

*A Note on the Effect of Income Growth and Changes in the Tax Rate on Consumption and Saving Ratios.**

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THE purpose of this note is to suggest that income growth and changes in the tax rate affect the observed ratio of savings or consumption to personal disposable income. This is because of the lag in tax payments—which are assessed on last year's income.¹ The difference between taxes paid and liability for tax is included in savings. If consumption and saving decisions by individuals in any year are based on their income in that year less the tax liability payable the following year, actual saving will vary according to changes in income and tax rates. Of course, if individuals ignore future liabilities for tax and base their decisions solely on current income less current taxes paid, then no bias arises because of lagged tax payments.

In order to show the direction of the bias between observed and actual savings ratios we have set out a simple model of consumption behaviour. We start with a basic national income identity:

$$C_t + S_t + T_t = Y_t \quad (1)$$

where C is consumption, S savings and T taxes paid and Y is personal income with t being a time subscript.

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1. In fact the lag is somewhat more complex. See L. K. Lennón: "The Flexibility of Irish Taxes on Income:" *Ireland, Some Problems of a Developing Economy* (ed. A. A. Tait and J. A. Bristow), Dublin 1972. We are only dealing in this note with direct taxes on income, more particularly, taxes on personal income. The effect of consumption taxes on savings is not discussed since there are no lags between liability and collection.

If we assume that consumption is a constant fraction, a , of personal income after allowing for tax liabilities on this income. Thus:

$$C_t = a\bar{Y}_t^d \quad (2)$$

where \bar{Y}_t^d is current personal income less tax liability. If the applicable tax rate is τ we can define \bar{Y}_t^d as:

$$\bar{Y}_t^d = Y_t - \tau Y_t = (1 - \tau)Y_t \quad (3)$$

However the tax paid in time t is based on the tax rates in force and personal income earned in time $t-1$. Thus:

$$T_t = \bar{\tau} Y_{t-1} \quad (4)$$

where $\bar{\tau}$ is the tax rate in force in the previous period.

Inserting 2, 3 and 4 into 1 yields:

$$S_t = Y_t - \bar{\tau} Y_{t-1} - a(1 - \tau)Y_t \quad (5)$$

In the Irish National Accounts personal disposable income is defined as current income less tax actually paid. In our model this is $Y_t - \bar{\tau} Y_{t-1}$. Suppose further that $Y_t = Y_{t-1}(1+r)$ where r is the growth rate of personal income. Thus we can rewrite 5 as follows:

$$S_t = \frac{Y_t - \bar{\tau} Y_{t-1}}{1+r} - a(1 - \tau)Y_t \quad (6)$$

The *observed* national income ratio of personal savings, S_t , to personal disposable income, $\frac{Y_t - \bar{\tau} Y_{t-1}}{1+r}$, thus becomes

$$\frac{S_t}{\frac{Y_t - \bar{\tau} Y_{t-1}}{1+r}} = 1 - a \frac{(1 - \tau)}{(1 - \bar{\tau})} = S^* \quad (7)$$

Because of our definition of consumption above it is clear that the true savings ratio, i.e., the savings ratio, that would emerge if tax liability was paid on a current basis is $1 - a$. The observed ratio S^* differs from this depending on the values of τ , $\bar{\tau}$ and r . We have summarised the effects in Table 1 where a + sign indicates that the observed ratio is biased upwards relative to the true ratio, a - sign indicates a downward bias and 0 indicates both ratios are the same.

TABLE I: Bias in Observed Savings Ratio relative to True Ratio for Various Values of τ , $\bar{\tau}$ and r

	$r < 0$	$r = 0$	$r > 0$
$\bar{\tau} > \tau$	-	-	?
$\bar{\tau} = \tau$	-	0	+
$\bar{\tau} < \tau$?	+	+

A query (?) indicates that the direction of the bias is indeterminate.

With a rise in the tax rate $\bar{\tau} < \tau$ the bias will be upward except perhaps if there is declining income (i.e., $r > 0$). Similarly rising income ($r > 0$) tends to bias the ratio upwards, except perhaps if tax rates fall, $\bar{\tau} > \tau$.

An example of the possible magnitude of the bias requires certain assumptions about the desired savings ratio. Let us suppose that it is 10 per cent so that a becomes 0.90. Assume that income is growing at 10 per cent per annum, a not unreasonable figure since we are dealing in nominal values, and that the tax rate rises from 0.05 to 0.055 which is about the order of magnitude of observed tax rate changes since 1947. This means that the calculated savings ratio on the basis of the National Accounts definition of disposable income will be 10.9 per cent instead of 10.0 per cent an error of 9 per cent.

Suppose we define the ratio of tax paid to personal income in time t , say T^* as

$$T^* = \frac{T_t}{Y_t} = \frac{\tau Y_{t-1}}{Y_t} = \frac{\bar{\tau}}{1+r} \quad (8)$$

then we can see that (7) becomes

$$S^* = 1 - \frac{a(1-\tau)}{(1-T^*)} \quad (9)$$

Thus S^* is negatively related to T^* since a rise in the ratio of taxes paid to personal income tends to reduce S^* . A fall in T^* tends to increase S^* . For unchanged tax rates $\bar{\tau} = \tau$ changes in T^* are due to changes in income. This negative relationship between S^* and T^* may account for some part of the relationship found between the savings ratio and the ratio of direct taxes to personal income found in Kennedy and Dowling.²

The fact that changes in income and tax rates tends to bias the observed savings

2. K. A. Kennedy and B. R. Dowling: "The Determinants of Personal Savings in Ireland: An Econometric Inquiry" *Economic and Social Review*, Oct., 1970, Vol. II, No. 1.

ratio because of lags in tax payments, depends crucially on the behavioural assumptions made about consumption decisions. If no account is taken of future liabilities for tax in making consumption decision, then the observed savings ratio is, in fact, the desired savings ratio; and no unintended savings occur because of difference between tax liabilities and taxes paid. However, it would appear to be more reasonable to assume that people do attempt to take into account their future liabilities for tax before they make consumption decisions.³ Certainly this would represent a more rational behaviour pattern, and in the absence of substantial contrary evidence an assumption of rationality would appear justified.

Of course, if income growth was constant, and the tax rate unchanged, the upward bias in the savings ratio would be constant. But fitting an empirical relationship between consumption (or savings) and personal disposable income as defined for national accounts purposes is likely to be more difficult in the presence of cyclical fluctuations in income and tax rate changes. Further, since the introduction of PAYE in 1959 it is likely that the tax paid in time t depends to some considerable extent on income earned in time t ; and so for the post-war period the degree of bias caused by lagged tax payments has probably altered. This again would tend to make estimation of a consumption function over the whole post-war period more difficult.

If the behavioural assumptions in the consumption function are correct then the stabilisation properties of the income tax system are not affected by the fact that taxes assessed in one year are not collected until the following year.⁴ However, response to tax reductions may depend on individuals being able to borrow to finance consumption if the advantages of a fall in tax rate cannot be reaped out of current income due to the heavy accrued taxes that have to be paid. The deflationary effects of a tax increase could be offset if banks expand credit when deposits are temporarily increased in anticipation of future tax liabilities. It should also be remembered that the tax rate defined in the model earlier is not the rate determined in the annual budget, although it is almost certainly related to it. It is possible that the tax rate, τ , would change over time even if no changes in the statutory rates or tax allowances were made. Thus, if the elasticity of income taxes to personal income is greater than 1, the actual tax rate will rise over time as income grows. This will tend to increase the upward bias in the savings ratio caused by the growth in income.

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3. Although in this regard the *Report of the Commission on Income Taxation* (First Report), Dublin, 1958, noted the difficulty in collecting income tax arrears in some cases due to lack of provision for future tax liabilities.

4. This is because current consumption in our model depends on current income less estimated liabilities for tax. Thus an increase in current tax rates, although not affecting revenues until the following year, affects current consumption immediately.