

**Consumption Taxes, Income Taxes, and Saving:
Evidence from OECD Countries**

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Abstract: We use data from an unbalanced panel of up to 30 OECD countries spanning the years 1975 to 2008 to estimate the effect of changes in fiscal and demographic variables on private and national savings rates. In particular, we focus on the impact on private and total national saving rates of substituting consumption taxes for income taxes. Using tax rates and other key variables averaged at five-year intervals, we find strong evidence that a revenue-neutral shift from income taxation to consumption taxation would increase aggregate savings. However, we also find that the magnitude of this effect decreases as the level of outstanding government debt increases. We conclude that current savings respond significantly to expectations of future taxes on the income generated by those savings.

1. Introduction

Research on the effect of taxation on saving can be broadly characterized as comprising two types of analysis, empirical estimation and numerical solutions to theoretical models.¹ The empirical literature on the elasticity of savings to the after-tax rate of return on assets is vast. Smith's (1990) survey of this literature documents the wide range of estimates that have been reported. For example, for the United States alone, estimated elasticities of savings with respect to after-tax yields have ranged from Blinder's (1975) estimate of nearly zero, to Boskin's (1978) estimate of 0.4, to Summers's (1981) estimates ranging from about 1.0 to as high as 3.7. Cross-country comparisons of long-run savings rates are beset with the considerable difficulties of obtaining comparable measures of saving in very different institutional environments.

Dissatisfaction with the difficulties of estimating a stable empirical relationship between after-tax yields and savings led to the application of numerical methods of analysis to the problem. As noted by Kotlikoff (1984) and Lucas (1990), attempts to infer the effect of taxes on savings by means of estimating a unique elasticity of saving with respect to intertemporal changes in a country's income-tax rate are beset with difficulties that arise when long-term expectations play a significant role in current behavior. An additional and important complication in the particular case of tax policy and saving is the potential uncertainty over the permanence of any tax-rate change. Furthermore, in a closed economy any particular tax-rate change may alter, or may accompany other policy changes that alter, the after-tax rate of return on investment. Lucas (1990) argues that these issues are best dealt with by means of policy simulations carried out on a simple model of intertemporal observation. Evans (1983) and Auerbach and Kotlikoff (1987) share this view, but the significant differences among their results indicate the sensitivity of this approach to the specific parameterization of one's model.

We propose an approach intended to exploit some of the salient features of the actual tax policies of most of the developed countries other than the United States.²

¹ At least one attempt has been made to use experimental methods to estimate the impact of income taxation on saving (Meade, 1995).

² While the general concept of consumption taxation appears straightforward, the actual design of tax systems using consumption as their base can be quite intricate (see the excellent survey by Auerbach, 2009). In this paper we do not make fine

In particular, most of the OECD countries have imposed both consumption and income taxes over a long period of time. The statutory rates imposed by these countries vary over time and across nations, and in a democracy any such changes are deliberated—and therefore anticipated—in advance of their imposition.

The extent to which capital flows among the OECD countries are relatively unimpeded, so that it is reasonable to treat capital accumulation and domestic saving as separable decisions, remains a matter of continuing empirical investigation. Feldstein and Horioka (1980) found a high correlation between aggregate investment and saving within their sample of 16 OECD countries during the period 1960-74, suggesting that these can be treated as essentially closed economies for purposes of interest-rate determination. However, Harberger (1980) estimated that the range of cross-country variation in the return to capital was sufficiently small as to suggest that there is a single global capital market in the long run. Recent empirical studies by Kollias *et al.* (2008) and Georgopoulos and Hejazi (2009) lend support to Harberger's view that there is a high degree of capital mobility internationally.

The degree of openness of each country's capital market will affect the interpretation of what we report as the response of private saving to tax policy. Under conditions of complete international capital mobility, our estimate of the effect of tax-rate changes on aggregate private saving will solely reflect the response of households and firms to exogenous changes in the after-tax rate of return to saving. As the degree of openness declines, our estimate of the effect of personal income taxes on saving is actually an estimate of the combined effect of those taxes on saving and investment. The balance of the evidence, at least for the European economies, is that complete openness is a reasonable approximation, so our theoretical analysis will focus exclusively on the case of households facing an exogenous interest rate. Regardless of the degree of capital mobility, however, our empirical estimates represent the actual response of *aggregate* saving to tax policy.³

distinctions among countries institutional approaches to consumption taxation, focusing instead on the broader issue of consumption taxation of any type vs. taxation of all forms of income.

³As shown in the Appendix, in a closed economy the predicted effect of corporate income taxation on saving is identical to the predicted effect of personal income taxation on saving. In a fully open economy, there is no first-order effect of corporate income taxation on domestic saving.

Our empirical strategy is to analyze a panel of up to 22 OECD countries⁴ over the period 1975-2007, treating changes in the rates of taxation, as well as variations in the level of government spending, national income, and the demographic structure as exogenous to households' saving decisions. Under these assumed conditions, we estimate the response of national and aggregate personal savings rates to changes in tax rates. The estimates we obtain from our sample conform closely to the predictions of a simple economic theory of the intertemporal allocation of consumption.

We begin the rest of our paper by developing a simple life-cycle model of private saving in the presence of taxes, government spending, and fluctuating public debt, using that model to generate testable implications of the effect of various fiscal policies on the private and national savings rates. We then briefly describe the pattern of taxation in the OECD countries during the sample period. Finally, we report estimates of the response of savings rates to changes in our key fiscal-policy variables: income-tax rates, consumption-tax rates, and government spending.

2. Taxes and Saving over the Life Cycle

Our starting point is a simple two-period life-cycle model of the intertemporal allocation of consumption with exogenously determined initial income flows in each period. The role of government is limited initially to levying proportional taxes on either consumption or income, rebating the revenue generated by those taxes in the form of lump-sum grants uncorrelated with any individual household's tax payments. The representative household can borrow or lend at the market interest rate r .

The budget constraint of household i is

$$(1) \quad C_{i1} + \beta C_{i2} = (Y_{i1} + G_1) + \beta(Y_{i2} + G_2) - (T_{i1} + \beta T_{i2}),$$

where G_1 and G_2 are the lump-sum grants received by each household and β_i is the household's discount factor, which is equal to $1/(1+r)$. The budget constraint of the government is

$$(2) \quad N(G_1 + \beta G_2) = \sum_i (T_{i1} + \beta T_{i2}),$$

where N is the (unchanging) number of households in the economy. The time path of government debt is determined by (2) and the values of NG_1 and $\sum T_{i1}$.

⁴ The precise number of countries in our panel varies over time due to data limitations.

Assuming that the first period of the life cycle is the period of intensive labor supply, $Y_{i1} > Y_{i2}$, so household optimization generates positive private saving in period 1:

$$(3) \quad S^*_{i1} = Y_{i1} + G_1 - C^*_{i1} - T_{i1} .$$

In assuming that the initial levels of income Y_{i1} and Y_{i2} are exogenously determined, we are abstracting from the labor-leisure choice of the household, so that the only margin on which taxation can affect behavior is the intertemporal allocation of consumption.

2.1 Neutrality of Consumption Taxation under Complete Tax Finance

It is straightforward to establish the neutrality of consumption taxation under these assumptions. Let the rate of taxation of consumption be τ . Then the household's lifetime tax liabilities are $\tau(C_{i1} + \beta C_{i2})$ and its optimal consumption path satisfies

$$(1a) \quad C^*_{i1} + \beta C^*_{i2} = (1-\tau)[(Y_{i1} - S^*_{i1}) + \beta(Y_{i2} + (1+r)S^*_{i1})] + (G_1 + \beta G_2) .$$

Since $\beta = 1/(1+r)$, (1a) reduces to

$$(1a') \quad C^*_{i1} + \beta C^*_{i2} = (1-\tau)(Y_{i1} + \beta Y_{i2}) + (G_1 + \beta G_2) .$$

Since the relative price of future consumption is unaffected by the consumption tax, the tax is neutral. This is readily apparent from the value of (1a') for a household with the economy-wide average value of taxes, since $\tau(Y_{i1} + \beta Y_{i2}) = (G_1 + \beta G_2)$ for that household if both the government and the private sector face the interest rate r .

2.2 Nonneutrality of Income Taxation

Under income taxation at rate t , the household's budget constraint becomes

$$(1b) \quad C^*_{i1} + \beta C^*_{i2} = (1-t)(Y_{i1} + \beta Y_{i2} + r\beta S^*_{i1}) + (G_1 + \beta G_2).$$

While the present value of government transfers still must equal the present value of tax payments by the average household, because this relationship is not true for any household other than the average, the choice of S^*_{i1} is distorted by the income tax. It is of particular importance to note that, for the economy as a whole, this distortion is purely a compensated price effect. Thus, while the income effect may induce some ambiguity about the comparative statics of income taxation for any individual household, at the aggregate level the presumption is strong that income taxation will reduce the saving rate (S^*_{i1}/Y_{i1}).

2.3 The Effect of Deficit Finance on Saving

The possibility that the government will not maintain perpetual budget balance in each period means that private saving may differ from national saving in any one period. If the government finances some part of its expenditures through the sale of bonds to the private sector, taxes will vary over time to satisfy the conditions

$$(2a) \quad NG_1 = \sum_i T_{i1} + B_1, \text{ and}$$

(2b) $NG_2 = \sum_i T_{i2} + B_2$, where B_1 and B_2 represent net bond sales to the public. The government's budget constraint (2) implies the additional constraint

$$(2c) \quad B_1 + \beta B_2 = 0.$$

For simplicity, suppose that all period-1 government spending is financed by bond sales. Taxes in period 2 must generate revenue equal to $NG_2 + (1+r)NG_1$

so the household's optimization problem satisfies

$$(4) \quad C^*_{i1} + \beta C^*_{i2} = Y_{i1} + \beta Y_{i2} + (G_1 + \beta G_2) - \beta F_i[G_2 + (1+r)G_1], \text{ where } F_i[\cdot] \text{ is the function that determines the } i^{\text{th}} \text{ household's period-2 tax liability.}$$

If taxation took the form of lump-sum levies, then for the representative household equation (4) would collapse to $C^*_{i1} + \beta C^*_{i2} = Y_{i1} + \beta Y_{i2}$. This implies the familiar "Ricardian Equivalence" condition that $\sum_i S^*_{i1}$ would increase on a one-to-one basis with B_1 . In this case, fluctuations in private saving would simply offset fluctuations in public borrowing; the stable behavioral variable would be national saving (defined as $\sum_i S^*_{i1} - B_1$). This simple result does not hold, however, under *either* consumption or income taxation.

Under consumption taxation, (4) becomes

$$(4a) \quad C^*_{i1} + \beta C^*_{i2} = Y_{i1} - S^*_{i1} + G_1 + \beta\{(1-\tau_2)[Y_{i2} + (1+r)S^*_{i1}] + G_2\}, \text{ while under income taxation it becomes}$$

$$(4b) \quad C^*_{i1} + \beta C^*_{i2} = Y_{i1} - S^*_{i1} + G_1 + \beta\{(1-t_2)[Y_{i2} + rS^*_{i1}] + G_2\}.$$

It is apparent from (4a) that deficit finance in period 1 means that even consumption taxation will distort the saving decision in period 1, because it raises the relative price of consumption in period 2. Indeed, in the extreme case of complete deficit financing of government spending in period 1, consumption and income taxation distort the saving decision in period 1 equally. While at first glance it appears that income taxation imposes a lower rate of taxation on S_{i1} than does consumption taxation (since the latter taxes repayment of principal as well as interest income), the fact that the revenue requirements in period 2 are the same in

either case means that the income-tax rate (t_2) must exceed the consumption-tax rate (τ_2) by an amount that causes S_{i1} to be taxed equally under either system.

We conclude that, under either consumption or income taxation, deficit spending in period 1 will tend to reduce national saving unambiguously, while increasing private saving by less than would be the case under lump-sum taxation. However, as long as period-1 government spending is at least partially financed by direct taxation, income taxation will reduce the period-1 saving rate relative to consumption taxation. In general, the degree to which income taxation reduces saving relative to consumption taxation decreases as the current rate of government borrowing rises

3. Value-Added Taxes and Income Taxation among Industrial Countries

We test the predictions of our analysis in section 2 using data primarily from the OECD over the period 1975-2005, with additional data from the World Bank. Since the membership of the OECD changes over this period, our data constitute an unbalanced panel.

We consider three different measures of the savings rate for each country as dependent variables: net national saving as a proportion of GDP, net private saving as a proportion of GDP, and saving by households and non-profit organizations as a proportion of households' disposable income. The first of these measures is taken from the World Bank's World Development Indicators, while the second and third measures of savings rates are obtained from the OECD's Economic Outlook and Current Account. The key difference between net national saving and household saving are the inclusion of saving by firms in the former measure and the exclusion of personal taxes from the base of the latter measure.

The effect of taxation on current saving clearly operates through expected future tax rates rather than historical or current rates, except insofar as those latter rates help forecast future rates. Changes in tax policy, however, do not occur continuously, but are more typically determined by medium-run political and economic factors. We therefore choose to deal with these timing issues by taking as our observations the average rates of all variables computed over non-overlapping five-year intervals.

Our measure of the consumption tax rate in each country is the statutory VAT rate. Although in principle a tax on value added can fall on either production, income, or consumption, depending upon its design, nearly all countries that adopt value-added taxation choose a VAT of the consumption type. The prevalence of consumption-type VATs has led some (Metcalf, 1995), and perhaps many, authors to treat a VAT as necessarily a tax on consumption. That this might lead to error is illustrated by the case of China, which switched from a VAT of the income type (first imposed in 1994) to one of the consumption type in 2008. However, since the sample of countries we consider, as listed in Table 1, includes no country that

imposes a VAT of any type other than the consumption type, henceforth we shall use the two terms interchangeably.

A striking feature of rates of consumption taxation among the countries in our sample is that change in the statutory rate occurs only occasionally within a country, but there is significant dispersion in rates (including “rates” of zero; i.e., the absence of a VAT) across countries. Thus, it seems reasonable to assume that changes in VAT rates are not viewed as merely transitory phenomena, but rather as events calling for behavioral responses.

All countries in our sample tax income, usually at rates that vary with income levels, making it more difficult to specify a single, unambiguous measure of the rate of income taxation. Our ideal measure is the marginal tax rate facing each household, which would be the top statutory marginal rate if every household were in the highest income bracket. Since the top marginal rate does not apply to every household, and quite commonly applies only to a small fraction of a country’s households, we also use the “average personal income-tax rate” as calculated by the OECD for each country over time. This figure represents the percent of the median household’s income that is paid directly in taxes on wage income. While this average rate is not the marginal statutory rate facing the average household, it should nevertheless be reasonably closely related to the actual marginal tax burden facing the average household. Certainly it will be a better measure of the marginal tax burden on a typical household than the statutory top marginal rate would be. This is particularly true because the higher the top marginal tax rate, the likelier it is to affect only a small percentage of all households.

Both the top marginal rate and the average income-tax rate in our panel vary considerably across countries and over time within countries. The top marginal income-tax rate for each country in our sample, as reported by the OECD, ranges from a low of 19 percent in the Slovak Republic to a high of over 88 percent in Japan. The average personal income-tax rate has ranged from a low of 1 percent in Greece to a high of over 42 percent in Denmark and Turkey.

The figures in Appendix B demonstrate that there is no consistent pattern of comovements of average income and consumption tax rates over the period of observation among the countries in our sample. In some countries such as Austria and Germany, they have tended to move together, while in other countries such as Finland, Great Britain, New Zealand, and Turkey, they have more clearly tended to be used as substitute revenue sources.

4. Other Factors Affecting Saving

a. *Government Debt*

Our analysis in section 2 above shows that the expected private-sector response to an increase in the stock of outstanding public debt is an increase in private saving

but a decrease in national saving. It also makes clear that the differential effects of income and consumption taxation diminish as the government finances a greater share of its current expenditure by issuing debt. Therefore, the greater is the government's expected future debt over an indefinite horizon, the smaller the effective difference between income and consumption taxation. Since there is no single best indicator of expected future government debt, we use alternately the contemporaneous ratio of outstanding public debt to GDP and the contemporaneous fiscal deficit as a proportion of GDP.

b. Social Security Taxes

To the extent that a state-run system of retirement benefits is financed by taxes that are positively related to future benefits, the system is one of forced saving, which would clearly reduce each household's desired supplementary direct saving. Thus, social security taxes are expected to reduce private saving.

c. Corporate Income Taxes

In a country facing a parametric interest rate in a global capital market, corporate taxation would affect domestic investment but not domestic saving. As shown in Appendix A, however, the effect of corporate income taxation on private saving is expected to be the same as the effect of personal income taxation in an economy that must raise its capital internally.

d. Age Structure of the Population

Since the typical household saves during its working years in planning its retirement spending and bequests, the age structure of the population can affect the national saving rate. We therefore include the percent of the working-age population (ages 25-64) as a possible determinant of the aggregate saving rate in each country.

e. Income Level

The level of a household's income can potentially affect its saving behavior in a couple of ways. First, a higher lifetime income may induce earlier retirement, which would necessitate a higher rate of saving during the household's working years in order to achieve the desired level of consumption smoothing over the entire life cycle. Second, a higher absolute level of saving (due to a higher absolute income) might give a household access to a wider array of financial options offering a greater average yield. Neither of these effects is certain, but they are at least possibilities to be considered.

f. Income Growth

In an economy facing completely open credit markets, it would be expected that a higher expected rate of future income growth would induce households to borrow more and save less in order to achieve their desired levels of consumption

smoothing. On the other hand, if current income has been growing because it has temporarily exceeded a stable trend, then current saving would be unusually high during periods of high growth. While the ultimate effect of income growth is ambiguous, it is clearly a factor that should be taken into account.

Summary statistics of all the variables are reported in Table 2.

5. Empirical Results

We estimate the effects of income and consumption taxes on saving by means of a linear regression with country and year fixed effects. Our basic equation is

$$(5) \quad (S/Y)_{it} = \alpha_i + \delta_t + \sum_j \beta_j T_{jit} + \beta_d D_{it} + \sum_k \gamma_k D_{it} * T_{kit} + \sum_m \eta_m X_{mit} + \varepsilon_{it}, \text{ where}$$

$(S/Y)_{it}$ is one of our three measures of the aggregate private saving rate in country i during period t , T_{jit} is the tax rate on tax base j (e.g., income, consumption, etc.) in country i in period t , D_{it} is one of our two measures of future public debt in country i as of period t , T_{kit} is either the consumption tax rate or the average income-tax rate in country i in period t , X_{mit} is each of the remaining variables hypothesized to affect private saving, and ε_{it} is a Gaussian error term. The various α , δ , β , γ , and η terms are the parameters to be estimated.

Our parameter estimates are presented in Tables 3-5. We shall focus our discussion primarily on the estimated parameters from the specifications that use the household saving rate as a percent of disposable income as the dependent variable.

a. *Determinants of Household Saving*

Of primary interest is our estimate of the differential effect of income versus consumption taxation absent any effects of public debt. Consider the specification reported in column 2 of Table 3, which includes time-period and country fixed effects as well as interactions between public deficits on the one hand and consumption-tax rates and average personal income-tax rates on the other. We find that a 100 basis-point increase in the average personal income-tax rate is, *ceteris paribus*, related to a 29 basis-point reduction in the household saving rate. By contrast, as expected, there is no significant relationship between the household saving rate and the consumption-tax rate.

The estimated values of γ for the average income-tax rate and the consumption tax rate (their respective interaction terms with the government's deficit) are also as predicted. Higher deficits are associated with a diminution of the difference between the estimated effects of income and consumption taxes on saving. At a household saving rate of ten percent, the difference between the two types of taxes would essentially disappear if the fiscal deficit were as high as seven percent of GDP. (The revenue-equivalent income-tax rate would be about ten percent less than the corresponding consumption-tax rate given the assumed household saving rate.)

The magnitude of this effect suggests that any potential efficiency gains from consumption taxation can be reduced substantially by fiscal deficits.

We observe that the estimated effect of income taxation on saving appears to be of the same magnitude as the effect of social-security taxes. This finding stands in marked contrast to the comparative amount of savings-policy concern addressed to these two taxes.

The estimated effect of the corporate income tax on saving is of uncertain statistical significance. Recall that the predicted value of this coefficient ranges from zero (in the case of a country that is fully integrated into the global capital market) up to a value that is equivalent to the estimate of the coefficient on the income-tax rate (in the case of a country that is completely closed to external capital markets). The relatively small size of our estimate of the impact of the corporate tax rate, along with its relatively large confidence interval, is fully consistent with Harberger's view of national capital markets as largely, but not perfectly, globally integrated.

As predicted, the estimated effect of increased public debt is to increase private saving, but this parameter (β_d) is not estimated with sufficient precision to be statistically significant despite its considerable magnitude.

The influence of the age structure of the population is also as expected. A 100 basis-point increase in the proportion of the population that is of standard working age is associated with a household saving rate that is 78 basis points higher. Demographics are clearly an important driver of cross-country differences in saving rates.

Finally, in this specification of equation (5), neither the level of GDP per capita nor its growth rate appears to be significantly related to private savings.

As is apparent from Table 4, the specification of equation (5) that uses total outstanding government debt as its measure of D_{it} yields parameter estimates that are very similar to those obtained when the five-year average annual deficit is used to measure D_{it} . The principal difference between the two sets of estimates is that the coefficients on the various tax rates are estimated with less precision in the specification using outstanding debt rather than the deficit.

b. Determinants of All Private Saving

Columns 1-2 of Table 5 report the estimates of equation (5) obtained from OECD data using the ratio of net private saving to GDP as the dependent variable. The specifications shown are analogous to those reported previously using household saving as the dependent variable, as are the results of the estimation. Once again, a reduction in the average personal income-tax rate coupled with a revenue-neutral

increase in the consumption-tax rate is associated with an increase in the combined saving rates of households and firms. A higher fiscal deficit is strongly associated with higher private saving, as expected, although the comparable estimate for the outstanding stock of public debt is not statistically significant. It is, however, unambiguously true that the magnitude of the effect of such a tax substitution falls as the size of the public debt or deficit increases. The effect of the domestic corporate tax rate is small and statistically insignificant, contributing further support for the view that the capital markets of the developed nations are highly integrated. Demographics affect private saving strongly, but the effect of social-security taxes is not estimated with sufficient precision to be statistically significant.

c. Determinants of Net National Saving

Our third measure of saving is net national saving, which adds public-sector saving to private saving. For this specification we use World Bank as well as OECD data for comparison purposes and obtain highly similar results. The results are reported in Columns 3-4 of Table 5.

As in our previous specifications, we find that a substitution of consumption taxation for income taxation is clearly associated with an increase in the saving rate. The magnitude of this estimated effect is consistent with those obtained from the two previous specifications.

The one parameter estimate that our analysis predicts to be of a different sign in this specification is β_d , the coefficient on the government-spending variable. Intuitively, holding tax revenue constant, higher government spending will translate into higher budget deficit. While higher levels of public debt are expected to induce higher private saving, they are predicted to reduce combined public and private saving because distortionary taxation means that private savings do not increase by the full amount of the increment to the public debt. Our estimates of β_d are fully consistent with this prediction of our model, being negative and statistically significant.

6. Conclusion

We have tested the implications of a simple model of households' saving behavior using an unbalanced panel of observations from up to 22 OECD countries over a 30-year period. Our particular hypothesis of interest is the prediction that a substitution of consumption taxation for income taxation would, *ceteris paribus*,

induce an increase in private saving. Using three different measures of saving, we are unable to reject this hypothesis.

We also test the ancillary hypothesis that the advantages of consumption taxation over income taxation with respect to stimulating savings are diminished when households expect future tax increases to service current fiscal deficits. We fail to reject this hypothesis as well.

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Table 1: VAT

Country	Code	Year implemented	Standard rate (2)														Domestic zero rate (1)	
			1976	1980	1984	1988	1990	1992	1994	1996	1998	2000	2003	2005	2006	2007		
Australia	AUS	2000	-	-	-	-	-	-	-	-	-	-	10.0	10.0	10.0	10.0	10.0	yes
Austria	AUT	1973	18.0	18.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	no
Belgium	BEL	1971	18.0	16.0	19.0	19.0	19.0	19.50	20.5	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	yes
Canada	CAN	1991	-	-	-	-	-	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	6.0	yes
Czech Republic	CZE	1993	-	-	-	-	-	-	23.0	22.0	22.0	22.0	22.0	22.0	19.0	19.0	19.0	yes
Denmark	DNK	1967	15.0	22.0	22.0	22.0	22.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	yes
Finland	FIN	1994	-	-	-	-	-	-	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	yes
France	FRA	1968	20.0	17.6	18.6	18.6	18.6	18.6	18.6	20.6	20.6	20.6	19.6	19.6	19.6	19.6	19.6	no
Germany	DEU	1968	11	13	14	14	14.0	14	15	15	16	16	16	16	16.0	19	19	no
Greece	GRC	1987	-	-	-	16	18.0	18	18	18	18	18	18	18	18	19.0	19	no
Hungary	HUN	1988	-	-	-	25	25.0	25	25	25	25	25	25	25	25	20.0	20	no
Iceland	ISL	1989	-	-	-	-	22.0	22	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	yes
Ireland	IRL	1972	20	25	23	25	23.0	21	21	21	21	21	21	21	21	21.0	21	yes
Italy	ITA	1973	12	15	18	19	19.0	19	19	19	20	20	20	20	20.0	20	20	yes
Japan	JPN	1989	-	-	-	-	3.0	3	3	3	5	5	5	5	5.0	5	5	no
Korea	KOR	1977	-	10	10	10	10.0	10	10	10	10	10	10	10	10.0	10	10	yes
Luxembourg	LUX	1970	10	10	12	12	12.0	15	15	15	15	15	15	15	15.0	15	15	no
Mexico	MEX	1980	-	10	15	15	15.0	10	10	15	15	15	15	15	15.0	15	15	yes
Netherlands	NLD	1969	18	18	19	20	18.5	17.5	17.5	17.5	17.5	17.5	19	19	19.0	19	19	no
New Zealand	NZL	1986	-	-	-	10	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	yes
Norway	NOR	1970	20	20	20	20	20.0	22	22	23	23	23	24	25	25.0	25	25	yes
Poland	POL	1993	-	-	-	-	-	-	22	22	22	22	22	22	22.0	22	22	yes
Portugal	PRT	1986	-	-	-	17	17.0	16	16	17	17	17	19	19	21.0	21	21	no
Slovak Republic	SVK	1993	-	-	-	-	-	-	25	23	23	23	20	19	19.0	19	19	no
Spain	ESP	1986	-	-	-	12	12.0	13	16	16	16	16	16	16	16.0	16	16	no
Sweden	SWE	1969	17.65	23.5	23.5	23.5	23.46	25	25	25	25	25	25	25	25.0	25	25	yes
Switzerland	CHE	1995	-	-	-	-	-	-	6.5	6.5	6.5	7.5	7.6	7.6	7.6	7.6	7.6	yes
Turkey	TUR	1985	-	-	-	10	10.0	10	15	15	15	17	18	18	18.0	18	18	no
United Kingdom	GBR	1973	8	15	15	15	15.0	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	yes
United States	USA																	

Source: national delegates; position as at 1 January 2007

1. "Domestic zero rate" means tax is applied at a rate of zero to certain domestic sales. It does not include zero rated exports.
2. Specific rates are applied within specific regions

Table 2: Summary Statistics

Variable	Obs	Mean	Std.Dev	Min	Max	coef. of var
net HH saving as % of HH disposable income, OECD	122	8.57	5.82	-3.09	24.59	0.68
net private saving as % of GDP, OECD	159	7.87	4.61	-12.02	20.03	0.58
net national saving as % of GDP, OECD	179	7.94	5.24	-3.98	26.22	0.66
net national saving as % of GDP, WDI	194	9.09	5.00	-4.23	25.72	0.55
VAT	210	12.80	8.62	0.00	25.00	0.67
top marginal personal income tax rate, central & sub-central	192	51.19	11.90	19.00	88.40	0.23
corporate income tax rate, central gov	187	34.21	9.75	8.50	56.00	0.28
average personal income tax rate, income tax	184	16.87	8.97	0.27	42.68	0.53
social security tax (employer & employee)	181	20.20	10.19	0.00	42.86	0.50
% aged 25-64 in population	210	48.99	4.83	41.10	68.50	0.10
per capita GDP in constant 2000 US\$	203	17.89	10.09	1.99	52.88	0.56
Government expenditure as % of GDP	202	18.23	4.62	7.98	29.30	0.25
Government budget deficit % of GDP	171	2.29	4.15	-17.74	12.62	1.81
Government debt as % of GDP	143	22.45	37.40	-139.27	111.49	1.67

Table 3: Taxes and Net Household Savings as % of Household Disposable Income, control for government deficit as percentage of GDP

	1	2	3
average personal income tax rate _ income tax	-0.342 [0.133]*	-0.291 [0.136]*	-0.28 [0.136]*
VAT	-0.062 [0.111]	-0.094 [0.107]	-0.105 [0.108]
gov't budget deficit, % GDP	0.116 [0.140]	0.337 [0.329]	0.386 [0.332]
APIT * deficit % GDP		0.016 [0.012]	0.016 [0.012]
VAT * deficit % GDP		-0.036 [0.013]**	-0.034 [0.013]**
social security tax (employer & employee)	-0.454 [0.154]**	-0.303 [0.160]+	-0.334 [0.162]*
corporate income tax rate, central gov	-0.158 [0.072]*	-0.133 [0.070]+	-0.146 [0.071]*
top marginal personal income tax rate, central+local			0.064 [0.059]
% population aged (25-64)	0.836 [0.255]**	0.781 [0.250]**	0.715 [0.257]**
GDP per capita in 1,000 of 2000 US\$	-0.206 [0.151]	-0.263 [0.147]+	-0.182 [0.164]
growth rate (%) of per capita GDP	-0.04 [0.252]	0.011 [0.242]	0.005 [0.242]
Constant	-4.445 [13.854]	-5.321 [13.574]	-6.365 [13.589]
Observations	105	105	105
Number of countries	22	22	22
R-squared	0.46	0.52	0.53

Note: Standard errors in brackets; + significant at 10%, * significant at 5%, ** significant at 1%. All specifications include country and time period fixed effects. Sample includes all countries but Spain, Great Britain, Greece, Iceland, Luxemburg, Mexico, New Zealand, and Turkey.

Table 4: Taxes and Net Household Savings as % of Household Disposable Income, control for government debt as percentage of GDP

	1	2	3
average personal income tax rate_income tax	-0.163 [0.150]	-0.33 [0.173]+	-0.325 [0.174]+
VAT	-0.072 [0.110]	-0.168 [0.117]	-0.168 [0.118]
net gov't financial liabilities, % GDP	-0.05 [0.020]*	-0.084 [0.052]	-0.093 [0.056]
APIT * net gov't liabilities % GDP		0.006 [0.003]*	0.006 [0.003]*
VAT * net gov't liabilities % GDP		-0.003 [0.002]	-0.003 [0.002]
social security tax (employer & employee)	-0.298 [0.161]+	-0.247 [0.163]	-0.22 [0.172]
corporate income tax rate, central gov	-0.206 [0.070]**	-0.178 [0.072]*	-0.17 [0.074]*
top marginal personal income tax rate, central+local			-0.031 [0.063]
% population aged (25-64)	0.699 [0.264]**	0.659 [0.264]*	0.668 [0.266]*
GDP per capita in 1,000 of 2000 US\$	-0.36 [0.139]*	-0.362 [0.146]*	-0.394 [0.161]*
growth rate (%) of per capita GDP	-0.197 [0.245]	-0.215 [0.242]	-0.203 [0.245]
Constant	2.13 [14.201]	6.04 [14.582]	7.134 [14.832]
Observations	103	103	103
Number of cntrid	22	22	22
R-squared	0.49	0.52	0.53

Note: Standard errors in brackets; + significant at 10%, * significant at 5%, ** significant at 1%. All specifications include country and time period fixed effects. Sample includes all countries but Spain, Great Britain, Greece, Iceland, Luxemburg, Mexico, New Zealand, and Turkey.

Table 5: Taxes and Net Private Savings as % of GDP, Net National Saving as % of GDP

	Net Private Saving as % of GDP		Net National Saving as % of GDP	
	1	2	3	4
average personal income tax rate_income tax	-0.193 [0.084]*	-0.323 [0.107]**	-0.26 [0.070]**	-0.263 [0.076]**
VAT	0.077 [0.063]	0.119 [0.078]	0.082 [0.054]	0.046 [0.058]
gov't budget deficit, % GDP	0.731 [0.211]**			
APIT * deficit % GDP	-0.005 [0.008]			
VAT * deficit % GDP	-0.021 [0.008]**			
net gov't financial liabilities, % GDP		0.017 [0.035]		
APIT * net gov't liabilities % GDP		0.003 [0.002]		
VAT * net gov't liabilities % GDP		-0.004 [0.001]**		
gov final consumption exp as % of gdp			-1.114 [0.152]**	-0.877 [0.164]**
social security tax (employer & employee)	-0.091 [0.100]	-0.143 [0.106]	-0.263 [0.082]**	-0.284 [0.087]**
corporate income tax rate, central gov	0.02 [0.041]	-0.042 [0.045]	0.117 [0.037]**	0.121 [0.040]**
% population aged (25-64)	0.353 [0.173]*	0.469 [0.176]**	0.18 [0.127]	0.243 [0.130]+
GDP per capita in 1,000 of 2000 US\$	-0.05 [0.102]	-0.199 [0.100]+	0.22 [0.073]**	0.298 [0.078]**
growth rate (%) of per capita GDP	0.618 [0.149]**	0.509 [0.155]**	0.552 [0.131]**	0.457 [0.140]**
Constant	-6.889 [9.234]	-3.274 [9.836]	19.655 [7.359]**	12.352 [7.562]
Observations	137	120	154	165
Number of cntrid	25	25	27	30
R-squared	0.44	0.47	0.53	0.42

Note: Standard errors in brackets; + significant at 10%, * significant at 5%, ** significant at 1%. All specifications include country and time period fixed effects. Sample for Columns 1-2 includes all countries but Switzerland, Hungary, Luxembourg, Mexico, and Turkey. Savings measure in Column 3 is from OECD, and sample does not include Switzerland, Hungary, and Luxembourg. Savings measure in Column 4 is from WDI, and sample includes all countries.

Appendix A

The Identical Effects of Personal and Corporate Income Taxes on Saving in a Closed Economy

If $r(S)$ is the minimum after-tax yield on assets required to induce the saving rate S , then the minimum before-tax return (r_m) required to induce saving rate S is $r(S)/(1-t_p)$, where t_p is the appropriate personal income-tax rate.

If $\rho(I)$ is the before-tax rate of return on corporate equity (assumed to be a declining function of total domestic investment, I), then the maximum after-tax yield firms can pay shareholders (denoted i) is $(1-t_c)\rho(I)$, where t_c is the appropriate corporate income-tax rate.

Equilibrium requires that $i = r_m$, so, treating $\ln(1+t)$ as equivalent to t ,

$$(A1) \quad \ln[\rho(I)] - \ln[r(S)] = t_c + t_p .$$

Defining η as the elasticity of investment with respect to the user cost of capital, and defining ε as the elasticity of saving with respect to the after-tax yield on assets, then totally differentiating (A1) implies

$$(A2) \quad [d\ln(I)/\eta] - [d\ln(S)/\varepsilon] = dt_c + dt_p .$$

Since $d\ln(I) = d\ln(S)$ in a closed economy, (A2) implies

$$(A3) \quad d\ln(S)/dt_p = d\ln(S)/dt_c = \varepsilon\eta/(\varepsilon-\eta),$$

so that private saving responds equally to the personal and corporate income tax rates in a closed capital market.

Appendix B

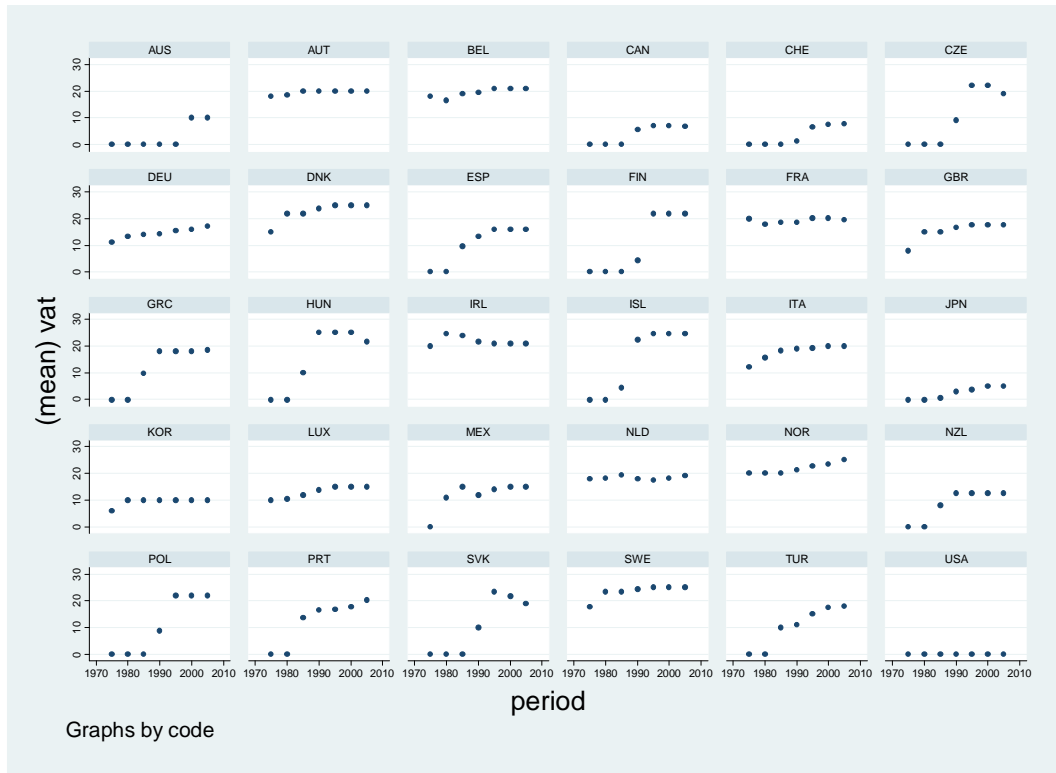
Appendix Table 1: Minimum and Maximum of Average and Marginal Income-Tax Rates

Country	average personal income tax rate		top marginal personal income tax rate	
	min	max	min	max
Australia	23.70	25.22	46.33	63.83
Austria	7.86	14.76	50	62
Belgium	15.20	27.88	57	72.74
Canada	16.60	21.67	46.33	53.75
Czech Republic	8.92	10.76	32	45.5
Denmark	30.18	42.68	40	69.26
Finland	24.41	30.70	38.4	53.75
France	6.98	15.50	45.39	63
Germany	15.96	21.07	43	56
Greece	1.00	8.16	40	61.5
Hungary	16.05	19.94	36.67	56
Iceland	14.66	24.53	33	44.56
Ireland	9.94	26.78	41.67	71.33
Italy	11.55	18.86	44.37	72
Japan	5.97	8.74	50	88.4
Korea	1.95	3.08	41	55
Luxembourg	9.83	17.45	38	57.71
Mexico	0.27	6.63	29	55
Netherlands	6.51	14.77	52	72.15
New Zealand	20.03	26.70	33	63
Norway	21.05	25.65	28	63.63
Poland	6.17	17.22	40	42.8
Portugal	4.45	10.17	40	85.5
Slovak Republic	6.57	8.87	19	44.5
Spain	10.09	13.98	28.48	65.31
Sweden	24.17	36.54	49.09	64.19
Switzerland	9.81	11.49	40.36	44.33
Turkey	14.99	42.04	35	68
United Kingdom	15.70	23.16	40	83
United States	15.68	23.25	39.50	70

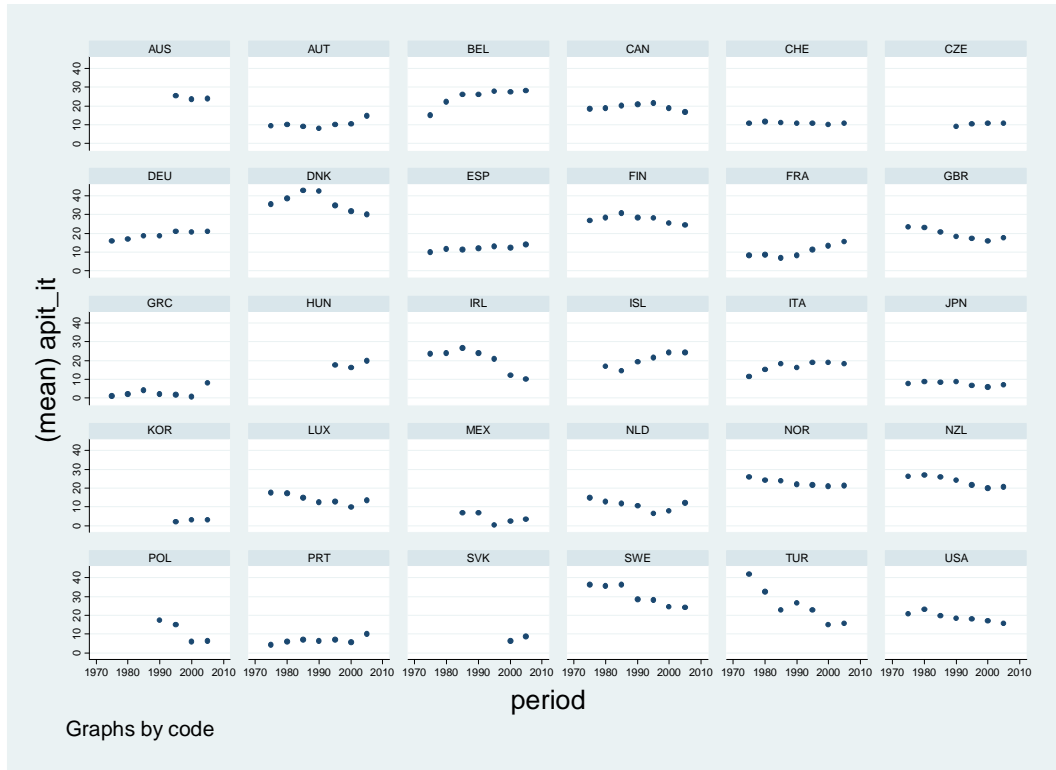
Appendix Table 2: Average Net Saving Rates and Government Budget Deficit, Debt

Country	Net Household Saving % HH Disposable Income	Net Private Saving % GDP	Net National Saving % GDP (OECD)	Government Deficit % GDP	Government Debt % GDP
Australia	6.53	6.24	5.41	1.68	9.91
Austria	9.53	8.57	8.67	2.74	30.52
Belgium	12.05	12.77	8.76	5.50	86.59
Canada	9.88	10.06	8.01	3.25	36.95
Czech Republic	3.96	6.10	4.85	4.40	-9.73
Denmark	0.25	5.51	5.27	0.75	21.81
Finland	1.37	4.37	8.09	-2.36	-32.99
France	12.37	8.45	7.39	2.70	21.99
Germany	10.81	7.96	7.83	2.57	34.02
Greece		4.21	-0.21	6.30	80.34
Hungary	7.18			6.59	21.00
Iceland		-1.54	2.11	0.30	17.30
Ireland	6.34	9.98	8.88	4.04	17.28
Italy	17.25	12.27	7.26	7.22	80.66
Japan	12.25	12.30	12.68	3.61	38.80
Korea	13.93	14.39	21.06	-2.38	-17.42
Luxembourg				-2.18	
Mexico			11.67		
Netherlands	11.74	12.38	11.32	2.70	32.75
New Zealand		0.32	2.92	-0.47	21.17
Norway	3.60	5.98	14.17	-6.62	-56.07
Poland	8.22	7.10	4.58	4.07	13.61
Portugal	3.15	8.09	4.93	5.04	35.60
Slovak Republic	4.40	7.12	2.85	6.09	-0.62
Spain		7.62	8.22	2.83	38.33
Sweden	7.14	10.15	10.95	0.81	-0.58
Switzerland	11.61			1.08	13.29
Turkey			12.86		
United Kingdom		5.61	4.69	3.14	30.04
United States	5.81	6.95	4.87	3.18	40.21

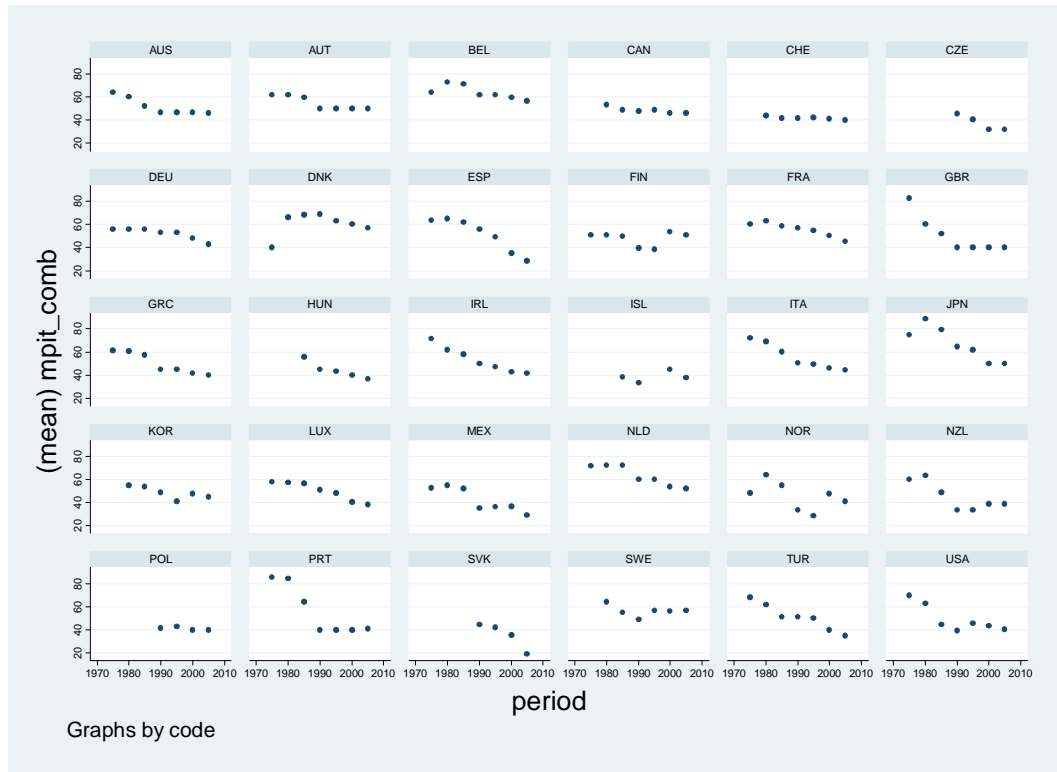
Appendix Figure 1A: Value Added Tax



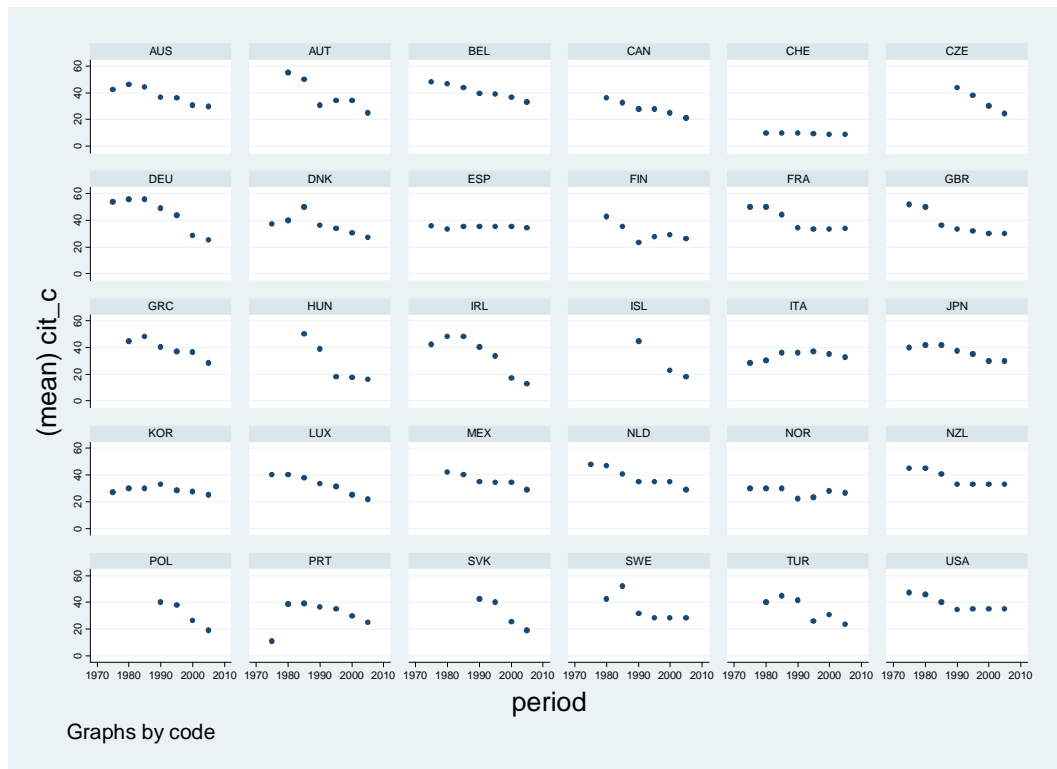
Appendix Figure 1B: Average Personal Income Tax Rate



Appendix Figure 1C: Top Marginal Personal Income Tax Rate: Combined Central and Sub-central



Appendix Figure 1D: Corporate Income Tax: Central Government



Appendix Figure 1E: Social Security Tax, combined employer, employee contribution

