DOES RAISING TAXES ON THE WEALTHY HURT THE ECONOMY?
THE EFFECTS OF TOP MARGINAL INCOME TAX RATES ON GDP GROWTH IN A SAMPLE OF OECD
COUNTRIES

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Danielle B. Parnass, B.A.

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Thesis Advisor: Christopher M. Toppe, PhD.

ABSTRACT

This thesis assesses whether marginal income tax rates for top earners have an effect on a country's GDP per capita growth. The paper builds upon previous research on the relationship between tax rates and economic growth by analyzing a sample of 20 OECD countries from 1981 to 2010 using country year fixed effects models. Controlling for other forms of taxation and widely-used growth regressors, the results indicate that top marginal income tax rates have no effect on GDP per capita growth. However, the study does find that corporate taxes have a strong and statistically significant negative effect on growth, while national consumption taxes have a strong and statistically significant positive effect on growth. These findings suggest that policymakers may benefit from seeking alternative approaches to tax policy to maximize a country's economic well-being.

This thesis is dedicated to my loving family and friends,
whose support and encouragement motivate me every day.

Many thanks,
Dani

FIGURES

TABLES

Policies that seek to reform tax rates are often the subject of intense political debate, largely because of the direct implications for consumers, businesses, and governments. From an anecdotal perspective, individuals and businesses alike decry the deleterious effects of high taxes on personal wealth, consumption, and overall workforce incentives. On the other hand, governments justify higher tax rates as helping to shrink deficits and fund basic public goods. Various economic theories support each of these assertions, yet the question remains as to which tax approach actually has an effect on economic growth, and to what degree. Is there perhaps a net positive, net negative, or net neutral effect of tax rates, especially at the higher end of the income distribution, on a country's gross domestic product (GDP)? In other words, once we control for political rhetoric, do tax cuts or tax increases on the wealthy help the economy?

Before determining the role of income tax rates overall, it is important to understand the theoretical underpinnings of economic growth. In one of the classic macroeconomic growth theories developed by Solow (Engen and Skinner, 1996), labor and capital are considered the main determinants of a country's total output or GDP. However, this model is exogenous in nature: productivity is held constant and thus changes in fiscal policy do not impact long-term growth. More recent growth theories, however, hold there are important endogenous factors that can affect productivity and have an impact on long-term economic growth. These include externality or spillover effects on the economy – a business's decision to invest in research and development or an individual's decision to pursue further education – that are influenced by changes in fiscal policy (Engen and Skinner, 1996). In this framework, the behavioral and incentive effects of tax policy can in fact influence a country's long-term growth rate.

Fiscal policy consists of both taxation and government expenditures, and the interplay of these two variables can have varying effects on economic growth. In the short run, lowering income taxes gives more money to households, which can lead to more spending on goods and services – also known as consumption – and more savings. In the long run, lower taxes allow individuals to keep more of their earnings, which may incentivize them to work more. Consumption, savings, and labor supply are all contributing factors to an economy's total output (Hungerford, 2012). However, lower tax rates can also add to a government's deficit when not offset with other sources of revenue, ultimately hurting economic growth. On the other hand, higher tax rates can lead to greater government spending on programs that can improve both private sector production and individuals' standards of living – other possible determinants of economic growth (Engen and Skinner 1996).

In addition to fiscal policy, other factors have been shown to have a strong effect on economic growth. For example, Barro (1991) found education at an early age to be one of the major determinants of a country's future growth by using early school enrollment rates as a proxy for initial human capital. Other studies such as Mankiw et al. (1992) have demonstrated that the initial income level of a country, measured through GDP rates, is an important factor in determining its future GDP growth. Trade openness, inflation rates, population growth, and political corruption have also been shown to play a role in a country's economic growth (Lee and Gordon, 2005).

It is then important to distinguish between the various types of tax rates and each one's role in economic growth. These generally include income tax rates, corporate tax rates, and consumption tax rates. Previous studies such and Lee and Gordon (2005) have found a strong negative correlation between corporate tax rates and GDP growth, but the effects of personal

income tax rates are less conclusive. Much of this has to do with a lack of a constant definition of how best to measure income tax rates for these purposes. Mendoza et al. (1994), as cited by Lee and Gordon (2005), looked at the average tax rate for each country. However, this may not capture the marginal effects that have the biggest impact on incentives and outcomes (Gravelle, 2011). Other studies have conducted regressions of total tax revenue on GDP to estimate marginal tax rates (Koester and Kormendi, 1989; Garrison and Lee, 1992; Padovano and Galli, 2001). Easterly and Rebelo (1993), as cited by Lee and Gordon (2005), used a weighted average of statutory individual tax rates to measure its economic effects.

This paper specifically examines the effects of top personal income tax rates on the annual growth rate of GDP per capita, controlling for other variables. The decision to examine the highest rate of income tax comes from the predominance of these top rates in national discourse, as well as the purported effects of the behavior of wealthy individuals on the economy (Gravelle 2011; Auten and Joulfaian, 2009). GDP per capita growth is a measure of the change in a country's output each year, standardized across countries with different population sizes. Data for this study comes from a cross-country sample of OECD countries from 1980 to 2010 using the World Bank's World Development Indicator (WDI) and OECD statistics on country tax rates. This paper builds upon Lee and Gordon's (2005) model in a few ways: it focuses on top income tax rates, limits the sample to OECD countries, and expands the data through 2010. Padovano and Galli (2001) note in their study of OECD countries that limiting the sample to these nations helps avoid the aggregation bias that exists in collecting data from certain countries and also allows for the inclusion of variables on tax reform that has not necessarily occurred across the board.

This paper attempts to parse out the specific effects of top income tax rates on GDP growth rates by taking into account the various other determinants of economic growth. The results from this study will inform policymaking by providing empirical evidence on whether tax hikes or tax cuts will effectively stimulate overall economic growth.

LITERATURE REVIEW

Marginal and Average Tax Rates

Marginal tax rates are defined as the rate that is applied to each additional dollar of income earned. In other words, the marginal tax rate indicates how much an individual's income is taxed at its highest bracket, and how much more income would be taxed if it were to rise. It is one of the most important measures of tax policy because it captures the incremental effects of taxes on income. In theory, if individuals face higher tax rates at higher levels of income it will affect their economic behavior and decisions to work, save, or invest more. Therefore, research on tax rates and how they affect economic incentives, behavior, and growth often focuses on marginal tax rates (Palacios and Harischandra, 2008). In a progressive income tax structure, by which most OECD countries abide, the marginal tax rate increases for higher levels of income. (OECD, 2006).

Average tax rates refer to the total amount of taxes an individual pays as a proportion of his or her total taxable income. This means that an individual does not pay one tax rate on all of his or her income; the marginal tax rate reflects the highest level of income, but what one pays in total is an average of each rate for each proportion of income. For example, a single individual in the U.S. in 2010 would have paid 10% in taxes on the first $8,375 of his income (unless standard deductions applied), 15% on the next $25,624 of his income, 25% on the next $48,399 of his income, and so on. Therefore, while his marginal tax rate may be 25%, his average tax rate would be much lower (Walby, 2010). Average tax rates are still important in tax policy research because they reflect the total tax burden that individuals face, and thus how much their economic well-being is affected (Palacios and Harischandra, 2008).

Theoretical Perspectives on High Marginal Tax Rates

One benefit of high marginal tax rates is the ability to raise more revenue to finance public expenditures. Though these measures generally do not show up in the cost estimations of taxes and government spending on economic growth, there is evidence to support the notion that a lack of positive government spending is harmful to the economy. For example, a World Bank report showed that in developing countries in particular, when the government did not provide basic needs such as electricity firms were either unable to produce efficiently or were forced to do so on their own at a much higher cost (Engen and Skinner, 1996). Furthermore, in an era of increasing government debt, an aging population, high unemployment, and declining infrastructure, there is added pressure for the public sector to step in and prevent worsening economic conditions (OECD, 2006).

High marginal tax rates at the top of the income distribution are also used to help mitigate rising income inequality. In most OECD countries, income redistribution through the progressive tax structure has fluctuated over the years as a central policy objective. Generally, the higher the top tax rate the more income redistribution is desired in a country (OECD 2006). A 2006 OECD study showed that top income tax rates were reduced in 19 OECD countries and increased in only 3 between 2000 and 2005. The paper suggested that this could be reflective of a reduction in marginal tax rates across the board, but also indicative of a decrease in the use of high rates on top earners for income redistribution purposes.

These arguments are the basis for the equity-efficiency trade off in tax policy. There are two views in economics on how to quantify fairness in the system: horizontal equity and vertical equity. Horizontal equity views fairness as individuals in the same economic circumstances facing the same tax rates, regardless of differences in how they accrue that income (wages,

capital gains, investments). Vertical equity defines fairness a little differently: individuals with

more income should bear more of the tax burden since they have the ability to do so. This is the

main economic argument for progressive tax policies and is the main driver of redistribution

(OECD, 2006).

On the other hand is the efficiency argument: taxes are inherently distortionary in terms

of economic behavior and thus higher tax rates (at any level of the tax structure) will affect

incentives to work, invest, save, and produce efficiently (OECD, 2006). Lower marginal tax rates

are often touted as beneficial to economic growth from both the demand side and the supply side.

Demand-side theory, also known as Keynesian economics, holds that a cut in tax rates, in

addition to more government spending, will put more money in the hands of consumers who will

then stimulate the economy by purchasing more goods and services. This increase in aggregate

demand will then lead to more jobs and more output. However, demand-side theories tend to

only help in the short run. In the long-run, employment is not theoretically an issue because an

economy is thought to naturally create jobs. This is an underlying assumption in supply-side

theory, which is focused more on producers and holds that cutting taxes will create more

opportunities for saving and investment that will ultimately increase productivity in the economy

in the long run. Long-run, supply-side issues then focus on labor force participation, savings, and

investment as determinants of economic growth (Hungerford, 2012; Gravelle and Marples,

2011).

For purposes of income tax rates, these long-run distortionary effects are generally

viewed in terms of labor supply and savings and investment. Other taxes such as corporate taxes

and consumption taxes have their own effects on savings and investment as well as productivity

and consumption. In terms of labor supply, the effect of taxes can be mixed. An increase in

individuals' take-home pay (i.e., lower tax rates) can either induce less work because more leisure has become affordable through fewer hours of work, or it can induce more work because of higher returns on each additional hour. Both these scenarios are a result of income and substitution effects respectively, and the ultimate outcome in labor supply depends on the empirical evidence of which force is stronger. The theoretical perspectives on savings and investment are similarly mixed. More after-tax income can increase savings now to provide for more consumption in the future, or it can increase preferences for more consumption in the present and therefore lower private savings (Gravelle and Marples, 2011). However, most analysts assume that the substitution effect is stronger in both cases – lower marginal tax rates (and thus higher take-home pay) should lead to more labor and more savings (CBO, 2012).

Low savings rates are generally thought to be bad for an economy because national saving finances investment, and without enough saving, investment must be financed from abroad. National savings is composed of private savings, as describe above, and public savings, which arises from budget surpluses at the local, state, and federal level (Hungerford, 2012). Taxes can also play a role in public savings to the extent they help accrue more government revenue, though this is not specific to income taxes alone. If taxes are cut and they are not immediately financed through other means or offset by less government spending, they will increase a country's deficit and raise interest rates, which has a negative effect on investment (Gale and Orszag, 2005).

Theoretical Perspectives on Economic Growth and GDP

Investment and labor supply are important measures of economic growth because of a theoretical framework developed by Solow in 1956 that guides much growth literature today. In

this model, changes in output or GDP are a function of changes in a country's capital stock and

its labor force. It is expressed as

$$\dot{y}_i = \alpha_i \dot{k}_i + \beta_i \dot{m}_i + \mu_i$$

where Y is the real GDP growth rate, k represents the net investment rate as a change in the

capital stock over time, m is the labor force, and mu measures productivity growth (and is

assumed to be fixed). The coefficients on capital and labor represent the marginal productivity of

capital and the output elasticity of labor, respectively (Engen and Skinner, 1996). While taxes

play a role in the accumulation of capital and labor as outlined above they do not affect

productivity growth, which is generally determined by technology and is constant. Therefore,

changes in fiscal policy will not affect the rate of growth because it plays no role in technology

capacities. However, it can affect the level of output in an economy – growth will adjust to the

same rate over time but can occur at a lower level of output overall (Engen and Skinner, 1996).

The above equation is known as the exogenous growth model because technology and

productivity are assumed to be factors that are external to economic activity. However, since the

1980s there has been growing literature on endogenous growth models that involve economic

changes such as tax policy as having an effect on productivity and thus long-term growth. The

model emphasizes positive externalities from education or business investment in research and

development that can have spillover effects on productivity (mu). Since productivity is no longer

assumed to be constant, changes in fiscal policy can more directly affect long-term growth

(Engen and Skinner, 1996; Lee and Gordon, 2005). It is within this framework that most studies

on taxation and economic growth have operated, and it will constitute the underlying focus of

this paper as well.

Literature on Taxation and Economic Growth

There is much literature on the effects of taxation on economic growth in the context of tax revenue overall. These studies do not focus on income taxes specifically but their results are helpful in guiding hypotheses of whether marginal income tax rates will have a positive or negative effect on the economy. The results are mixed and are often dependent on how taxes are measured. The first body of literature focuses on marginal tax rates, which are often difficult to obtain. Koester and Kormendi (1989) studied 63 countries in the 1970s and conducted a time series regression of tax revenue on GDP to obtain a measurement of marginal tax rates. This method allowed them to create a variable that reflected the incremental effects of marginal tax rates and then include it in their overall regression of GDP growth on taxes. They also included average tax rates in their estimation and found that once one controls for per capita income, or the level of GDP in a country, and average tax rates, which reflects the size of the government sector based on total tax revenue, the negative effects of marginal and average taxes on economic growth disappear. However, the authors did find a strong negative correlation between marginal tax rates and the level of GDP in a country.

Garrison and Lee (1992) extended this study through 1985 using a similar model. Their research confirmed that there was no negative effect of marginal tax rates on GDP growth, however their expanded model did not find any relationship between taxes and the level of economic activity either. Additionally, Koester and Kormendi's negative relationship disappeared when the authors separated countries into industrial and developing nations, and it also disappeared when they removed two outlier countries from the original sample. This led the authors to conclude that the negative relationship the previous study had found between taxes and level of GDP was more of a function of which countries were included in the sample.

Another study using the marginal tax rate regression measurement did find a strong negative correlation between marginal tax rates and economic growth. Padovano and Galli (2001) studied 23 OECD countries between 1951 and 1990 and corrected for some of the difficulties in Koester and Kormendi's original model, such as the assumption that marginal tax rates are constant over time, which would lead to inefficiency and bias in their results. Padovano and Galli therefore included a level and a slope dummy in their regression of tax revenue on GDP to account for tax reform and changes in tax rates over time. They further concluded that studying homogenous economies with similar tax structures and fiscal policies would lead to more accurate coefficients.

Engen and Skinner (1992) looked at 107 countries from 1970 to 1985 and measured average tax rates by dividing total tax revenue by GDP as a proxy for the effects of taxes on economic growth. They found that fiscal policy, in terms of government spending and taxation, are both negatively correlated with economic growth, with government spending carrying a stronger negative effect. They concluded that a smaller public sector will spur more economic activity because it forces the private sector to be more productive to make up for the lack of services provided by the government. However, average tax rates raise problems of strong collinearity with government expenditures. As noted above, average tax rates across all individuals equal the total amount of tax revenue a government takes in, which would be correlated with how much that government spends. Both essentially are measures of the size of the government sector. Additionally, average tax rates tend to underestimate marginal tax rates because they are effectively lower than the top tax rates applied to the highest levels of income (Padovano and Galli, 2001).

Literature on Top Marginal Tax Rates

Other studies have focused specifically on the behavioral responses of the wealthy to changes in the top marginal income tax rate because this group has more economic resources at their disposal and provides much of the savings and business investment to the economy (Auten and Joulfaian, 2009; Gravelle and Marples, 2011). In the U.S., the top 1% of earners account for a large and growing portion of total income as well as total tax revenue (Eissa and Giertz, 2006). Additionally, policy changes to income tax rates often focus on rates for the top tax bracket and thus top income earners are given much media and political attention. These studies measure the effect of taxes on a variety of economic indicators, including GDP growth, income elasticity, labor supply, and investment.

In one study, Auten and Joulfaian (2009) examined the income elasticity of high earners in the U.S. to the tax cuts implemented in 2001 and 2003 under President George W. Bush. Using panel data on wealthy households' tax returns (the top 1% of tax filers) from 1979 to 1995, they found that taxable income for this group tends to decline during periods of high taxes, but will rise in anticipation of high taxes in the future (Auten and Joulfaian, 2009). The elasticity of taxable income means that a percentage change in marginal tax rates will lead to a percentage change in the amount of income that is reported. This is of interest because it is another measure of the amount of output in an economy (Reynolds, 2011). Measuring the responses of taxable income is often more beneficial than measuring the responses in the labor supply because it encompasses a variety of factors including work hours, work effort, human capital, or even tax avoidance (Eissa and Giertz, 2006). Most studies of this nature find that an increase in marginal tax rates will lead to a decrease in reported income. This occurs at a higher rate for top earners

and suggests that any revenue from the higher tax rates will be offset more by the reduction in reported income from this group (Reynolds, 2011).

A Congressional Research Service (CRS) study (Hungerford, 2012) looked at the relationship between top marginal tax rates and GDP growth in the U.S. since 1945 and found a small positive correlation between high tax rates and economic growth, but one that was not statistically significant. The study tested four different measures of economic growth: private savings, private investment, labor productivity growth (or output produced per hour), and real GDP growth. None of the relationships was statistically significant, leading the author to conclude that the positive effects could be more of a result of other economic conditions and that tax rates for a small group of individuals, though they hold more economic resources than any other segment of the population, would not have a strong effect on overall economic growth.

Another CRS study (Gravelle and Marples, 2011) looked at the relationship between top marginal income tax rates in the U.S., which have been declining since 1965 save for a few upward fluctuations, and labor force participation rates. During the same time period, labor force participation for men declined while labor force participation for women rose. Additionally, average work hours have steadily declined in both the U.S. and worldwide, though this trend may also be a result of changes in the composition of the workforce. The study concluded that any relationship between top marginal tax rates and labor supply, savings, and investment is not a strong association. Additionally, the study looked at historical trends in top marginal tax rates and GDP growth and found that periods of high top marginal tax rates in the U.S. were actually correlated with higher economic growth, though the relationship was not causal.

On the other hand, Carroll and Prante (2012) found that an increase in the top marginal income tax rates in the U.S. would result in lower output, employment, wages, and investment.

They employed an Ernst & Young LLP general equilibrium model based on the 2011 economy and how it would hypothetically respond to the proposed changes in legislation in 2012 and 2013. The authors concluded that the specific effects of an increase in the top income tax rates would reduce the labor supply and disposable incomes. The effects of an increase in taxes on capital gains and dividends would similarly have an adverse effect on investment and the capital stock.

Ferede and Dahlby (2012) studied the effects of reducing top income tax rates, corporate tax rates, and sales tax rates on economic growth and investment in Canada. They argued that studying the effects of income tax rates across a wide range of countries is difficult to interpret because each country defines their tax base differently so the effects on growth are not necessarily comparable. However, their analysis of top income tax rates in 10 Canadian providences did not find any significant effects on economic growth. They did find that lower corporate taxes were correlated with higher growth and more investment, and that higher sales taxes resulted in positive economic growth.

Gemmel, Kneller, and Sanz (2011) used panel data on 15 OECD countries to assess the effects of top personal income tax rates and corporate tax rates on economic growth. Using various types of regression methods and controlling for fiscal policy measures such as public expenditures, budget surpluses and other variables, the authors found a statistically significant (but economically small) negative effect of top personal income tax rates on economic growth. They also found negative effects of corporate tax rates on GDP growth, but concluded that unless taxes were reduced in both cases they were not likely to individually have a strong effect on growth rates. A big contribution of this model was that it accounted for the openness of

economies by controlling for international variables, though these have more of an effect on corporate tax rates.

Lastly, Lee and Gordon (2005) examined 70 countries from 1970 to 1997 to study the effects of top income tax rates and corporate tax rates on GDP growth. Holding a variety of factors such as education, average trade openness, inflation rates, population growth rates, government consumption, and total income per capita constant, they found that top income tax rates do not have a statistically significant effect on GDP growth, but that corporate tax rates have a strong negative effect on growth. This paper builds upon Lee and Gordon's model by focusing on income tax specifically, limiting the sample to OECD countries, and expanding the data to include the first decade in the new millennium, which plays an especially pertinent role given the global financial crisis.

RESEARCH QUESTION AND HYPOTHESIS

This paper examines the relationship between economic growth and marginal income tax rates on the top bracket of earners – i.e., the wealthy. Building on Lee and Gordon's work (2005) that focuses on corporate tax rates and their effect on economic growth, I use GDP per capita growth as the dependent variable and top marginal income tax rates as the key independent variable of interest. Because research is mixed on the direction of the relationship between income taxes and economic growth and the significant of this relationship, my analysis is therefore based on the hypothesis that marginal income tax rate on top earners have no effect on GDP per capita growth in the country, on average, holding all other relevant determinants of growth constant. In other words, raising or lowering taxes on the wealthy will have no effect on economic growth. The null and alternative hypotheses are thus as follows:

H_o: Top marginal tax rates on top earners have no effect on GDP growth

H_1: Top marginal tax rates on top earners do have an effect on GDP growth

This specification will help inform the debate on whether increases or decreases in marginal tax rates for the wealthy will have significant economic consequences as policymakers around the world grapple with how to emerge from the recent fiscal crisis and provide a solution to mounting debt.

DATA

In order to analyze this question, I focus on a sample of Organisation for Economic Co-operation and Development (OECD) countries from 1981 to 2010 using a unique merge of OECD tax data and the World Bank's World Development Indicators (WDI). The OECD is a group of high-income, developed countries that work together to deal with global economic issues. Limiting the analysis to these countries is beneficial because there are not as many missing observations in the macro-level data, and because using countries with similar economies and political systems reduces the aggregation bias that can often arise when extrapolating results for countries that are very different (Padovano and Galli, 2001). Additionally, using a large time frame helps average out economic changes that occur due to the fluctuating business cycle. The year range in this study is the most recent look at tax data in the literature and encompasses the global financial crisis that began in 2007.

The OECD Tax Database provides various tax statistics for its 34 OECD member countries beginning in 1981. Eleven of these countries did not join the OECD until more recently, so tax data is not provided for them for the full time frame of this analysis. An additional country did not have data for the dependent variable, and two other countries had little if no variation in their top income tax rates over time. I thus limit the sample set for purposes of this study to 20 countries that have been OECD members since 1981.[a] I use the OECD data for top marginal income tax rate, corporate tax rate, and consumption tax rate variables, as well as to calculate average tax rates and tax progressivity. I then merged these data by country with a selection of variables from the WDI databank, which consists of 331 indicators for 214 countries

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[a] Countries included in this study are Australia, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Italy, Japan, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, United Kingdom, and United States.

from 1960 to 2011 that broadly measure economic, social, and political well-being. The dependent variable, GDP growth per capita, comes from this databank, as do all other control variables.

The key independent variable of interest, top marginal income tax rates, has produced interesting trends since OECD began collecting data in 1981. On average, the trend in OECD countries has been a substantial decline in the top rate from the 1980s through the 2000s, which was most pronounced in the 1980s. However, some countries have in fact raised taxes in recent years. Figure 1 shows a sample of seven countries in the data set and the variation in their top income tax rates over time, in addition to the average of the OECD sample used in this study. The highest tax rates belong to Portugal in the early 1980s at 84.4% while the lowest tax rates belong to Norway at 7% in the early 1990s.

Figure 1: Top Marginal Income Tax Rates 1981-2010, Sample of OECD Countries
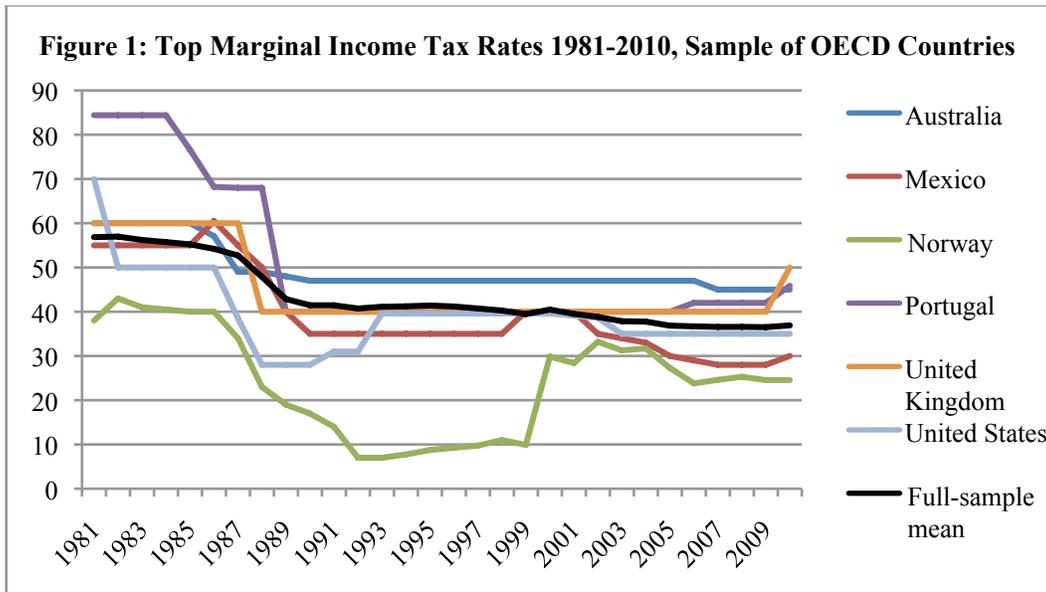
GDP growth has fluctuated over this same time period, with the predicted dips in growth in 2009 following the global economic crisis. This would seem to indicate that, at first glance, there is no strong correlation between the top marginal tax rates and economic growth. Figure 2 shows the trends in GDP growth for the same seven countries and the OECD sample average.

Figure 2: GDP Per Capita Growth Rates 1981-2010, Sample of OECD countries
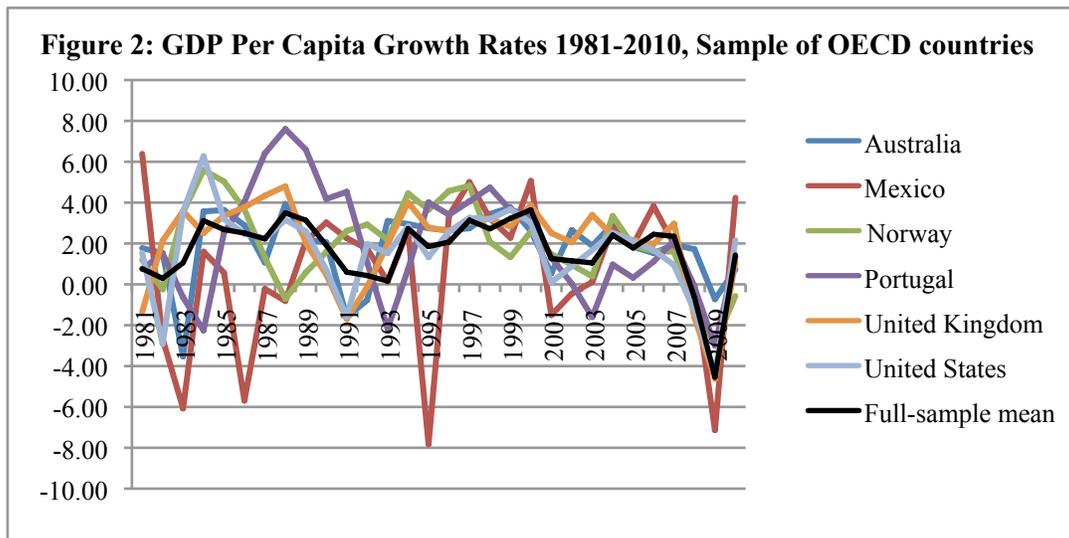
To further investigate this relationship, a simple correlation between these two variables confirms the null hypothesis that there is no relationship between GDP growth and the top income tax rates, as reported in Table 1. This would imply that high tax rates do not have any effect on economic growth in a country.

Table 1: Correlation between GDP Per Capita Growth and Top Marginal Income Tax Rates

Variables	GDP growth	Top income tax rate
GDP growth	1.0000	
Top income tax rate	0.0703 (0.0855)	1.000

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

However, this study takes into account all of the confounding factors that have been found to have an effect on economic growth based on previous literature in an attempt to parse out the specific impact of top marginal income tax rates. Table 2 shows the summary statistics

for the independent variable, key dependent variable, and range of control variables. The average

top tax rate across the 20 countries over 30 years is about 44%, which by comparison is well

above the top tax rate in the majority of OECD countries in 2010.

Table 2: Descriptive Statistics

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
Independent variable					
GDP per capita growth (annual %)	600	1.682	2.400	-8.975	9.492
Key dependent variable					
Top marginal income tax rate	600	44.43	13.58	7	84.40
Control variables					
Corporate tax rate	600	34.61	7.464	15	56
Consumption tax rate (VAT and GST)	600	14.16	7.958	0	25
Average income tax rate	600	30.06	11.45	6.500	75
Tax progressivity (top/average tax rate)	600	1.541	0.317	1	2.405
Lagged log of GDP (constant 2000 US$)	599	26.60	1.500	22.75	30.09
School enrollment, primary (% gross)	557	103.3	6.076	87.78	126.7
Population growth (annual %)	599	0.642	0.510	-0.346	2.217
Inflation, GDP deflator (annual %)	600	5.463	10.50	-6.382	139.7
Government consumption (% GDP)	600	19.58	4.093	8.269	29.80
Gross capital formation (% of GDP)	600	21.89	3.467	14.11	35.56
Trade (% of GDP)	600	69.96	47.73	15.92	319.6
Number of Country	20	20	20	20	20

Tables 3 and 4 below then provide the distribution of top income tax rates in all OECD

countries in 1981 and in 2010 (including those not in this sample) as a reference point:

Table 3: Distribution of Top Marginal Income Tax Rates in 1981 (OECD Sample)

Top Income Tax Rate	Country	
Below 50%	29%	Sweden
	38%	Norway
	40.04%	Denmark
	43%	Canada
50% - 59%	51%	Finland
	55%	Mexico
	56%	Germany
	57%	Luxembourg
60% - 69%	60%	Australia, France, Greece, New Zealand, UK
	65.09%	Spain
	68%	Italy
70% and above	70%	US
	72%	Belgium, Netherlands
	75%	Japan
	84.40%	Portugal

Table 4: Distribution of Top Marginal Income Tax Rates in 2010 (OECD Sample)

Top Income Tax Rate	Country	
Below 30%	18.67%	Denmark
	24.55%	Norway
	25%	Sweden
	27.13%	Spain
	29%	Canada
30% - 39%	30%	Finland, Mexico
	35%	US
	35.50%	New Zealand
	38%	Luxembourg
40% - 49%	40%	France, Japan
	43%	Italy
	45%	Germany, Greece, Australia
	45.88%	Portugal
50% and above	50%	UK, Belgium
	52%	Netherlands

To empirically test the relationship between economic growth and top income tax rates, I construct a country and year fixed effects model to eliminate omitted variables that may also affect growth but remain unchanged between countries and over time. Fixed effects essentially controls for factors that are not easily measured such as institutional or historical differences between countries that may affect growth. It also implicitly controls for some more easily measured variables such as country size and geographic location. Additionally, because the data span 30 years, year fixed effects help control for economic fluctuations over time due to business cycles or global financial crises, as seen recently in OECD countries.

However, because the variation between countries drops away, within-unit variation in the dependent variable of interest becomes important. Though top income tax rates have changed drastically over time, as evidenced by Figure 1 above, there is not consistent variation in the variable from year to year; tax reform may alter a rate significantly in one year (for example, comprehensive tax reform in the U.S. in 1986), but then remain static until the next big policy change. As described in the data section, I have thus dropped countries whose variation did not exceed at least two changes over the specified time period.

Following the basic specifications in the literature, the fixed effects model for this analysis is as follows:

GDP per $capita$ $growth_{it} = \beta_0 + \beta_1 top$ $marginal$ $income$ tax $rate_{it} + \beta_2 corporate$ tax $rate_{it} + \beta_3 consumption$ tax $rate_{it} + \beta_3 average$ tax $rate_{it} + \beta_4 tax$ $progressivity_{it} + \beta_5 lagged$ log of $GDP_{it} + \beta_6 primary$ $school$ $enrollment$ $rate_{it} + \beta_7 inflation_{it} + \beta_8 population$ $growth_{it} + \beta_9 trade$ $openness_{it} + \beta_{10} investment_{it} + \beta_{11} government$ $consumption_{it} + \beta_{12} COUNTRY_t + \beta_{13} YEAR_i + u_{it}$

In order to isolate the specific effects of income taxes on the wealthy, I look at two

general groups of control variables: one group includes different forms of tax rates and the other

includes variables that have been shown to influence GDP growth throughout the literature. For

the first group, I include controls for corporate tax rates; consumption taxes, such as general

sales taxes and value-added taxes; the average income tax rate; and a measure of tax

progressivity. For the second group, I include controls such as the level of GDP or income in a

country, primary school enrollment rates, inflation, population grown, trade openness,

government spending, and private investment.

GDP per capita growth

In order to assess the economic effects of tax rates, the dependent variable in this study is

GDP per capita growth, and is measured as the annual percentage growth rate of GDP per capita

based on constant 2000 U.S. dollars. Gross domestic product refers to the sum of all the

production in an economy, plus any taxes on those products and minus any subsidies that are not

already included in the value of the product. GDP per capita is GDP divided by the midyear

population of each country. This helps standardize a country's total income according to the size

of its population so that cross-country references are more meaningful (World Bank, 2012). GDP

is not always regarded as the best measure of economic activity because it only measures an

economy's aggregate output and does not account for factors such as well-being or inequality.

However, it is still one of the more widely used measures of economic growth in the literature

and is thus used in this study.

Top marginal income tax rates

I construct the variable for top marginal income tax rates using OECD data on central government personal income tax rates for wage income. This is the statutory rate that does not include any sub-central taxes, social security contributions, tax allowances, or other surtaxes. The top rate refers to the percentage of taxable income that applies to the highest tax bracket threshold of income, and the rates apply to a single person without any dependents. OECD provides data on each tax bracket and its corresponding threshold of income and marginal tax rate. I pulled the rate for the maximum bracket in each country and appended the data into one final variable for top marginal income tax rates.

Other tax rates

I have included other tax variables in the model that may independently have an effect on GDP growth. Corporate tax rates refer to the basic central government statutory rate on corporations before deductions for any sub-central tax if applicable. The rate reflects either a flat tax rate or the top marginal rate when multiple brackets are involved. Consumption taxes refer to the tax on the spending on goods and services in a country, and are measured either as a value added tax (VAT) or a general sales tax (GST) at the central government level. For this variable, OECD only reported data for every other year prior to 2000, so I imputed the values for the missing years by taking the average of the two surrounding years. Additionally, many countries did not introduce a federal consumption tax until more recently, so I changed the values to zero instead of missing when there was no tax rate. The U.S. for example has never had a federal VAT or GST tax, so the value of this variable for the U.S. is zero.

I then also include a measure of the average tax rate, which I computed as the average of each tax rate per bracket in each country from the OECD data. I then created a variable for tax progressivity based on Gordon and Lee's (2005) measurement that took the top income tax rate divided by the average tax rate. This helps account for differences in tax structure between countries. For example, if a country had a flat tax in certain years, their measure of progressivity would be 1 because the top and average tax rates would be the same. The higher the top tax rate relative to the average tax rate, the more progressivity in that country's tax code. Based on the descriptive statistics for this variable, the highest tax progressivity measure is around 2.4, indicating that some countries had a top tax rate that was more than double the average tax rate.

Growth controls

GDP is used as a control variable because the level of GDP or income in a country will have an effect on the amount of growth that the country sees. For example, most development theory holds that low-income countries (those with lower rates of GDP) will grow faster than high-income countries. This is known as convergence theory, so controlling for this level is important (Barro 1991). I take the log of GDP to account for the large deviation in standard GDP numbers, and then lag the variable by one year so that per capita growth in the current year is being measured against GDP in the previous year. GDP is also expressed in constant 2000 U.S. dollars, though as opposed to the independent variable, this measure of GDP is not taken per capita because lagging the same variable in a fixed effects model that already accounts for changes across time may not yield the right measurement.

Other control variables come from various models in Lee and Gordon (2005), Padovano and Galli (2001), and Acosta-Ormaechea and Yoo (2012) studies that measure taxation and

economic growth, as these variables have been shown throughout the literature to also influence growth. Primary school enrollment rates are included as a proxy for human capital accumulation. Population growth measures the change in midyear population from one year to the next. Trade as a percent of GDP is included as a proxy for trade openness and is measured as the sum of exports and imports as a share of GDP. Government expenditure is included as a fiscal policy measure, which measures all government spending for goods and services, employee compensation, and most national defense expenditures. The variable gross capital formation refers to the level of domestic investment that is spent on additional purchases to the economy's fixed assets. Lastly, I control for inflation using the GDP deflator, which shows the rate of price changes in the economy as a whole and is measured as the ratio of GDP in current local currency to constant local currency.

RESULTS

Table 5: Fixed-Effects Regressions of GDP Per Capita Growth (Annual %)

VARIABLES	(1)	(2)	(3)	(4)
Top income tax rate	0.0114	-0.0514*	-0.00478	0.0211
	(0.0134)	(0.0295)	(0.0140)	(0.0278)
Corporate tax rate		-0.0137		-0.0354*
		(0.0183)		(0.0182)
Consumption tax rate (VAT and GST)		0.0787***		0.137***
		(0.0229)		(0.0223)
Average income tax rate		0.101***		-0.0221
		(0.0377)		(0.0354)
Tax progressivity (top/average tax rate)		1.770**		-1.037
		(0.784)		(0.740)
Lagged log of GDP (constant 2000 US$)			-0.621***	-0.519***
			(0.178)	(0.174)
School enrollment, primary (% gross)			-0.0317	0.0222
			(0.0248)	(0.0258)
Trade (% of GDP)			0.0165**	0.0170**
			(0.00711)	(0.00765)
Population growth (annual %)			-1.313***	-1.347***
			(0.280)	(0.277)
Inflation, GDP deflator (annual %)			-0.0504***	-0.0565***
			(0.0101)	(0.00991)
Government consumption (% GDP)			-0.289***	-0.308***
			(0.0674)	(0.0654)
Gross capital formation (% of GDP)			0.162***	0.221***
			(0.0375)	(0.0383)
Constant	0.0954	-3.184*	23.15***	15.05**
	(0.887)	(1.769)	(6.150)	(6.256)
Observations	600	600	555	555
R-squared	0.454	0.473	0.559	0.593
Number of Country	20	20	20	20

Standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

The main results of this study are presented in Table 3, estimating the country-year fixed effects regression of GDP growth per capita on top marginal income tax rates. Models 1, 2, and 3 measure the various groups of regressors on GDP per capita growth, and model 4 is the full

model with all control variables. Each model includes year dummies to control for economic and historical factors that change over time. The basic results indicate that, consistent with the null hypothesis, top marginal income tax rates do not have a statistically significant effect on GDP growth per capita, even when controlling for all relevant factors in model 4. To understand these results a little more closely, Table 3 shows each regression with different groups of control variables to test whether the right indicators are included in the final model. Model 1, for example, includes the basic relationship between top income tax rates and GDP growth per capita. Similar to the simple correlation in the Data section but also controlling for constant country and year differences, this model indicates no relationship between top income taxes and economic growth.

Model 2 then includes the other tax variables to see if controlling for different types of taxation on individuals and businesses affects this relationship. As we see in this model, top income tax rates have a significant negative relationship at the 10 percent level. The results suggest that a 10 percent increase in the top marginal tax rate is associated with a .5 percent decrease in GDP per capita growth. Though statistically significant, this measure is economically small as the standard deviation for GDP growth in this sample is 2.4. The other tax measures in model 2 yield interesting results. Corporate tax rates are not significant, which is contrary to most literature, and have a strong negative effect on economic growth. Consumption tax rates in this model are strongly positive and significant, as are average income tax rates and tax progressivity.

This model, albeit limited, presents an interesting story of tax rates because of the opposing signs on the top rates compared to average rates and progressivity. The results would seem to suggest that taxes overall may be good for economic growth except when imposed on

the top bracket of income. Similarly, the tax progressivity coefficient suggests that a more progressive tax structure is better for economic growth, but the negative coefficient on the top rate indicates that this progressivity is better targeted at the bottom of the distribution than at the top. For example, progressivity can be achieved by providing tax cuts for or transfers to low-income households instead of raising taxes on higher-income households.

Model 3 includes the various growth controls that have been found in the literature to have a significant effect on growth. In this case, the coefficient on top income rates becomes insignificant. The findings of these growth variables are consistent with previous literature as indicated in the Data section: countries grow faster when they have lower initial levels of income, more open trade, less population growth, lower levels of inflation, less government spending, and more private investment. The only growth measure that is not significant is education as a proxy for human capital, which some studies have found to be insignificant in fixed effects models as well (Lee and Gordon, 2005), indicating that there are two opposing effects of taxes on human capital growth (Padovano and Galli, 2001).

Model 4 then combines models 2 and 3 for one final model in which top income tax rates are still not statistically significant. The growth measures in model 4 are consistent in terms of significance with model 3 with slightly stronger coefficients. The other tax variables change in significance, however, with the exception of the consumption tax rate which remains strongly positive and significant: a 10 percent increase in the consumption tax rate is associated with a 1.3 percent increase in GDP per capita growth. In this model, corporate tax rates are significant and negative, suggesting that a 10 percent increase in corporate tax rates is associated with a .3 percent decrease in economic growth. Average income tax rates and tax progressivity become insignificant when the other growth variables are included.

CONCLUSION AND POLICY IMPLICATIONS

This study uses country-year fixed effects to measure the impact of top marginal income tax rates on economic growth. The results find that top marginal income tax rates are insignificantly correlated with GDP per capita growth in a panel dataset of 20 OECD countries spanning 1981-2010, when controlling for relevant determinants of economic growth and other tax variables. This suggests that economic theory on behavioral responses to tax rates as discussed in the Literature Review section is inconclusive regarding whether the income or substitution effect is stronger for individuals facing higher tax rates. In other words, higher tax rates can lead to both more growth or less growth in different circumstances – i.e., more or less saving, more or less labor force participation, etc.

The model uses several control variables based on empirical and theoretical underpinnings for the various determinants of economic growth. Gross domestic product is measured as the sum of a country's public and private consumption, investment, government expenditures less tax revenue, and net exports; however, GDP growth has been shown to have other determinants. The classic Solow model predicts that real GDP growth is a function of capital and labor, where productivity is assumed to be fixed. In more recent endogenous growth models, productivity is not fixed and allows room for fiscal measures to impact growth through externalities such as human capital accumulation or innovation that have spillover effects on productivity. Thus, the control variables in this study control for such effects through education, investment, government spending, and levels of GDP. Other recent studies suggest that this relationship is more significant in the context of an open economy, and thus a variable for trade openness is included. The results for these fiscal and macroeconomic growth determinants are consistent with the literature.

30

However, this study yields interesting results regarding other forms of taxation. For example, corporate tax rates are found to be significantly negatively correlated with economic growth. This supports theory and literature that suggests lower corporate tax rates encourage more entrepreneurship and innovation in the private sector (Lee and Gordon, 2005). This also reflects the positive coefficient on gross capital formation, where increases in private investment are associated with increases in economic growth. Average income tax rates are not significant, perhaps reflecting the ambiguity within the literature on how to best measure tax rates at different income brackets without muting the marginal effects of taxes on behavior. Tax progressivity is also not significant, which also may be a result of how progressivity is measured. For example, in this study tax progressivity is taken as the top income tax rate divided by the average tax rate to account for how much higher the tax rate at the top of the distribution is relative to the middle of the distribution. However, many progressive tax policies are also targeted toward the bottom of the distribution by way of tax credits or transfers for lower-income households (OECD, 2006). Future studies may find different results using more comprehensive measures of progressivity.

Perhaps the most interesting result from this study is the strongly positive effect of consumption tax rates on GDP per capita growth, where a 10 percent increase in consumption tax rates is predicted to increase growth by 1.3 percent. These findings, coupled with the negative effect of the corporate tax rate, suggest that tax policy may be better served by moving away from a corporate tax toward a larger consumption tax. Currently, 33 out of 34 OECD countries have some form of a national consumption tax with the United States as the sole exception. This is up from 10 countries in the 1960s and now accounts for approximately 31 percent of all government revenues across OECD countries. (OECD, 2012). Proposals in the

United States have touted the benefits of implementing a national consumption tax, both in terms of economic efficiency and debt reduction, however major structural tax changes in the United States have become politically infeasible, especially without eliminating or greatly reducing other existing forms of taxation (VATinfo, 2012).

Despite these significant results for corporate and consumption taxes and consistency with the literature on other variables, there are limitations to the model used here. Endogeneity concerns of tax rates to economic growth would bias the results if causation also runs from the dependent variable to the independent variable. For example, governments sometimes change their tax rates in response to macroeconomic conditions, as opposed to GDP growth changing in response to adjustments in tax rates alone. Using a 30-year panel dataset and fixed effects model helps control for some of these effects, though using instrumental variables to isolate the exogenous impact of tax rates has been done in some studies (Lee and Gordon, 2005; Gemmel, Kneller, and Sanz, 2011) and leaves room for future research to expand upon this study. Additionally, as discussed in the Data section, GDP may not be the only measure of economic well-being that is relevant to the effects of raising taxes. Other studies that look specifically at income inequality or labor force responses may yield other important considerations that go beyond the implications on gross domestic product.

Ultimately, the statistical insignificance of the top marginal income tax rate on economic growth may in itself hold significance in terms of policy. If raising or lowering rates on the top income bracket does not have an impact at least in terms of GDP per capita growth, then policies targeting income taxes may be less important than those focusing on corporate or consumption taxes. Though the question of how much the wealthy should pay in taxes plays a large role in the global debate on tax policy, this cohort alone may not have much influence on economic

outcomes. Robust national tax policies should thus consider the interplay of different sectors and households when determining a country's tax code.

<div align="center">**BIBLIOGRAPHY**</div>

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