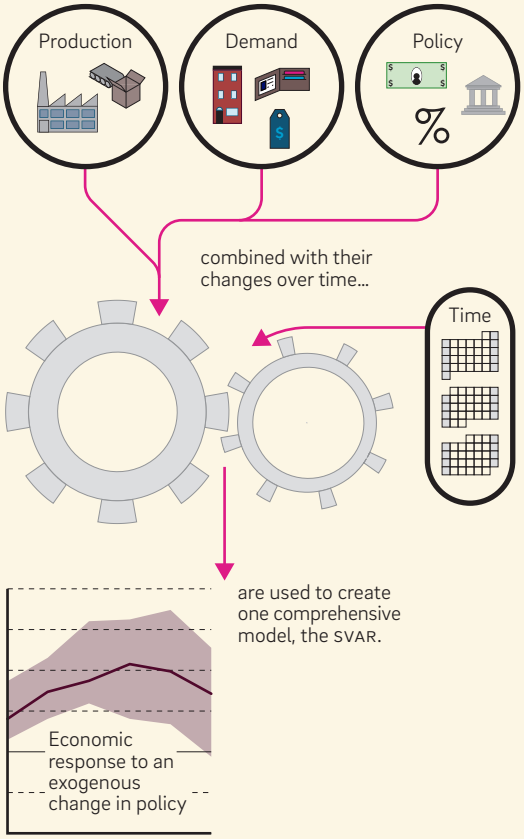
For example, when setting a graduated tax rate schedule, policymakers typically take into account special factors affecting current economic activity, such as the effects of a change in government spending or an adverse shock affecting the purchasing power of households.

By explicitly modeling how variables under the control of policymakers (like the graduated tax rate schedule) interact with other variables (such as economic conditions) in a flexible manner, SVARs offer a useful framework for understanding the effects of policy changes without having to introduce specific economic modelling restrictions regarding the functioning of the entire economy.

FIGURE 7

SVARs Explained

Variables and equations representing facets of the economy...



the average marginal tax rate paid by a representative individual in the population (Figure 2).[7]

Armed with the average marginal tax rate, we can study the effects of changes in marginal tax rates on aggregate economic activity. But how, precisely? Structural vector autoregressions (SVARs) are one of the most powerful tools economists have for assessing how changes in economic policies affect the economy.

Using SVARs and building on the 2018 work of economists Karel Mertens of the Federal Reserve and José Luis Montiel Olea of Columbia University, Emory University economist Juan Rubio-Ramírez, Federal Reserve economist Daniel Waggoner, and I estimated how key macroeconomic variables react to a tax cut.[8] Specifically, we considered an increase of about 1 percent in the net-of-tax average marginal tax rate based on post-World War II data (Figure 3). The net-of-tax average marginal rate is 1 minus the average marginal tax rate, so an increase in the net-of-tax average marginal rate is equivalent to a decrease in the average marginal rate, that is, a tax cut. One year after the tax cut, personal income increases by about 1.3 percent, real GDP increases by about 0.7 percent, and unemployment declines by a tad more than 0.3 percentage point.[9]

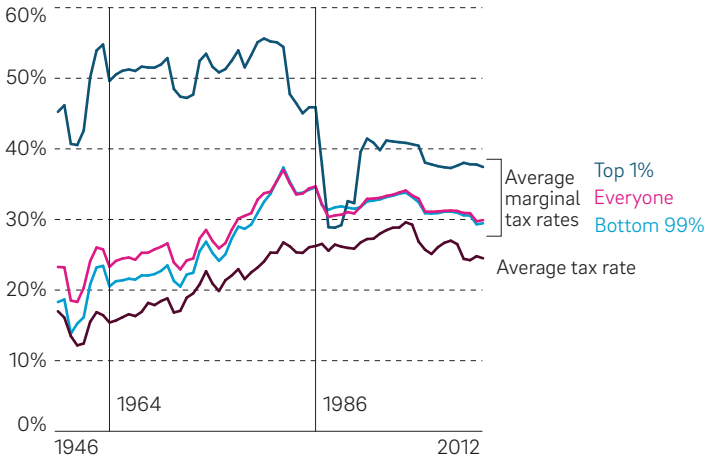
*See **Structural Vector Autoregressions**.*

FIGURE 2

The Evolution of Personal Income Tax Rates After World War II

To understand the economic effects of changes in personal income tax rates, we exploit exogenous changes in these rates such as those induced by the Revenue Act of February 1964 and the Tax Reform Act of October 1986.

Average tax rate and average marginal tax rates, 1946–2012



Source: Mertens and Montiel Olea (2018).

Note: The average tax rate is defined as the sum of federal personal current taxes and contributions for social insurance divided by total income. The average marginal tax rate is the sum of federal, state, and payroll tax rates across taxpayers weighted by their income relative to the total income of the population. The average marginal tax rate for the top 1 percent and bottom 99 percent correspond to the sum of federal income tax rates and payroll tax rates across taxpayers in a given bracket of the income distribution, weighted by their income relative to the total income of these taxpayers' income bracket.

Changes in marginal tax rates are persistent. According to our estimates, the net-of-tax average marginal rate remains essentially constant during the year after it was changed. It then only gradually returns to its previous level. Given this pattern, households likely understand that changes in taxes will persist for a while but eventually will be reversed. This is insightful because the strength of the economic response depends on whether households perceive the change as permanent or transitory.

Marginal vs. Average Tax Rates

The sizable macroeconomic effects associated with changes in marginal tax rates suggest that strong substitution effects are at play. In particular, the responses of real GDP, personal income, and unemployment are consistent with an increase in the labor supply by households induced to work by lower taxes. Changes in marginal tax rates can also have wealth effects, but these effects seem to be minor, so economists generally associate modifications in federal income tax brackets exclusively with substitution effects.[10]

*See **Substitution and Wealth Effects.***

To what extent are these substitution effects the main driver of the economic response to changes in tax rates? To find out, Mertens and Montiel Olea compared the economic effects of changes in net-of-tax average marginal rates, which are more directly related to substitution effects, with the economic effects of changes in average tax rates, which are more directly related to wealth effects.[11] They found no evidence of an economic response to changes in average tax rates, so tax reforms, they reasoned, likely operate exclusively through substitution effects.

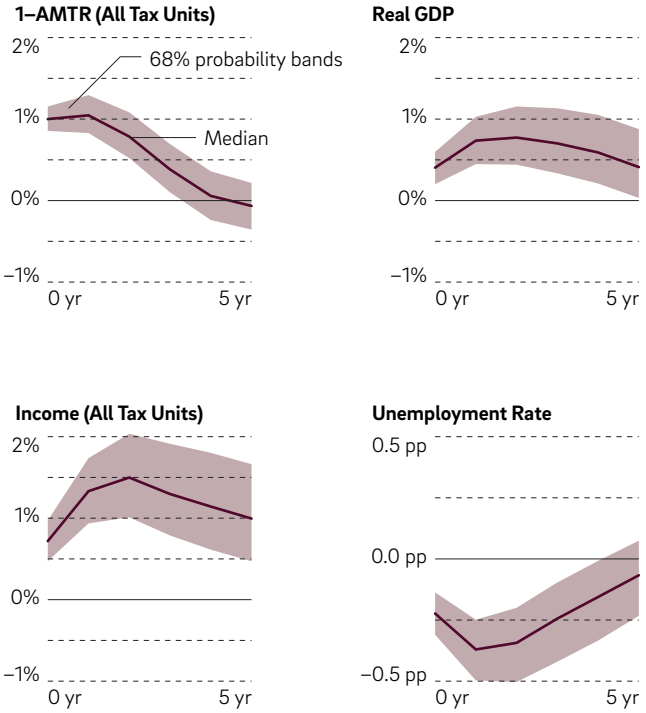
But their conclusion hinges on a particular counterfactual tax experiment that compares marginal with average tax rates. When Rubio-Ramírez, Waggoner, and I used an alternative and more flexible approach to compare the two, we found that changes in average tax rates do also affect personal income, real GDP, and the unemployment rate (Figure 4).[12, 13]

We estimated the changes in personal income, real GDP, and the unemployment rate one year after an increase of 1 percent in the net-of-tax average marginal rate, and one year after a decline of about 1 percent in the average tax rate.[14] Based on our estimates, when we increase the net-of-tax marginal tax rate by 1 percent, real personal income increases by 1.5 percent, real GDP increases by 0.8 percent, and the unemployment rate declines by about

FIGURE 3

What Happens If We Cut the Marginal Tax Rate?

Change in real GDP and income (percent) and the unemployment rate (percentage points) in the five years after a hypothetical increase of about 1 percent in the net-of-tax average marginal tax rate (AMTR).



Source: Author's calculations based on Arias, Rubio-Ramírez, and Waggoner (forthcoming).

Note: A tax filing unit is typically defined as any married person or any single person aged 20 or older.

Substitution and Wealth Effects

When analyzing the economic consequences of a tax cut, it helps to think in terms of wealth effects and substitution effects.

Wealth effects are directly related to the level of consumption and leisure that households can achieve during their lifetimes. For example, consider the single individual in the sidebar Marginal vs. Average Personal Income Tax Rates who pays $8,990 in taxes on $72,400 of adjusted gross income. If this individual's standard deduction permanently increases by about $4,000, they pay $880 less in taxes. Thus, their wealth increases, and hence their consumption and leisure increase, too. Importantly, wealth effects depend on the permanence of the cut. If the individual perceives the increase in the standard deduction as a transitory change financed by future higher taxes, then they will most likely save the additional income from today's lower taxes to pay for tomorrow's higher taxes. In such a case, the wealth effect would be nil.

Substitution effects result from changes in the relative cost of leisure and consumption (that is, the marginal cost of leisure in terms of consumption). For example, if, instead of an increase in the standard deduction, this individual faces a lower marginal tax rate, then an extra hour of their leisure time (which equals an extra hour of forgone paid labor) becomes more costly, and they will probably choose to work additional hours instead. Again, it matters whether the change is transitory or permanent. In canonical macroeconomic models, a permanent reduction in the marginal tax rate that leaves the present value of government revenues unchanged causes a permanent increase in labor and consumption, whereas a transitory reduction causes a short-lived increase in labor and a somewhat longer but transient increase in consumption.[16]

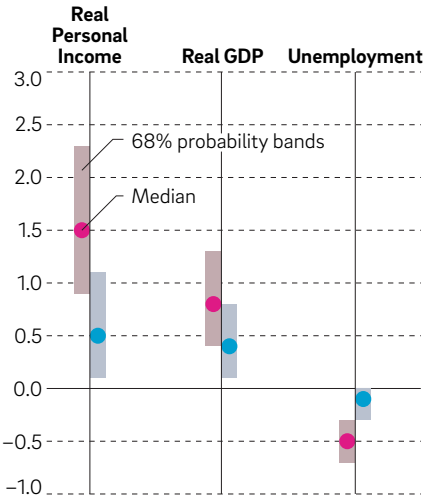
FIGURE 4

Changes in Average Tax Rates, Like Changes in Net-of-Tax Average Marginal Tax Rates, Affect Macroeconomic Indicators

Percent change in key macroeconomic variables

Increase in the Net-of-Tax (AMTR)

Decrease in the Average Tax Rate



Source: Arias, Rubio-Ramírez, and Waggoner (forthcoming).

0.5 percentage point. Similarly, when we reduce the average tax rate by 1 percent, real personal income increases by 0.5 percent, real GDP increases by 0.4 percent, and the unemployment rate decreases by 0.1 percentage point. In other words, when evaluating how changes in tax policy affect the economy, substitution effects related to changes in marginal tax rates are important, but wealth effects related to changes in average tax rates also play a role.[15]

The Effects of Personal Income Taxation Across Income Groups

So far I've focused on the effects of changes in tax rates that apply to all individuals, as summarized by the average marginal tax rate and the average tax rate. But this does not reflect differences in tax rates levied on people in different income brackets. Does the economy respond differently to tax cuts for specific income brackets?

This is a strongly debated question inside and outside academia. The logic of trickle-down economics suggests that reducing the tax rate for high earners stimulates the economy because workers with the most valued skills increase their labor supply and their investment in entrepreneurial activities in response to lower taxes. According to this view, these effects eventually raise income and increase employment opportunities for all households. The logic of bottom-up economics suggests that reducing the tax rate for low earners enables low-income households to break away from work disincentives such as means-tested benefits, and that it stimulates consumption because households with low earnings have a higher marginal propensity to consume. (That is, they are more likely to spend a higher share of an additional dollar of income.) According to this view, these effects lead to broad gains in economic activity.

Which view is supported by the data? The estimates based on my work with Rubio-Ramírez and Waggoner indicate that both forces are at play, but with different timing.

Inspired by the work of Mertens and Montiel Olea and using their measures of exogenous variation in marginal tax rates (that is, changes in marginal tax rates unrelated to contemporaneous macroeconomic conditions and government spending at the time of the change), we studied the effects of changes in these tax rates at the top and bottom of the income distribution.[17] We found that exogenous changes in the marginal tax rate for the top 1 percent of the income distribution have large short-run effects (Figure 5). One year after a 1 percent increase in the net-of-tax marginal rate (that is, a tax cut for the top 1 percent), personal income for the top 1 percent increases by about 1.5 percent, real GDP expands, and the unemployment rate declines. We also find evidence of trickle-down effects: The income of the bottom 99 percent also increases, albeit by less than for the top 1 percent. Consequently, income inequality increases when we reduce the tax rate for the rich, but the effects are largely transitory.

Turning to the exogenous changes in the marginal tax rate for the bottom 99 percent of the income distribution, we found that these tax changes have large medium- to long-run effects (Figure 6). Three years after a roughly 1 percent increase in the net-of-tax marginal rate (that is, a tax cut for the bottom 99 percent), income for the bottom 99 percent rises by about 2 percent. In addition, this tax change is associated with a large increase in real GDP and a decline in the unemployment rate. Three years after the reduction in tax rates for the bottom 99 percent, real GDP is 1.5 percent higher and the unemployment rate is about 0.4 percentage point lower. Interestingly, income for the top 1 percent also increases significantly after three years, suggesting the presence of bottom-up effects.

When we compared the effects of tax cuts for the top 1 and bottom 99 percent, we found support for both the trickle-down and bottom-up arguments. There are, however, some differences. According to our estimates, cutting taxes for the top 1 percent causes short-run gains but negligible medium- to long-run gains, whereas cutting taxes for the bottom 99 percent causes larger medium- to long-run gains but smaller short-run gains. The timing of these gains may influence the popularity of different tax reforms.

Our findings are not definitive. Although Mertens and Montiel Olea, using a different counterfactual tax experiment, came to a remarkably similar conclusion, we might not be fully isolating the effects of each type of tax change.[18] In addition, our findings on the trickle-down effects are at odds with a recent paper by Princeton economist Owen Zidar, who finds that exogenous changes in personal income tax rates for people in the bottom 90 percent affect the economy, but changes for people in the top 10 percent do not. Our findings may differ from Zidar's because we measured the economic effects with respect to changes in the marginal tax rate, whereas Zidar's study focuses on total tax liability changes. As shown above, the responses to changes in average and marginal tax rates can differ, so more research is needed to reconcile these findings.

Conclusion

In this article I use an empirical perspective to revisit important questions about personal income taxation. Based on my research, tax cuts—in the form of reductions either in the marginal tax rates or on the overall tax burden—are associated with increases in economic activity.

Furthermore, reducing tax rates on the top 1 percent as well as on the bottom 99 percent leads to higher economic activity.

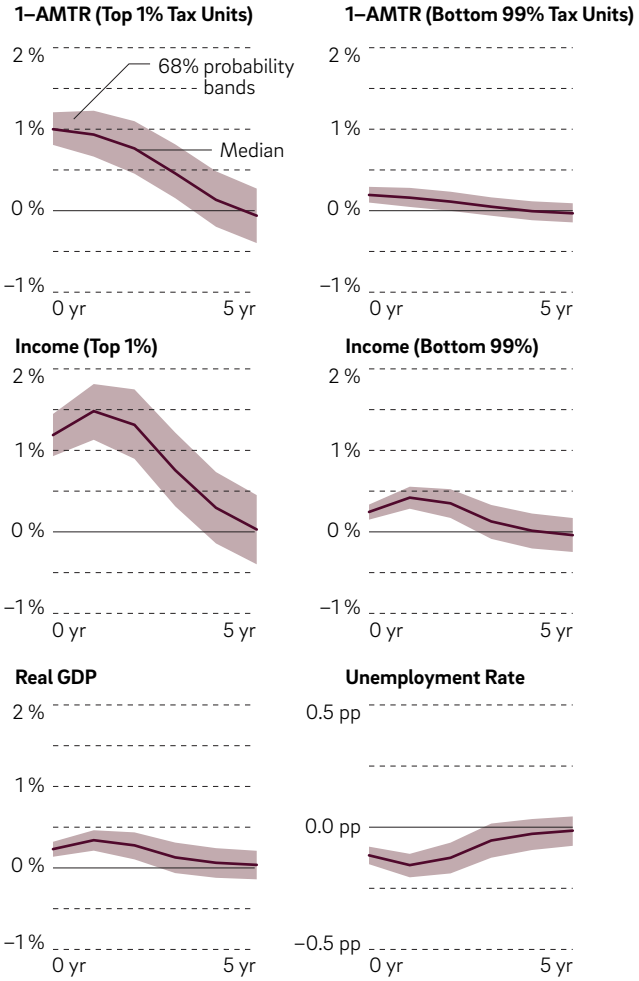
Nevertheless, these results do not imply that lower taxes benefit society. Such a normative statement requires economic modeling that, among other things, considers the medium- to long-run economic consequences for income inequality and welfare. The latest theoretical models incorporating those effects typically feature an explicit role for income risk, Social Security benefits, and government budget constraints. These theoretical models, which dominate the literature on optimal personal income taxation, commonly find that increasing the current marginal tax rate for the top 1 percent would lessen income inequality and improve social welfare.[19]

FIGURE 5

What Happens If We Cut Taxes for the Wealthy?

Income inequality increases when we reduce the marginal tax rate for the rich, but the effects are largely transitory.

Change in real GDP and income (percent) and the unemployment rate (percentage points) in the five years after a hypothetical increase of about 1 percent in the net-of-tax average marginal tax rate (AMTR) for the top 1 percent of the income distribution.



Source: Author's calculations based on Arias, Rubio-Ramírez, and Waggoner (forthcoming).

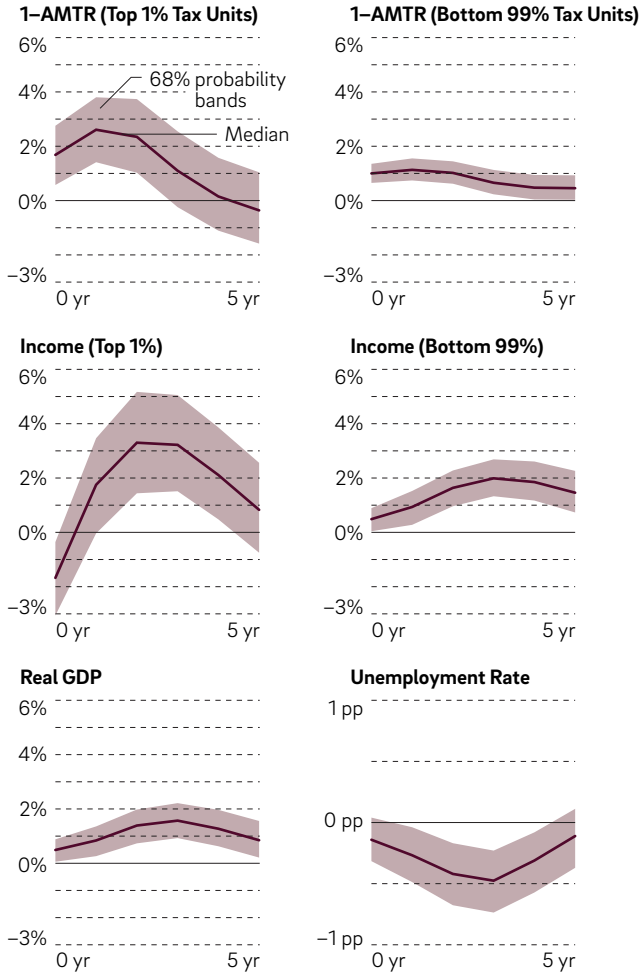
Note: A tax filing unit is typically defined as any married person or any single person aged 20 or older.

FIGURE 6

What Happens If We Cut Taxes for Everyone Else?

Cutting taxes for the bottom 99 percent causes larger medium- to long-run gains but smaller short-run gains than cutting taxes for the top 1 percent.

Change in real GDP and income (percent) and the unemployment rate (percentage points) in the five years after a hypothetical increase of about 1 percent in the net-of-tax average marginal tax rate (AMTR) for the bottom 99 percent of the income distribution.



Source: Author's calculations based on Arias, Rubio-Ramírez, and Waggoner (forthcoming).

Note: A tax filing unit is typically defined as any married person or any single person aged 20 or older.

Notes

1 The first federal personal income tax was imposed in August 1861 as an emergency measure to fight the Civil War and was allowed to expire in 1872. See Brownlee (2016).

2 Wisconsin and Mississippi imposed personal income taxes in 1911 and 1912, respectively, just before the federal income tax. "Social Security payroll tax" refers to the Federal Insurance Contributions Act (FICA) tax on income to fund Social Security and Medicare.

3 Barro and Redlick's (2011) and Mertens and Montiel Olea's (2018) findings suggest that the economy responds to changes in the average marginal rates but not to changes in average tax rates. In contrast, Romer and Romer (2010), Mertens and Ravn (2013), Zidar (2019), and Arias, Rubio-Ramírez, and Waggoner (forthcoming) find that changes in average tax rates can affect the economy. Zidar (2019) finds that the effects of tax cuts on employment are driven mainly by tax cuts for low-income groups rather than by tax cuts for high-income groups. His results are in line with Parker, Souleles, Johnson, and McClelland (2013). In contrast, Mertens and Montiel Olea and Arias, Rubio-Ramírez, and Waggoner find evidence that tax cuts for both low-income and top-income groups affect the economy.

4 The marginal tax rate for Social Security, not Medicare, is zero above an income ceiling, which currently stands at $142,800.

5 More generally, Figure 1 shows the average tax rate corresponding to different levels of adjusted gross income.

6 More specifically, I use the overall average marginal tax rate built by Barro and Redlick, which I henceforward refer to as the average marginal tax rate. Barro and Redlick's average marginal tax rate works as follows: Imagine an economy comprising only two taxpayers who pay taxes under the current federal income tax code. (For now, ignore state and payroll taxes.) If one taxpayer has an annual adjusted gross income of $72,400 and therefore (after taking the standard deduction) pays a marginal tax rate of 22 percent, and the other taxpayer has an annual adjusted gross income of $342,000 and therefore (after taking the standard deduction) pays a marginal tax rate of 35 percent, then the average marginal tax rate of this hypothetical economy is 33 percent, i.e., 33 = 22 (60,000/(60,000+330,000)) + 35 (330,000/(60,000+330,000)). Even though Barro and Redlick's average marginal tax rate takes into account a significant part of the complexity of the tax code, such as the earned-income tax credit (EITC) and phase-outs of exemptions, it does not consider other programs such as Medicaid and food stamps.

7 I use the term "individual" as interchangeable with the term "tax filing unit," which is typically defined as any married person or any single person aged 20 or older.

8 In particular, our work made a methodological contribution that allowed us to replicate Mertens and Montiel Olea's 2018 findings regarding the economic effects of an average marginal rate tax cut and to expand the type of tax cut counterfactuals that they considered.

9 Romer and Romer (2014) find smaller effects from changes in marginal tax rates using data from the interwar era.

10 See Barro (1997) for a textbook treatment.

11 The average marginal tax rate and the average tax rate are included simultaneously in the SVAR. This is important because these tax rates are highly correlated. By including the two rates simultaneously, research studies aim to use the average tax rate to isolate wealth effects and the average marginal tax rate to isolate substitution effects. See Barro and Redlick (2011). Nonetheless, such an approach might not fully isolate the wealth and substitution effects. Hence, we need more research before we can reach definite conclusions based on the results reported in this article.

12 See Arias, Rubio-Ramírez, and Waggoner (forthcoming) for additional details.

13 As in the case of marginal tax rates, to assess the macroeconomic effects of changes in the average tax rate we need a summary measure of the average tax rate faced by each individual. As a consequence, the average tax rate is defined as the sum of federal personal current taxes and contributions for social insurance divided by total income. See Mertens and Montiel Olea (2018).

14 Although Figure 4 reports the median and the 68 percent probability intervals, in this article I focus on the median estimates.

15 We also need more research to determine which approach—Mertens and Montiel Olea's or Arias, Rubio-Ramírez, and Waggoner's—more strongly isolates exogenous changes in average marginal tax rates from exogenous changes in average tax rates.

16 These insights are based on the nonstochastic version of the standard growth model with a government described in Ljungqvist and Sargent (2004). If the permanent reduction in the marginal tax rate is accompanied by a permanent reduction in government expenditures, then there is a positive wealth effect that offsets the incentives of individuals to work additional hours. Consequently, in such a case labor may increase or decrease depending on the relative strength of the wealth and substitution channels.

17 We used the top 1 percent and bottom 99 percent average marginal rates constructed by Mertens and Montiel Olea. These measures correspond to the sum of federal income tax rates and payroll tax rates across taxpayers in a given bracket of the income distribution, weighted by their income relative to the total income of these taxpayers' income bracket. Notice that in contrast to the average marginal tax rate for all individuals, the average marginal tax rates for the income brackets in question do not include state income taxes. But as highlighted by Mertens and Montiel Olea, the variation in state income taxes is small and unlikely to affect the main conclusions of the analysis.

18 This is because following a tax cut for the bottom 99 percent, the decline in the average marginal tax rate for the bottom 99 percent is

accompanied by an even larger decline in the average marginal tax rate for the top 1 percent. One possible explanation for this is that the reduction in average marginal tax rates for the top 1 percent is induced by a change in the income composition driven by a decline in top incomes. In other words, some of the wealthy see their income decline (or report lower income as a result of tax avoidance) and fall into a lower tax bracket with a lower tax rate.

19 See, for example, Diamond and Saez (2011), Kindermann and Krueger (forthcoming), and Piketty, Saez, and Stantcheva (2014). An exception to the finding that the optimal personal income tax rate for high-income individuals is higher than the current one is Jaimovich and Rebelo (2017). These authors find that once endogenous growth is taken into account, the tax rate that maximizes the welfare of workers and entrepreneurs is 31 percent.

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