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Taxation and the Household Saving Rate: Evidence from OECD Countries

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Abstract

This paper analyzes anew the relationship between taxation and the household saving rate. On the basis of standard savings and tax revenue data from OECD countries, it provides compelling and robust empirical evidence of a powerful impact of taxes on household savings. In particular, income taxes are shown to affect negatively the household saving rate much more than consumption taxes.

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SUMMARY

Many factors influence the rate of savings of a country, and many researchers have over the years attempted to identify these factors and assess their empirical importance. Much of this literature has been applied to U.S. data. Among the factors that may influence the saving rate, taxes have often been assumed to be important and most studies on the subject have focused on how different taxes could have affected the saving rate differently. Unfortunately, the empirical identification of the relationship between tax levels and tax structures on the one hand and the saving rate on the other has been inconclusive.

This study presents new and compelling empirical evidence on the above relationship based on standard savings and tax revenue data from OECD countries over a period of 25 years. In particular, it finds that the shares in GDP of both total taxes and income taxes have a highly statistically significant and strongly negative impact on the household saving rate. The impact of consumption taxes as a share of GDP on the household saving rate is quantitatively less pronounced, but remains statistically significant.

I. 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 of OECD countries.²

Theoretical and empirical studies abound on the impact of different types of taxes or of different tax provisions on private saving behavior.³ Many of these studies have dealt with the American reality, a reality characterized by a relatively stable level and structure of taxation, 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.⁴ 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—evidence largely overlooked in the existing literature—on the impact of taxation on

²See 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 and others (1996), which covers the same sample of OECD countries as the present paper as well as a large sample of developing countries. Its focus is, however, 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.

³For 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.

⁴For a recent discussion of the effectiveness of various tax-based saving incentives in the United States, see Bernheim (1997).

the household saving rate in OECD countries. This evidence is derived from a panel data set covering 21 OECD countries over a period of two and a half decades (1970–1994). 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 the Figure.⁵ As the Figure shows, only five of the countries (i.e., those in the first quadrant) experienced a clear 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 taxes. It is also found that, when the total tax revenue/GDP ratio is held constant, the household saving rate bears a positive and statistically significant relationship to the ratio of consumption tax revenue to GDP. This could largely be interpreted as the effect on the saving behavior of replacing income with consumption taxes. In general, the empirical results reported in this paper are quite robust, in the sense that they survive alternative plausible forms of the estimated equations. 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.

In Section II, 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 III concludes the paper. The Appendix provides a more detailed discussion of the theoretical issues involved.

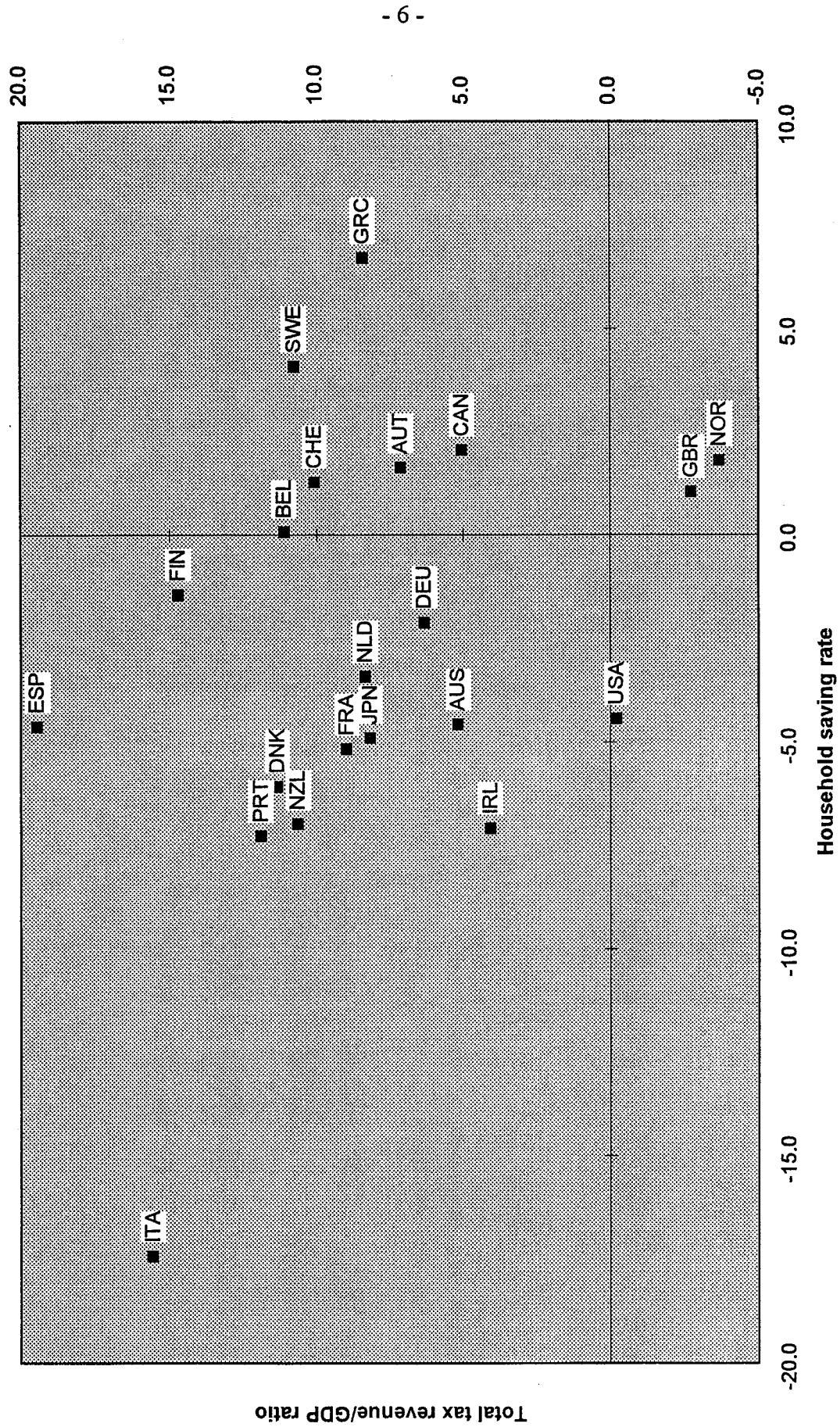
II. THEORETICAL CONSIDERATIONS AND EMPIRICAL EVIDENCE

A. 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

⁵The changes shown for Ireland, New Zealand, and Norway are over somewhat shorter periods as explained below.

Figure. Household Saving Rate and Total Tax Revenue/GDP Ratio
 (In percentage point change between 1970 and 1994)



of the literature on the subject. If this elasticity is positive,⁶ 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.⁷ 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.⁸ 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.⁹

⁶The 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).

⁷Theoretical 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 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).

⁸One of the first to show empirically the importance of demographic variables in determining savings was Graham (1987).

⁹In 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

(continued...)

B. Empirical Evidence

The empirical results reported in this paper are based on a panel data set of annual observations covering 21 OECD countries over the period 1970-94.¹⁰ Data on the independent variables used in the estimated equation, obtained from the revenue statistics of OECD (1996), comprise (1) total tax revenue/GDP ratio (X_1), (2) income tax revenue/GDP ratio exclusive of social security tax revenue (X_2), (3) income tax revenue/GDP ratio inclusive of social security tax revenue (X_3), and (4) consumption tax revenue/GDP ratio (X_4). Data on the dependent variable, obtained from the OECD analytical database, comprise the aggregate household saving rate.¹¹ The equation has been estimated in either the level, (natural) log, or first-difference form. The regression results based on the ordinary least squares procedure are reported in the Table.

As can be seen from the Table, irrespective of the variant of the equation estimated, the estimated coefficient of X_1 is negative and highly statistically significant when it is the only independent variable in the equation. Thus, higher taxes lead to lower household savings. When either X_2 or X_3 appears jointly with X_1 in the equation, the estimated coefficients of the variables all have the expected negative sign and are (save one) statistically significant--most of them highly so. The lone exception is the estimated coefficient of X_1 in the log variant of the equation. It is interesting 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 in either the level or the log variant of the estimated equation; in the first-difference form, the differences between the two estimated coefficients are much smaller.

The equation has also been estimated, in both its level and log variants, with X_1 paired separately with either X_2 , X_3 , or X_4 . 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

⁹(...continued)

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.

¹⁰Due to data limitations, the following OECD countries are excluded from the sample: Czech Republic, Hungary, Iceland, Korea, Luxembourg, Mexico, Poland, and Turkey. Also, the time series data for Ireland, New Zealand, and Norway cover somewhat shorter periods as indicated in the Table.

¹¹These data on the household saving rate are also published semi-annually by OECD. See, for example, OECD (1997).

Table. OECD Countries: Taxation and the Household Saving Rate, 1970–94 1/

Dependent variable: household saving rate 2/	Independent variable 3/				R^2	Number of observations
	X_1	X_2	X_3	X_4		
Level (1)	-0.48 * (13.25)	n.a.	n.a.	n.a.	0.26	512
Level (2)	n.a.	-0.91 * (20.94)	n.a.	-0.12 *** (1.72)	0.49	512
Level (3)	n.a.	n.a.	-0.56 * (11.11)	-0.18 ** (2.05)	0.24	512
Level (4)	-0.13 * (3.49)	-0.82 * (15.87)	n.a.	n.a.	0.50	512
Level (5)	-0.34 * (4.24)	n.a.	-0.19 *** (1.84)	n.a.	0.26	512
Level (6)	-0.62 * (12.58)	n.a.	n.a.	0.45 * (4.17)	0.28	512
Log (1)	-1.53 * (9.81)	n.a.	n.a.	n.a.	0.17	486
Log (2)	n.a.	-0.99 * (14.18)	n.a.	-0.25 * (3.12)	0.32	486
Log (3)	n.a.	n.a.	-1.23 * (9.45)	-0.13 (1.42)	0.18	486
Log (4)	-0.56 * (3.30)	-0.85 * (10.28)	n.a.	n.a.	0.32	486
Log (5)	-0.64 ** (2.06)	n.a.	-0.83 * (3.30)	n.a.	0.18	486
Log (6)	-2.06 * (9.72)	n.a.	n.a.	0.44 * (3.63)	0.19	486
First difference (1)	-0.40 * (6.72)	n.a.	n.a.	n.a.	0.08	491
First difference (2)	n.a.	-0.47 * (5.22)	n.a.	-0.54 * (3.86)	0.08	491
First difference (3)	n.a.	n.a.	-0.38 * (5.01)	-0.49 * (3.45)	0.08	491

1/ Annual data. 1977–94 for Ireland; 1971–94 for New Zealand; and 1975–94 for Norway.

2/ Source: OECD analytical database.

3/ Source: *Revenue Statistics*, OECD (1996). All revenue data expressed as percentages of GDP.

X_1 = total tax revenue;

X_2 = income tax revenue (code 1000);

X_3 = income and social security tax revenue (code 1000 plus code 2000); and

X_4 = consumption tax revenue (code 5000).

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

aggregate household saving rate when the total tax revenue is held constant. In the event, the estimated income tax coefficient, whether in terms of X_2 or X_3 , continues to be negative and statistically significant. In contrast, the consumption tax coefficient has, not surprisingly, turned positive (but at the same time remains highly statistically significant). This is a fundamental implication of the result, noted earlier, that income taxes depress savings more than consumption taxes do. Thus, with constant total tax revenue, the positive consumption tax coefficient measures the impact on savings if the former are replaced by the latter.

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.

III. 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 OECD countries over a period of two and a half decades (1970-1994).

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 and robust. 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 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.¹²

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

$$(1) \quad w \cdot (1 - \tau) = c_t^y (1 + \nu) + s_t^y,$$

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

$$(2) \quad s_t^y [1 + r \cdot (1 - \tau)] = c_{t+1}^o (1 + \nu).$$

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

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

where $\Omega \equiv w \cdot (1 - \tau) / (1 + \nu)$ 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:

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

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

¹²The 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.

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,

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

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

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

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

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

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

$$(8) \quad s_t = s_t^y + s_t^o = s_t^y - s_{t-1}^y / (1 + n) = s_t^y \cdot n / (1 + n).$$

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 counter-balanced by (dis)savings by the old.

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

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

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

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

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

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

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

$$(12) \quad 1/\theta_t = w \cdot (1 - \tau) \cdot (1 + n) / (n \cdot s_t^y) + r \cdot (1 - \tau) / n.$$

Equation (12) can be used to assess how changes in the income tax rate τ , consumption tax rate ν , and population growth rate n would affect the aggregate household saving rate. Since the right-hand-side of equation (12) contains s_t^y , which is a function of both τ and ν , a first step in this assessment would be to ascertain the impact of changes in τ and ν on the savings of the young. Totally differentiating equation (1), with the use of equation (4) and the definition of Ω , yields¹³

$$(13) \quad ds_t^y = - [1 - \eta \cdot (1 - \theta_t^y)] \cdot w \cdot d\tau - \delta \cdot \theta_t^y \cdot w \cdot d\tau - (1 - \eta) \cdot w \cdot (1 - \theta_t^y) \cdot d\nu,$$

where η denotes the income elasticity of the young's consumption, and is positive if consumption when young is a normal good;¹⁴ 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 $1 \geq \theta_t^y \equiv s_t^y / [w \cdot (1 - \tau)] \geq 0$ 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_t^y by lowering the disposable income (the first term on the right-hand-side of equation (13)); it would also lower s_t^y 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 ν would lower s_t^y 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.¹⁵

¹³For simplicity, in what follows all differentials and derivatives are evaluated at points with no *existing* taxes.

¹⁴Note 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 $1 \geq \eta \cdot (1 - \theta^y) \geq 0$ 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.

¹⁵Note that in equation (13), the coefficients of $d\tau$ and $d\nu$ 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

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

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 ν to get

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

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

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

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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