Taxation and the household saving rate: evidence from OECD countries *

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1. Introduction

Because savings are generally assumed to be one of the key sources of economic growth, the factors that determine the saving rate have been analyzed in a voluminous body of literature. Some of these factors, such as demographic and cultural factors, are not easily influenced by policy; others, such as the rate of inflation, the rate of interest, and the level and structure of taxes, are largely policy variables. In this paper, we focus on the impact of taxation on the household saving rate in a sample of OECD countries.[1]

Theoretical and empirical studies abound on the impact of different types of taxes or of different tax provisions on private saving behavior.[2] Many of these studies have dealt with the American reality, characterized by a relatively stable level and structure of taxation,

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[1] See Tanzi and Zee (1997) for a comprehensive examination of the relationship between taxation and growth. For a recent empirical investigation of the *nontax* determinants of savings, see Masson, Bayoumi, and Samiei (1998), which covers both OECD countries (with a sample that is almost identical to that of the present paper) and developing countries. Its focus is on national savings (the sum of domestic investment and current account surplus) less savings by the central government, rather than on the household saving rate.

[2] For an excellent general survey of this literature, see Boadway and Wildasin (1994). OECD (1994) provides a detailed and comprehensive survey of country tax provisions that could affect the level and composition of household savings in OECD countries.

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over a period of several decades, and by occasional important changes in particular tax provisions – such as individual retirement accounts (IRAs) – which could affect the rate of saving.[3] While most of the theoretical channels through which taxes could affect savings have been identified and widely discussed, the empirical literature does not convey an overwhelming impression that the effect of taxes on savings is either statistically significant or quantitatively important.

One reason for the inconclusiveness of the empirical results is probably due to the fact that different researchers have used different data sets and/or different definitions of savings and have, consequently, obtained different – and sometimes conflicting – results. Another reason could be that the heavy focus of many of the studies on the United States has meant that much of the existing body of empirical evidence on saving behavior has been dominated by the specific characteristics and circumstances of a single country and may, therefore, lack cross-country generality.

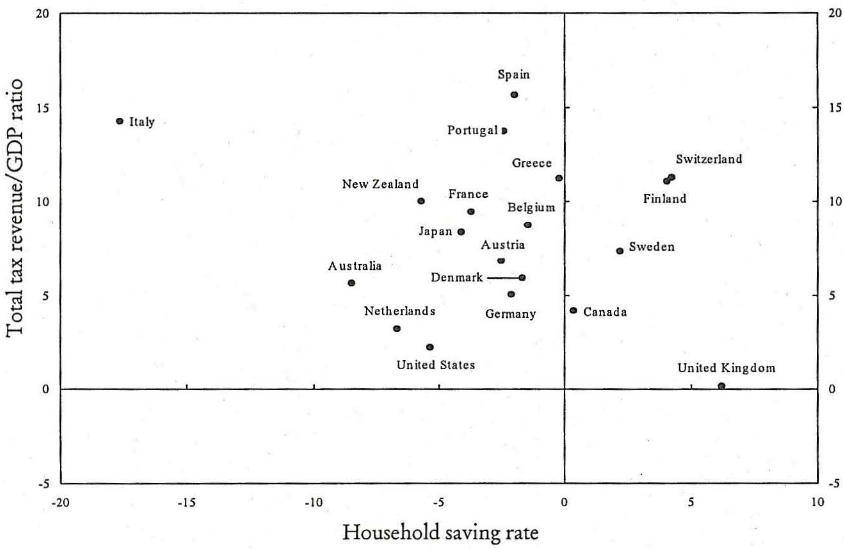
The primary purpose of this paper is to present some direct and, in our view, compelling evidence – largely overlooked in the existing literature – on the impact of taxation on the household saving rate in OECD countries. This evidence is derived from a panel data set covering 19 OECD countries over a period of two and a half decades (1971-95). A general picture of how the total tax revenue/GDP ratio and the household saving rate changed in these countries between the beginning and the end of this period is depicted in Figure 1. As Figure 1 shows, only five of the countries (i.e., those in the first quadrant) experienced a rise in both the total tax revenue/GDP ratio and the household saving rate; in the rest of the countries, higher total taxes were generally associated with lower household savings.

Regression results based on annual observations in fact indicate that the ratios of total tax revenue, income tax revenue and consumption tax revenue to GDP all bear a statistically significant and negative relationship to the household saving rate. This relationship is generally statistically significant at the highest confidence level. More specifically, the estimated negative coefficients of the tax variables tend to be particularly high for income taxes and much lower for consumption

[3] For a recent discussion of the effectiveness of various tax-based saving incentives in the United States, see Bernheim (1997).

FIGURE 1

HOUSEHOLD SAVING RATE AND TOTAL TAX REVENUE/GDP RATIO
(in percentage point change between 1971 and 1995)



taxes. It is also found that, when the total tax revenue/GDP ratio is held constant, the household saving rate remains negatively correlated with the income tax revenue/GDP ratio in a statistically significant way, but its correlation with the consumption tax revenue/GDP ratio becomes statistically insignificant. This could largely be interpreted as the effect on the saving behavior of a revenue-neutral replacement of income with consumption taxes. It is worth pointing out that these results have been obtained on the basis of straightforward regressions on data available directly from the OECD analytical database and revenue statistics. No further transformation of such data has been made, except to correct for panel serial correlation (explained below).

In Section 2, we present our empirical findings on the relationship between taxation and household saving behavior in OECD countries, preceded by a brief discussion of some of the pertinent theoretical considerations relating to this relationship. Section 3 concludes the paper. The Appendix provides a more detailed discussion of the theoretical issues involved.

2. Theoretical considerations and empirical evidence

2.1. *Theoretical considerations*

From the theoretical literature on taxation, it is a well-known result that, absent labor-leisure choice and the bequest motive, a wage tax is equivalent to a consumption tax in present value terms, on account of the intertemporal budget constraint. Since a general income tax taxes capital income in addition to wage income, the difference between the income tax and the consumption tax, in terms of their impact on household savings, hinges solely on the interest rate effect of the former. From this perspective, the sign and magnitude of the interest elasticity of savings is naturally a crucial behavioral parameter, and is in fact the focus of much of the literature on the subject. If this elasticity is positive,[4] it would then follow that a tax on income would depress household savings more than a tax on consumption, all other things equal. Our empirical findings reported below are consistent with this theoretical implication.

In addition to, and separate from, the interest elasticity of savings, the income elasticity of consumption – a behavioral parameter that has received relatively little attention in the literature on taxation and savings – also plays a crucial role (see Appendix for details) in determining the response of household savings to a change in taxation (be it income or consumption tax). The reason for this is quite straightforward. Since taxes affect household disposable income and, therefore, *both* the numerator and the denominator of the household saving rate, for this rate as a whole to decline following an increase in taxes, all other things constant, household consumption must decline proportionately less than the decline in their disposable income, that is, their income elasticity of consumption must be less than unity.[5]

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[4] The sign of the interest elasticity of savings is theoretically ambiguous, since it can be decomposed into opposing income and substitution effects. Available empirical evidence suggests that it is generally positive (see Atkinson and Stiglitz 1980 for a review).

[5] Theoretical considerations alone are not sufficient to ascertain whether the income elasticity of consumption should be greater or less than unity. The question essentially turns on the extent to which a household values its current consumption relative to future consumption. Available empirical evidence from the consumption literature suggests, however, that this elasticity is less than unity in the short run but

Our empirical findings are consistent with those from the consumption literature in indicating that consumption is income inelastic in the short run.

As aggregate data on household savings comprise both savings by the working population and dissavings by the retired, demographic changes with respect to the relative sizes of these two groups could also have an important bearing on observed variations in aggregate savings. For example, a demographic shift in favor of the former group should theoretically lead to a rise in savings.[6] While we have not overlooked the possible relevance of demographic variables in our empirical investigation, we are unable to obtain a meaningful and statistically significant relationship between such variables and saving behavior in the data set we used.[7]

2.2. *Empirical evidence*

The empirical results reported in this paper are based on a panel data set of annual observations covering 19 OECD countries (identified earlier in Figure 1) over the period 1971-95.[8] Data on the independent variables used in the estimated equation, obtained from OECD (1999b), comprise (1) total tax revenue/GDP ratio (X_1), (2) income tax revenue/GDP ratio (X_2), and (3) consumption tax revenue/GDP ratio (X_3). Data on the dependent variable, obtained from OECD (1999a), comprise the aggregate household saving rate. The equation has been

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is approximately equal to unity in the long run (in the familiar terminology of macroeconomics, this is equivalent to stating that the short-run marginal propensity to consume (MPC) is below unity while the long-run MPC is unity).

[6] One of the first to show empirically the importance of demographic variables in determining savings was Graham (1987).

[7] In all variants of the estimated equation reported below, a demographic variable – the dependency ratio – was initially included as an additional independent variable. Two alternative definitions of the dependency ratio were explored, based on data from United Nations (1996). One definition expressed those below 14 years and over 64 years of age as a percent of total working population, the other excluded those below 14 years of age from the definition. Neither definition produced satisfactory results: the estimated coefficient for the dependency ratio in all cases was found either to be statistically insignificant or to have the wrong sign, or both. Such results are, therefore, not reported.

[8] Due to data limitations, the following OECD countries are excluded from the sample: Czech Republic, Hungary, Iceland, Ireland, Korea, Luxembourg, Mexico, Norway, Poland and Turkey.

estimated on the basis of the ordinary least squares (OLS) procedure with country dummies (the so-called fixed-effects model) and using various combinations of the aforementioned tax variables.[9] The regression results are reported in Table 1 (estimated coefficients of the country dummies are suppressed).

As can be seen from the top half of Table 1 (OLS without correction for panel serial correlation), irrespective of the combinations of the tax variables in the estimated equation, the estimated coefficient of X_1 is always negative and highly statistically significant. Thus, higher taxes lead to lower household savings. When X_2 or X_3 appears jointly in the equation without X_1, the estimated coefficients of both of these variables have the expected negative sign and are statistically significant – especially that of X_2. It is interesting and important to note that both the absolute magnitude and the level of significance of the estimated income tax coefficient far exceed those of the consumption tax coefficient. The equation has also been estimated with X_1 paired separately with either X_2 or X_3. In each instance the estimated coefficient of X_1 remains negative and highly statistically significant. With X_1 included, however, the estimated coefficient of the other tax variable should be interpreted as measuring its impact on the aggregate household saving rate when the total tax revenue is held constant. In the event, the estimated income tax coefficient continues to be negative and highly statistically significant. In contrast, the consumption tax coefficient has not only turned positive, it has become statistically insignificant. This is a fundamental implication of the result, noted earlier, that income taxes depress savings more than consumption taxes do, since, with total tax revenue held constant, variations in consumption taxes largely represent variations in income taxes in the opposite direction.

The statistical significance of the estimated coefficients reported above is, however, overstated, given the presence of panel serial correlation as evidenced by the Durbin-Watson statistic. Following Masson, Bayoumi and Samiei (1998), the procedure developed by Bhargava, Franzini and Narendranathan (1982) was used to correct for such serial correlation, and the results are reported in the lower half

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[9] Tests based on the F statistic show that the country dummies are jointly significant.

TABLE 1

TAXATION AND THE HOUSEHOLD SAVING RATE[a]

Dependent variable: household saving rate[b]	Independent variable[c]			Number of observations	Adjusted R^2	Durbin-Watson	Panel serial correlation coefficient 4
	X_1	X_2	X_3				
Without correction for panel serial correlation							
Equation 1	- 0.37* (8.83)			475	0.78	0.46	0.91
Equation 2		- 0.73* (7.47)	- 0.27** (2.02)	475	0.79	0.46	0.91
Equation 3	- 0.19* (2.65)	- 0.48* (3.18)		475	0.79	0.46	0.91
Equation 4	- 0.38* (6.94)		0.07 (0.47)	475	0.78	0.46	0.91
With correction for panel serial correlation[d]							
Equation 1	- 0.38* (5.18)			456	0.08	1.86	- -
Equation 2		- 0.54* (4.76)	- 0.41** (2.39)	456	0.08	1.85	- -
Equation 3	- 0.27* (2.74)	- 0.28*** (1.85)		456	0.09	1.84	- -
Equation 4	- 0.38* (4.58)		- 0.01 (0.05)	456	0.08	1.85	- -

[a] Regressions are based on ordinary least squares with country dummies (coefficients not reported) using 1971-95 annual data for the 19 OECD countries identified in Figure 1.
[b] Source: OECD (1999a).
[c] Source: OECD (1999b). All revenues data expressed as percentages of GDP: X_1 = total tax revenue; X_2 = income tax revenue (code 1000); X_3 = consumption tax revenue (code 5000).
[d] Based on the procedure of Bhargava, Franzini and Narendranathan (1982).

Note: absolute *t*-ratios in parentheses; statistical significance is denoted by * (1 percent level), ** (5 percent level), and *** (10 percent level).

of Table 1.[10] What is remarkable about these results is that all of the conclusions have remained substantively unchanged, except that the negative impact on the aggregate household saving rate of consumption taxes has moved closer to that of income taxes than before. While the adjusted R^2 of all variants of the estimated equation did fall substantially following the correction for serial correlation, this is not unexpected since the only explanatory variables used in the regressions have been the tax revenue/GDP ratios.

On the whole, the above results are in complete accordance with one's theoretical intuition on the relationship between taxation and the household saving rate, as noted earlier. They provide a clear, direct, and compelling case for the negative impact on the latter of the burdens of total taxation, consumption taxation, and, in particular, income taxation. They also suggest that a move towards consumption relative to income taxation could lead to a higher rate of aggregate household savings.

3. Concluding remarks

The potential determinants of a country's saving rate are numerous, and are likely to encompass both tax and nontax factors. This paper has focused on the relationship between the aggregate household saving rate and taxation in a sample of OECD countries over a period of two and a half decades (1971-95).

The empirical evidence reported in this paper suggests that the negative impact of total taxes, income taxes and consumption taxes (all expressed as shares of GDP) on the household saving rate is compelling. The evidence also supports the conventional view that the impact of income taxes on household savings is much greater than that of consumption taxes. Therefore, an equal yield replacement of the former by the latter could actually raise the household saving rate. To our knowledge, these findings provide the strongest direct evidence available so far in the literature on the relationship between

[10] As indicated in Table 1, the estimated panel serial correlation coefficients for all variants of the equation were about 0.91, suggesting that a first-differencing procedure would also have largely corrected for the serial correlation.

taxation and savings. They have very important implications for tax policy regarding the choice of income and consumption taxation in tax systems when promoting savings is an important policy objective.

APPENDIX

This appendix provides a detailed discussion of the analytics of taxation and the saving rate, and underscores the important role the income elasticity of consumption plays in the analysis. To render the analytics as simple as possible, consider a two-period life-cycle model of savings, in which an individual works (at the wage rate w) in the first period and retires in the second. Consumption during retirement is, therefore, financed entirely by savings (with interest at the rate r) undertaken during the working period. For simplicity, it is assumed that labor supply is fixed and both w and r are time-invariant.[1] Using the superscripts "y" and "o" on variables to denote those pertaining to the young and the old, respectively, a young individual's budget constraint in any period t is given by

$$w\,(1-\tau) = c_t^y(1+v) + s_t^y, \tag{1}$$

where c is per capita consumption, s is per capita savings, τ is the income tax rate, and v is the consumption tax rate. In the following period, i.e., period t + 1, this individual is retired and faces the budget constraint

$$s_t^y[1 + r\,(1-\tau)] = c_{t+1}^o\,(1+v). \tag{2}$$

Equations (1) and (2) can be combined to yield the individual's familiar life-time budget constraint as

$$\Omega = c_t^y + c_{t+1}^o/[1 + r\,(1-\tau)], \tag{3}$$

where $\Omega \equiv w\,(1-\tau)/(1+v)$ is the present value of the individual's *effective* life-time disposable income. The consumption tax plays a role in determining this income because the tax is applicable at the same rate on consumption in both periods and, therefore, has the effect of reducing the life-time income available for consumption. Standard utility maximization by the individual produces the demand for consumption when young as a function of the effective life-time disposable income and the after-tax rate of interest:

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[1] The following analysis would, of course, be somewhat more complicated if labor supply is variable and/or intergenerational transfers are allowed. But these complications do not alter the basic point about the importance of the income elasticity of consumption in the analytics of taxation and savings.

(4) $$c_t^y(\cdot) = c_t^y[\Omega, r(1-\tau)].$$

The variable s_t^y in equations (1) and (2) represents only savings undertaken by the young. As such, it is not comparable to the aggregate personal or household savings as typically measured in national accounts, which would incorporate the (dis)savings of the old. Since the old receives only interest income, the old's (dis)savings in any period t is, by definition,

(5) $$s_t^o = r(1-\tau)\, s_{t-1}^y - c_t^o(1+v),$$

that is, it is the interest income received on the savings (undertaken when young in the previous period) less consumption. Substituting equation (2) into equation (5) yields

(6) $$s_t^o = r(1-\tau)\, s_{t-1}^y - s_{t-1}^y\,[1 + r(1-\tau)] = -s_{t-1}^y,$$

which indicates that the old dissaves by consuming the principal that was saved in the previous period. If the size of population grows at the rate n, then savings by the young in any two successive periods are related to each other by

(7) $$s_t^y = (1+n)\, s_{t-1}^y.$$

Total per capita savings in any period t is simply the sum of the young's savings and the old's (dis)savings in that period. With the use of equations (6) and (7), this sum can be shown to be

(8) $$s_t = s_t^y + s_t^o = s_t^y - s_t^y/(1+n) = s_t^y n/(1+n).$$

Note that, in the present framework, total per capita savings are zero when $n = 0$, since with no population growth, savings by the young are necessarily counterbalanced by (dis)savings by the old.

The disposable income, m, of the individual when young is simply the after-tax wage income:

(9) $$m_t^y = w(1-\tau),$$

while that of the individual when old is the after-tax interest income:

(10) $$m_t^o = r(1-\tau)\, s_{t-1}^y = r(1-\tau)\, s_t^y/(1+n).$$

Total per capita disposable income in any period t is, therefore,

(11) $$m_t = m_t^y + m_t^o = w(1-\tau) + r(1-\tau)\, s_t^y/(1+n).$$

Let $\theta_t \equiv s_t/m_t$ be the aggregate household saving rate. It proves convenient to work with the *inverse* of this ratio (assuming $n \neq 0$). By using equations (8) and (11), the inverse of the saving rate can be expressed as

(12) $$1/\theta_t = w(1-\tau)(1+n)/(n\, s^y_t) + r\,(1-\tau)/n.$$

Equation (12) can be used to assess how changes in the income tax rate τ, consumption tax rate v, and population growth rate n would affect the aggregate household saving rate. Since the right-hand side of equation (12) contains s^y_t, which is a function of both τ and v, a first step in this assessment would be to ascertain the impact of changes in τ and v on the savings of the young. Totally differentiating equation (1), with the use of equation (4) and the definition of Ω, yields[2]

(13) $$ds^y_t = -[1-\eta\,(1-\theta^y_t)]\,wd\tau - \delta\theta^y_t\,wd\tau - (1-\eta)\,w\,(1-\theta^y_t)dv,$$

where η denotes the income elasticity of the young's consumption, and is positive if consumption when young is a normal good;[3] δ denotes the interest elasticity of the young's savings, which, in principle, can be either positive or negative, depending on the relative strength of the opposing income and substitution effects; and $1 \geq \theta^y_t \equiv s^y_t/[w(1-\tau)] \geq 0$ is the young's rate of savings.

Equation (13) shows that a change in the income tax rate has two distinct but familiar effects on the young's savings: an increase in τ would lower s^y_t by lowering the disposable income (the first term on the right-hand side of equation 13); it would also lower s^y_t by reducing the after-tax rate of return to savings (the second term), provided that δ is positive (the normal case). In contrast, since the consumption tax reduces the individual's *effective* life-time disposable income, as noted earlier, the impact of a change in the consumption tax rate on the young's savings is dependent on the income elasticity of the young's consumption (the third term): an increase in v would lower s^y_t only if $\eta < 1$, i.e., the young's consumption is income inelastic so that a higher consumption tax leads to a higher total consumption spending when young, thus reducing savings. If $\eta > 1$, the outcome would be reversed.[4]

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[2] For simplicity, in what follows all differentials and derivatives are evaluated at points with no *existing* taxes.

[3] Note that the weighted average of the income elasticities of consumption when young and when old (the weights being the share of expenditure on each in the effective life-time disposable income) must add to unity. This implies that $1 \geq \eta\,(1-\theta^y) \geq 0$ if consumption is a normal good in both periods of an individual's life cycle, but η itself could be greater or less than unity.

[4] Note that in equation (13), the coefficients of $d\tau$ and dv are not identical even when $\delta = 0$. This is due entirely to the timing difference between the income tax and the consumption tax from the young's perspective. It is shown later that, in terms of the aggregate saving rate (i.e., when both the young's and the old's disposable incomes are taken into account), the income tax and consumption tax in fact have identical effects (abstracting from interest rate and population growth considerations).

Armed with equation (13), it is now straightforward to assess the impact of changes in the tax and demographic variables on the aggregate household saving rate. Differentiating equation (12) with respect to τ yields

$$(14) \qquad d(1/\theta_t)/d\tau = [(1-\eta)(1-\theta_t^y)/\theta_t^y + \delta - r\,\theta_t^y/(1+n)](1+n)/(n\theta_t^y).$$

The sign of equation (14) is *ambiguous*; it is dependent on the signs of the three terms inside the square brackets on the equation's right-hand side. The first term represents the income effect and measures how a change in τ would affect the young's consumption *relative* to the young's disposable income. If the income elasticity of the young's consumption is inelastic (i.e., $\eta < 1$), then the amount of the young's savings would fall in response to a rise in τ, which in turn would imply a drop in the young's own saving rate. All other things equal, this would also result in a drop in the aggregate household saving rate, as evidenced by the positive sign of the first term when $\eta < 1$. Clearly, this income effect would disappear if the young's consumption is proportional to disposable income.

The second term is the interest elasticity of the young's savings and measures the interest rate effect. If it is positive (i.e., $\delta > 0$), then a rise in τ would (all other things equal) also reduce the aggregate household saving rate. The third term represents the demographic effect and measures the impact of the income tax on the disposable income of the old. It is unambiguously negative because a rise in τ necessarily reduces the old's after-tax interest income but not its amount of dissavings. By itself, this would also lower the aggregate disposable income and, therefore, raise the aggregate household saving rate. Hence, the overall impact of a rise in τ on the aggregate household saving rate is *a priori* uncertain. It is interesting to note that, if the underlying utility function is Cobb-Douglas, i.e., $\eta = 1$ and $\delta = 0$, the aggregate household saving rate would be *positively* correlated with the income tax rate, on account of the demographic effect alone.

The impact on the aggregate household saving rate of a change in the consumption tax rate is likewise ambiguous and dependent on the income elasticity of the young's consumption, as can be seen by differentiating equation (12) with respect to v to get

$$(15) \qquad d(1/\theta_t)/dv = (1-\eta)(1+n)(1-\theta_t^y)/[n(\theta_t^y)^2].$$

Note that the expression on the right-hand side of equation (15) is identical to the income effect of a change in the income tax rate (see equation 14). This corresponds to the well-known proposition that, from a life-cycle perspective, a consumption tax is equivalent to an income tax if the latter excludes interest income.

Finally, the aggregate household saving rate can be altered by a change in the population growth rate. Differentiating equation (12) with respect to n yields

(16) $$d(1/\theta_t)/dn = -[r + 1/\theta_t^y]/n^2,$$

which is unambiguously negative. This states that an increase (decrease) in *n*, which represents a relative demographic change in favor of the number of the young (old) in the population, would lead to a rise (fall) in the aggregate household saving rate, as expected.

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