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PERSONAL SAVINGS AND CAPITAL INCOME TAXATION: A DIFFERENTIAL INCIDENCE ANALYSIS*

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Abstract:

The paper uses a standard intertemporal model of consumption and saving to develop the personal savings implications of the tax switch from capital income tax to wage tax under the circumstances, where the tax switch is carried out by keeping the (expected) present value of government tax revenues constant. This differential incidence analysis under perfect certainty, future income risk and rate of return risk does not support the 'conventional view', according to which consumption taxes will provide more of an incentive for households to save.

1. INTRODUCTION

A variety of arguments have been presented for a switch from income taxation to expenditure or consumption taxation, but no attempt is made here to examine the issue comprehensively (for surveys of the literature, see Bradford (1980), Sandmo (1985), and Stiglitz (1986), ch. 22 and 25). According to a widely held argument consumption taxes will provide more of an incentive for households to save so that the switch from income to consumption taxation is desirable because it would lead to a rise in personal savings (see e.g. Wright (1969), p. 279). For government to be concerned with the level of savings in its own right, there must be a sense in which social judgements override individual assessments of welfare. To the extent that saving is a 'merid good', government would like to see it expanded irrespective of the effect on individual welfare. Whether promoting savings should be the objective of government is, of course, highly debatable, but it is the essence of the 'incentive' case for consumption taxation.

The purpose of this paper is to reconsider this 'incentive' case for consumption taxation by using a simple intertemporal model of consumption and saving behaviour. More specifically, we look at the personal savings effects of a switch from income taxation to consumption taxation under various circumstances by starting from the perfect certainty and then extending the analysis to deal with the incentive issue under conditions of future income and rate of return uncertainty. In the presence of future income and rate of return uncertainty taxation may serve as an insurance or risk-sharing device so that it may have risk effects, which could either reinforce or run counter to conventional substitution and income effects. To anticipate results it turns out that even in the most simple life cycle model of consumption and saving it cannot be concluded that a compensated switch from income taxation to consumption taxation will increase personal savings. Whether or not this is so depends sensitively on the timing of compensation, the income effects, the relevant uncertainty and the assumptions about the nature of risk averse behaviour. Consequently, a widely held popular belief about the incentive effect of exempting capital income from taxation on personal savings is far from being generally true in a standard life-cycle framework.

We proceed as follows: Section 2 presents the basic framework to be used and utilizes it to develop personal savings effects of compensated tax switches from income to consumption taxation with perfect certainty. In section 3 the model is extended to deal with the relationship between saving behaviour and tax policy under future income and rate of return uncertainties. Finally, there is a brief concluding section.

2. PERSONAL SAVINGS AND TAX POLICY IN A SIMPLE LIFE-CYCLE MODEL

2.1. The framework

The consumer is assumed to have a preference ordering over present and future consumption c^1 and c^2, which is represented by an inter-temporally additive utility function $U = u(c^1) + (1+\rho)^{-1}u(c^2)$, where $(1+\rho)$ = rate of time preference and $u' > 0$ and $u'' < 0$. The present and future income y and I are assumed to be exogenously given and $R = 1 + r$ = the interest rate factor in the capital market. The consumer chooses between c^1 and c^2, which via the intertemporal budget constraint determines personal saving S. Partial derivatives are denoted by subscripts for functions with many variables and by primes for functions with one variable. The first and second-period budget constraints without taxes are $c^1 + S = y$ and $c^2 = RS + I$ respectively and denoting the current and future wage tax by t and the capital income tax from savings by t_r, we can write the above mentioned budget constraints as $c^1 = y\theta - S$ and $c^2 = (1+r\theta_r)S + I\theta$, where $\theta = 1 - t$ and $\theta_r = 1 - t_r$. Substituting the first budget constraints for the latter one gives the intertemporal budget constraint $c^2 = (1 + r\theta_r)(y\theta - c^1) + I\theta$. Denoting the current and future consumption tax by t_c, it is easy to see that the intertemporal budget constraint is equivalent to the one presented above if, $t = t_c(1 + t_c)$ so that wage and consumption tax are equivalent.[1)] Hence in what follows we do not use consumption, but wage tax. Finally, substituting the expressions for c^1 and c^2 into the utility function and maximizing it in terms of S gives the necessary and sufficient conditions for utility maximization

$$(1) \qquad U_S = -u'(c^1) + \beta u'(c^2) = 0$$

and

$$(2) \qquad U_{SS} = u''(c^1) + \beta R u''(c^2) < 0$$

where $\beta = (1+\rho)^{-1}\hat{R}$, and $\hat{R} = 1+r\theta_r$. The comparative statics of wage tax t and capital income tax t_r are

$$
(3) \quad \begin{cases} \text{(a)} \ S_t = -y - \theta^{-1}(y\hat{R} + I)S_I \\ \text{(b)} \ S_{t_r} = -r\theta_r^{-1}S_r^c - rS\theta^{-1}S_I \end{cases}
$$

where in (3a) we have used the fact that $S_y = \theta + \hat{R}S_I$, $S_I = U_{SS}^{-1}(-u''(c_2)\theta) < 0$ and where $S_r^c = U_{SS}^{-1}(-\theta_r(1+\rho)^{-1}u'(c^2)) > 0$ is the substitution effect of the before tax rate of return r on personal savings. Both the wage tax and the capital income tax affect saving a priori ambiguously; the wage tax has a negative direct and a positive income effect, while the indeterminacy of the capital income tax results from offsetting (positive) income and (negative) substitution effects.

2.2. Tax policy and personal savings

What is the effect of the tax switch between wage and capital income taxation on personal savings? In what follows we consider the changes in taxes, which will keep the present value of government tax revenues

$$
(4) \qquad T = t(y + IR^{-1}) + t_r rSR^{-1}
$$

unchanged. The tax switch is defined by $dt_r = -(yR+I)(rS)^{-1}dt - t_r S^{-1}dS$ and substituting this for dt_r in the expression $dS = S_t dt + S_{t_r} dt_r$ gives

$$
(5) \qquad (dS/dt)\big|_{T=T^0} = m\{S_t - (yR+I)(rS)^{-1}S_{t_r}\}
$$

where $m = 1+t_r S^{-1}S_{t_r}$. We assume that the government tax revenues and the capital income tax rate t_r are positively related $m > 0$ so that the so-called Laffer curve is upward sloping. Utilizing the expressions (3a-b) makes is possible to rewrite (5) as follows

$$(5') \qquad (dS/dt)\Big|_{T=T^{0}} = m\{\underbrace{(yR+I)(\theta_r S)^{-1}S_r^c}_{(+)} \underbrace{-y}_{(-)} + \underbrace{yrt_r\theta^{-1}S_I}_{(-)}\}$$

Thus the total effect of the tax switch on perosonal savings from capital income tax to wage tax, which will keep the present value of government tax revenues constant, is a priori ambiguous and can be decomposed into the positive substitution effect $(m(yR+I)(\theta_r S)^{-1}S_r^c)$, the negative direct effect (-my) and the negative income effect $(myrt_r\theta^{-1}S_I)$.

This can be explained roughly as follows: First, changing the tax base from capital income tax to wage tax tends to increase personal savings via the substitution effect, because the after-tax rate of return from savings will go up. But second, this is offsetted by the direct negative effect due to a rise in wage tax. Finally, there is the negative income effect, which stems from the difference between the before-tax and the after-tax rate of return; the tax switch to wage tax, which will keep the present value of government tax revenues constant, decreases the present value of taxes from the point of view of the consumer. Hence, the present value of income will increase and this tends to decrease current personal savings. Consequently, a widely held popular belief about the 'incentive' effect of exempting capital income from taxation on personal savings is far from being generally true.[2)]

3. TAX POLICY AND PERSONAL SAVINGS UNDER UNCERTAINTY

In what follows we maintain the assumption of perfect capital markets, but allow for future income uncertainty and rate of return uncertainty and develop their implications for the above mentioned tax policy.

3.1. Future income uncertainty

In the presence of future income uncertainty the consumer decides how much to save given taxes, current income, rate of return and a probability distribution of future income. Now the consumer is assumed to choose S so as to maximize the expected utility function $U^* = u(c^1) + (1+\rho)^{-1}Eu(c^2)$, where E denotes the expectations operator, $c^1 = y\theta - S$ and $c^2 = RS + I\theta$ is now stochastic because of future income uncertainty (for a survey of the economics of uncertainty, see Lippman McCall (1981)).

In what follows we assume that the Arrow-Pratt absolute risk aversion $A(c^2) = -u''(c^2)/u'(c^2)$ is decreasing. On the other hand, there seems to be no consensus on how the relative risk aversion $R_c = A(c^2)c^2$ varies, which is why we keep to the assumption of constant relative risk aversion as the benchmark case (see e.g. Machina (1983) for details).

The first- and second-order conditions for the maximization of U^* are $U^*_S = -u'(c^1) + Eu'(c^2) = 0$ and $U^*_{SS} = u''(c^1) + \beta\hat{R}Eu''(c^2) < 0$. The comparative statics of capital income tax is of the form

(6) $$S^*_{t_r} = -r\theta_r^{-1}S_r^{*c} - rS^*\theta^{-1}S^*_{\varepsilon|\varepsilon=0}$$

where $S_r^{*c} = U_{SS}^{*\ -1}(-\theta_r(1+\rho)^{-1}Eu'(c^2)) > 0$ is the substitution effect of r and $S^*_{\varepsilon|\varepsilon=0} = U_{SS}^{*\ -1}(-\beta Eu''(c^2)\theta) < 0$ denotes the additive change in $\tilde{I} = I + \varepsilon$ evaluated at $\varepsilon = 0$ and can be interpreted to mean an increase in the expected value of I with all other moments constant.

Before developing the implications of wage tax, it is useful first to look at the personal savings effect of a change in pure risk about I. Consider the effect of a multiplicative shift in the distribution of I, which is offsetted by an additive shift to restore the mean $\bar{I} = E(I)$ to its initial value. Such a shift can be interpreted as a mean-preserving change in risk and is defined for $\tilde{I} = \varepsilon + \eta I$ by $d\varepsilon/d\eta = -\bar{I}$ at $\varepsilon = 0$, $\eta = 1$. Now the effect of a change in pure risk can be expressed

$$(7) \qquad (S^*_{\eta|\varepsilon=0,\ \eta=1}) = U^{*\ -1}_{SS}(-\theta\mathrm{cov}(u''(c_2),I)) > 0$$

because of decreasing absolute risk aversion, which implies, but does not necessitate $u'''(c^2) > 0$. (7) indicates the precautionary demand for saving.

After this digression we can now express the comparative statics in in terms of wage tax

$$(8) \qquad S^*_t = -y - \theta^{-1}(yR + \bar{I})(S^*_{\varepsilon|\varepsilon=0}) - \theta^{-1}(S^*_{\eta|\varepsilon=0,\ \eta=1})$$

where we have utilized (7) and the fact that $S^*_y = \theta + RS^*_{\varepsilon|\varepsilon=0}$. The expression (8) decomposes the wage tax effect into the direct negative effect, the positive income effect and the negative risk-effect. The latter channel of influence results from the negative relationship between risk and tax rate under full loss-offset provisions so that raising the wage tax tends to decrease saving by decreasing the after tax uncertainty about future income.

Turning to tax policy we first have to deal with the question of what is meant by a tax switch in the presence of stochastic tax revenue. A possibility - which we follow - is to consider changes in taxes, which will keep the expected present value of government tax revenues $\bar{T} = t(y + \bar{I}R^{-1}) + t_r rS^{-1}$ constant.[3)] The tax switch is now defined by $dt_r = -(yR + \bar{I})(rS)^{-1} - t_r S^{-1} dS$ as $\bar{T} = T^0$. Substituting this for dt_r in $dS^* \doteq S_t^* dt + S_{t_r}^* dt_r$ gives

$$(9) \qquad (dS^*/dt)\Big|_{\bar{T}=T^0} = m^*\{\underbrace{(yR + \bar{I})(\theta_r S^*)^{-1} S_r^{*c}}_{(+)} \ \underbrace{-y}_{(-)} + \underbrace{yrt_r \theta^{-1} S^*_{\varepsilon|\varepsilon=0}}_{(-)} \ \underbrace{- \theta^{-1} S^*_{\eta\,|\,\varepsilon=0,\ \eta=1}}_{(-)}\}$$

where $m^* = 1 + t_r S^{*-1} S^*_{t_r} > 0$ because of the assumption of the upward sloping Laffer curve. According to (9) the total personal savings effect of the tax switch from capital income tax to wage tax is a priori ambiguous and can be decomposed into the positive substitution effect, the negative direct effect, the negative income effect and the negative risk effect under future income uncertainty. The first three channels of influence are familiar from the earlier analysis under certainty, but the risk effect is the novel one and stems from the negative relationship between wage tax and future income variability and exemplifies the role of taxation as a insurance device. Thus allowing for future income uncertainty will discourage private savings, ceteris paribus. This means that even though the tax switch would increase savings under certainty, savings may well go down in the presence of future income uncertainty.

3.2. Rate of return uncertainty

Finally, turn to consider savings under rate of return uncertainty. By the now familiar procedure savings S^{**} is now determined by maximizing $U^{**} = u(c^1) + (1+\rho)^{-1}Eu(c^2)$, where $c^2 = \hat{R}S + I\theta$ is stochastic because of uncertain R.

The comparative statics of the wage tax is $S_t^{**} = -\theta^{-1}(yS_y^{**} + IS_I^{**})$ where $S_y^{**} = U_{SS}^{**-1}(u''(c^1)\theta) > 0$ with $U_{SS}^{**} = u''(c^1) + (1+\rho)^{-1}E(u''(c^2)\hat{R}^2) < 0$ and $S_I^{**} = U_{SS}^{**-1}(-(1+\rho)^{-1}E(u''(c^2)\hat{R})\theta) < 0.$[4] Now utilizing the second-order condition U_{SS}^{**} for the expected utility maximization S_y^{**} can be expressed as follows $S_y^{**} = \theta + \bar{\hat{R}}S_I^{**} - B$, where $\bar{\hat{R}} = 1 + \bar{r}\theta_r$ is the expected after-tax interest rate factor and $B = U_{SS}^{**-1}(1+\rho)^{-1}\theta\mathrm{cov}(u''(c_2)R, R)$. Substituting the expression of S_y^{**} for S_y^{**} in S_t^{**} gives

$$S_t^{**} = -y(I+B) - \theta^{-1}(y\bar{\hat{R}} + I)S_I^{**} \tag{10}$$

where $B \gtreqless 0$ as $R_c \lesseqgtr (1/a)-1$ and where R_c is relative risk aversion and $a = SR/c^2$ is the fraction of future consumption accounted for by the saving plus capital income. The wage tax effect on personal savings under rate of return uncertainty can be decomposed into the positive income effect $(-\theta^{-1}(yR + I)S_I^{**})$ and the direct effect $(-y(1+B))$, where

B is negative if relative risk aversion and/or the fraction of future consumption accounted for by the saving plus capital income are high (low).[6)]

As for the capital income taxation, it is again useful to consider first the pure change in capital risk defined for $\hat{r} = \gamma + \xi r$ by $d\gamma/d\xi = -\bar{r}$ at $\gamma = 0$, $\xi = 1$. Like earlier this shift can be interpreted as a mean-preserving change in risk and after some manipulation its saving effect can be given as

$$(11)\qquad (S_{\xi}^{**}\big|_{\substack{\gamma=0\\ \xi=1}}) = U_{SS}^{**-1}\{-(1+\rho)^{-1}\theta_r\,[\mathrm{cov}(u'(c^2),r) + S\,\mathrm{cov}(u''(c^2)\hat{R},r]\}$$

Evaluating the covariance terms indicates how the sign of (11) depends on the relative risk aversion and the fraction of future consumption accounted for by saving plus capital income. More precisely, we have

$$(12)\qquad (S_{\xi}^{**}\big|_{\substack{\gamma=0\\ \xi=1}}) \gtreqless 0 \text{ as } R_c \gtreqless (2/a)-1$$

In contrast with the future income uncertainty case, its is not necessarily true that a rise in rate of return uncertainty would increase saving. Saving is increased (decreased) by a rise in capital risk if relative risk aversion and/or the fraction of future consumption accounted for by saving plus capital income are high (low). Consumers, who are very risk averse, will tend to increase their saving for 'hedging' reasons when capital risk is increased. They are worried, as it were, about the worst possible contingencies. When risk is increased, they will tend to save more in order to avoid these extreme contingencies, particularly if their future income depends heavily on risky capital income. On the other hand, if they are less risk averse, they tend to view the return from saving lower as risk is increased and hence tend to save less, particularly if their future income does not depend heavily on risky capital income. After this expression the channels of influence of capital income tax on personal savings can be decomposed as follows

(13) $$S^{**}_{t_r} = -\bar{r}\theta_r^{-1}(S^{**c}_{\gamma}|_{\gamma=0}) - \bar{r}S\theta^{-1}S^{**}_I - \theta_r^{-1}(S^{**}_{\xi}|_{\gamma=0, \xi=1})$$

where $(S^{**c}_{\gamma}|_{\gamma=0}) = U^{**-1}_{SS}[-(1+\rho)^{-1}\theta_r E(u'(c^2))] > 0$ describes the effect of a change in the expected value of r evaluated at $\bar{r}$. The sign of capital income tax is a priori ambiguous and depends on the negative substitution, thepositive income and the ambiguous capital risk effect.

The tax switch, which keeps the expected present value of government tax revenues $\bar{T} = t(y + I\bar{R}^{-1}) + t_r\bar{r}SR^{-1}$ constant, is defined by $dt_r = -(y\bar{R}+I)(\bar{r}S)^{-1}dt - t_rS^{-1}dS$. Substituting this for dt_r in $dS^{**} = S^{**}_t dt + S^{**}_{t_r}dt_r$ gives $(dS^{**}/dt)|_{\bar{T}=T^o} = m^{**}(S^{**}_t - (y\bar{R}+I)(\bar{r}S)^{-1}S^{**}_{t_r})$ and utilizing the equations (10) and (13) we end up with

(14) $$(dS^{**}/dt)|_{\bar{T}=T^o} = m^{**}\{\underbrace{(y\bar{R}+I)(\theta_rS^{**})^{-1}(S^{**c}_{\gamma}|_{\gamma=0})}_{(+)} - \underbrace{y(1+B)}_{(?)} + \underbrace{y\bar{r}t_r\theta^{-1}S^{**}_I}_{(-)} + \underbrace{(y\bar{R}+I)(\theta_r\bar{r}S^{**})^{-1}(S^{**}_{\xi}|_{\gamma=0, \xi=1})}_{(?)}\}$$

where $m^{**} 1 + t_r S^{**-1} S^{**}_{t_r} > 0$ because of the assumption of the upward sloping Laffer curve.

According to (14) the total personal personal savings effect of the tax switch from capital income tax to wage tax is a priori ambiguous and can be decomposed into the positive substitution effect, the ambiguous direct effect, the negative income effect and the ambiguous risk effect under rate of return uncertainty. With the exception of the B-term, the first three channels of influence are familiar from the earlier analysis under certainty, but the capital risk effect is a novel one and stems from the negative relationship between capital income tax and rate of return variability. Thus allowing for rate of return uncertainty might encourage or discourage savings, ceteris paribus. In particular, if risk aversion is very high and if the fraction of future consumption financed by non-wage income RS is very high, then the risk effect and the direct effect $(-y(1+B))$ are positive. Under these circumstances exempting capital income from taxation may well - in conformity with the 'conventional view' - increase savings.

4. CONCLUDING REMARKS

Using a simple intertemporal model of consumption and saving as the framework this paper has provided a theoretical analysis of the implications of the tax switch from capital income tax to wage tax for personal savings under the circumstances where the tax switch is carried out by keeping the present value (or expected present value) of government tax revenues constant.

It has first been shown that under perfect certainty and perfect capital markets the tax switch from capital income tax to wage tax affect personal savings a priori ambiguously; the total savings effect can be decomposed into the positive substitution effect, the negative direct effect and the negative income effect. Thus the differential incidence analysis even in the most simple life cycle framework does not support the 'conventional view', according to which consumption taxes will provide more of an incentive for households to save.

Accounting for future income and rate of return uncertainties brings a further channel of influence into the analysis, namely the risk effect of taxation. This results from the negative relationship between the tax rate and the after tax variability of the respective uncertain variable. A ceteris paribus risk effect on savings is negative for wage tax under future income risk, while it can be of any sign for capital income tax under capital risk and plausible assumptions about the behaviour towards risk. From the point of view of the tax policy this means that allowing for future income risk discourages personal savings, while allowing for capital risk leaves personal savings effect ambiguous. In particular, if consumers are very risk-averse and if their future consumption depends heavily on risky non-wage income, then exempting capital income from taxation may increase personal saving via the positive risk effect. This latter possibility provides in our framework the closest case for the 'conventional view', according to which consumption taxes will encourage personal savings.

FOOTNOTES:

1) Even though the proportional wage tax and the proportional consumption tax are equivalent in our framework, the timing of revenues to the government differs between these two taxes and this may be important if capital markets are imperfect. This is an interesting area for research.

2) This raises a question of what explains this widely held 'conventional view'? There are two aspects of importance in this context: First, the tax switch from capital income taxation to wage tax has been viewed mostly from the point of view of keeping the utility of the consumer constant. In our framework, it is easy to show that the tax switch, which will keep the utility of the consumer constant, is defined by

(1) $dt_r = -(y\hat{R} + I)(rS)^{-1}dt \qquad \text{as } U = U^0$

Substituting this for dt_r in $dS = S_t dt + S_{t_r} dt_r$ yields

(2) $(dS/dt)\big|_{U=U^0} = (y\hat{R} + I)(\theta_r S)^{-1} S_r^c - y$

Though now there is no income effect for the obvious reason, the sign of (2) is still a priori indeterminate as has been pointed out by Feldstein (1978). Second, however, the sign of (2) is sensitive to the timing of compensation as has been pointed out by Sandmo (1981). Namely, in compensating for a capital income tax change we have to adjust the consumer's income. The analysis above assumed that the compensation is charged in terms of both current and future income. On the other hand, the 'conventional view' implicitly assumes that the compensation is charged from the future income. In our framework this is equivalent to assume that there is no wage tax from current income y, in which case we have

(3) $(dS/dt)\big|_{U=U^0} = I(\theta_r S)^{-1} S_r^c > 0$

which provides a representation of the 'conventional view'.

3) This need not imply that government is risk neutral. To the extent that risks are independent across consumers and the number of consumers is large, the law of large numbers will guarantee government a constant total revenue despite uncertainty at the individual level. Under these circumstances government is simply a more efficient risk pooler than individuals. To the extent that the law of large numbers does not notwork e.g. because of the presence of 'business cycle risks', then the assumption that government is risk neutral is presupposed.

4) Notice that even though r takes its minimum value $r = -1$, $\hat{R} = t_r > 0$ so that $\hat{R}$ is always positive.

5) An appendix showing this is available from the author upon request.

6) As far as the size of relative risk aversion is concerned, the estimates, while varying widely, all come up with the conclusion that it is well above one (see e.g. Machina (1983) for further details).

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