Queen's Economics Department Working Paper No. 777

Time Consistent Policy and the Structure of Taxation

Neil Bruce

Department of Economics
Queen's University
94 University Avenue
Kingston, Ontario, Canada
K7L 3N6

2-1990

Time Consistent Policy and the Structure of Taxation

DISCUSSION PAPER #777

by

Neil Bruce
Queen's University, Kingston, ONT
and
University of Colorado, Boulder, CO

Time Consistent Policy and the Structure of Taxation

by

Neil Bruce

Queen's University
Kingston, Canada
and
University of Colorado
Boulder, CO

Abstract

It is now well known that "optimal" government policies may not be time consistent--that is, ex post *optimal. Time consistency considerations can be shown to reverse the conclusions about the relative merits of different tax structures that are drawn from Ramsey type analysis. In this paper I show with the help of a simple overlapping generations model that this is the case for the "presumption" that direct taxes, for which tax rates can be made contingent on household characteristics, weakly dominate indirect taxes, which are levied on transactions. The ability of the government, with direct taxation, to levy different tax rates on households in different periods of their lifecycles introduces a time consistency problem that is not present with the "anonymous" tax rates levied under indirect taxation.*

Key words: time consistency, direct and indirect taxation, overlapping generations.

First Draft: February, 1990.
Comments and suggestions will be appreciated.

Mailing Address until 7/31/90:

Department of Economics
Campus Box 256
University of Colorado
BOULDER, CO, 80309-0256

1. Introduction.

Several authors have analyzed the implications for tax policy resulting from the demonstration by Kydland and Prescott (1977) and Calvo (1978) that "optimal" government policies may be time inconsistent[1]. This analysis raises the question of how welfare superior but time consistent tax policies may be achieved. Kydland and Prescott (1980) argue that "tax rules" can be used to obtain welfare gains, while Lucas and Stokey prove that, in an exchange economy, future tax rates can be made time consistent if the government in each period chooses an appropriate term structure for the outstanding government debt. Unfortunately, Persson and Svensson (1986) later show that time inconsistency may arise in the Lucas-Stokey model regardless of the debt structure if the households can borrow and lend at a fixed interest rate. Other means of attaining time consistency include "reputation building" and "trigger strategy" equilibria[2].

Rogers (1987) shows that time consistency considerations may reverse standard conclusions about the relative merits of different tax structures.

---

[1]They include Fischer (1980) who points out the *ex ante* incentive for the government to tax capital at a low rate and the *ex post* incentive to tax it highly even if the government is "benevolent" (cares only about the utility of the household); Kydland and Prescott (1980) who suggest that time consistent tax policies may be "very sub-optimal"; and Lucas and Stokey (1983) who show that time inconsistency can arise even in an exchange economy. The time consistency of taxation is also considered by Brock and Turnovsky (1980), Judd(1985), Chamley (1985), and Chari *et al* (1989).

[2]Kotlikoff *et al* (1988) provide an example of the latter. They show that if laws are costly then a tax law that does not fully expropriate the sunk investment can be "sold" by the old generation to the young in exchange for the young accepting a larger share of taxes. The law is maintained because it becomes worthless if the purchasing generation reneges on its promise not to tax capital.

In particular, because of time consistency, taxes on consumption may be welfare superior to taxes on wages despite the fact that the latter are shown to weakly dominate consumption taxes by a Ramsey argument under the given conditions. In her model there is a single household with Cobb-Douglas preferences that lives for two (or more) periods. She shows that the Ramsey-optimal consumption tax rates are time consistent--that is, the government will have no incentive to "change its mind" about the tax rates it wants merely because of the passage of time (and the fixing of household decisions) whereas the Ramsey-optimal wage tax rates are not (unless the household does no saving in the absence of taxation)[3]. Further, she demonstrates with numerical examples that it is possible, even likely, that raising revenue with the taxes on consumption is welfare superior to raising revenue with a time consistent wage tax.

I extend Rogers' insight on the importance of the tax structure to the question of time inconsistency to the debate about the relative merits of direct versus indirect tax systems. The debate about whether direct taxes--levied on persons or households and, accordingly, may be individualized by letting the tax rate depend on household characteristics--are in some sense superior to indirect taxes--levied on transactions and are therefore "anonymous" (the same rate for all taxpayers)--is an old one in public finance. The closest thing to a definitive conclusion is the result by Atkinson and Stiglitz (1976) that direct taxes weakly dominate indirect taxes on vertical equity and efficiency

---

[3]Chamley (1985) also points out the time-inconsistency of optimal wage taxes, where wage rates are endogenous. Time inconsistency arises in Rogers' model even though wage rates are fixed.

grounds if the untaxed good (leisure) is weakly separable from all market goods in the households' preferences. I show that this conclusion, and therefore the presumption in favor of direct taxation, may not hold once time consistency considerations are introduced.

I consider a model in which households live for two periods and are identical except for their dates of birth, so generations overlap. In each period, the government chooses wage and/or consumption tax rates applying to the old and a young households in that period but is unable to commit to future tax rates for the households who are young. I show that when the government is free to levy "direct" taxes for which the tax rates can be made "cohort-specific", a time consistency problem arise because the tax rate(s) levied on the old households is always chosen contingent on the fixity of their earlier saving decision. Thus, the future tax rate the current government would like to promise the current young households is not that which they will face when they are old. In contrast, indirect taxes which are levied on transactions must apply at the same rate for both the old households who have already made their saving decision and the young generations who have not. This constraint "removes" the time consistency problem and introduces the possibility that an indirect tax system may be welfare superior to the time consistent direct tax system. In the model considered, the cases where consumption taxes are superior to time consistent wage taxes in the representative taxpayer model are sufficient (but not necessary) for indirect taxes to be superior to direct taxes in an overlapping generations model.

The outline of the remainder of the paper is as follows. In section 2 I develop the analysis of household choice in a way which is amenable for analyzing the time consistency problem. In section 3 I review the representative taxpayer model and the derivation of time consistent equilibrium tax rates. In section 4 I develop a simple overlapping generations model to show that if the government objective function is the lifetime utility of the representative household the problem for a government choosing tax rates on contemporaneous households in different periods of their lifecycles is, except for interpretation, the same as that for a government choosing tax rates on a single household in different periods of its lifecycle. In the final section I discuss the implications of the analysis for the choice of a tax structure, particularly with respect to the choice between direct and indirect taxes.

2. The Model of the Household.

The model of the individual household is the same as that presented in Rogers (1987). I develop it in a way that is useful for analyzing further the issue of time consistency in tax policy. The household lives for two periods and supplies labor in both. Its preferences are additively separable with the single period utility given by the Cobb-Douglas form $U(C_t,N_t) = \beta \cdot \ell nC_t+(1-\beta) \cdot \ell nN_t$, where C_t is consumption in period t, N_t is leisure consumed in period t and $0 < \beta < 1$. The household is endowed with one unit of time in each period, so its labor supply is $1-N_t$. A significant simplification attributable to the Cobb-Douglas form is that dependency of household choices made in the first period on tax rates anticipated in the second period arises solely through their impact on the household saving decision.

Let $V_t(\tau_t, \theta_t, K)$ be the period t indirect utility function corresponding to the solution of the problem

$$(1) \qquad \max_{C_t, N_t} \; U(C_t, N_t) \text{ s.t. } R^{t-1} \cdot \left[(1-\theta_t)\cdot(1-N_t)-(1+\tau_t)\cdot C_t\right] + (-1)^t \cdot K = 0$$

where saving denoted K is assumed fixed for this stage of the household's problem. Consumption in the first period is chosen as the numeraire so $R = (1+r)^{-1}$ where r is the real interest rate. The real interest rate and the real wage rate, which is normalized to unity, are assumed fixed by the technology. θ_t and τ_t denote the tax rate (subsidy if negative) at time t on wage income and consumption respectively. A tax rate on saving or its return is omitted, but the taxation of saving can be indirectly accomplished in the model through the choice of wage and consumption tax/subsidy rates.

The derivatives of the indirect period utility functions are given by $\frac{\partial V_t}{\partial \tau_s} = -\lambda_t \cdot C_t \cdot R^{t-1}$ and $\frac{\partial V_t}{\partial \theta_s} = -\lambda_t \cdot (1-N_t) \cdot R^{t-1}$ for s=t, zero otherwise, and $\frac{\partial V_t}{\partial K} = (-1)^t \cdot \lambda_t$, where λ_t is the marginal utility of income in period t. With the assumption that the period utility function is Cobb-Douglas λ_t, C_t, and N_t can be expressed:

$$(2) \qquad \lambda_t^{-1} = Y_t(\theta_t, K) = (1-\theta_t)\cdot R^{t-1} + (-1)^t \cdot K$$

$$(3) \qquad C_t(\tau_t, \theta_t, K) = \frac{\beta \cdot Y_t}{(1+\tau_t)} \cdot R^{1-t}$$

$$(4) \qquad N_t(\theta_t, K) = \frac{(1-\beta)\cdot Y_t}{(1-\theta_t)} \cdot R^{1-t}.$$

The intertemporal optimization problem of the household can now be considered as the "second stage" problem:

$$\max_{K} V_1(\tau_1,\theta_1,K) + \delta\cdot V_2(\tau_2,\theta_2,K) \tag{5}$$

where $0 < \delta < 1$ is the inverse of one plus the time preference rate. The first order necessary condition for the solution to (5) is $\lambda_1 = \delta\cdot\lambda_2$ which can be solved for the saving function:

$$K(\theta_1,\theta_2) = (1+\delta)^{-1}\cdot\left[\delta\cdot(1-\theta_1)-R\cdot(1-\theta_2)\right]. \tag{6}$$

In the absence of wage taxes (i.e., $\theta_1=\theta_2=0$), saving is positive (negative) if $\delta >$ (<) R. Under the Cobb-Douglas assumption, the level of saving is independent of the consumption tax rates. One could, at this point, substitute $K(\theta_1,\theta_2)$ into equations (2) to (4) to obtain Y_t, C_t and N_t as functions of the tax rates alone. However, it is more useful to maintain the explicit dependency on K as a fixed variable for the time consistency analysis. Thus the partial derivatives of household behavioral functions with respect to wage tax rates hold K constant, with the dependency of K on the θ_t introduced explicitly from equation (6) where needed.

3. Tax Policy in a Representative Taxpayer Economy.

This is the case considered by Rogers (1987). The representative taxpayer assumption requires that all households have identical quasi-homothetic preferences *and* that all households are in the same period of their life-cycles. The government sets tax rates so as to optimally finance a stream of public consumption where the benefit of public consumption at time t is given by $A(G_t)$ with $A'(G_t) = \partial A/\partial G_t > 0$. The objective of the government is assumed to coincide with the utility of the representative taxpayer. As of the first period, the Ramsey tax policy is given by the solution to:

$$(7) \qquad \max_{\tau_t,\theta_t,G_t} \sum_{t=1}^{2} \delta^{t-1}\cdot\Big(V_t(\tau_t,\theta_t,K)+A(G_t)\Big) \text{ s.t. } B(\theta_t,\tau_t,G_t,K)=0$$

and the behavioral equation (6). The function $B(\cdot)$ is obtained by substituting equations (3) and (4) into the government's budget constraint $\sum_{t=1}^{2} R^{t-1}\cdot[\tau_t\cdot C_t+\theta_t\cdot(1-N_t)-G_t]=0$. Induced changes in K can be ignored in the objective function of (7) courtesy of the envelope theorem--the argument is left explicit for the purpose of the time consistency analysis to follow.

The wage tax regime weakly dominates the consumption tax regime in the Ramsey problem. The separability assumptions imply that any consumption taxes will be imposed at a uniform rate (i.e., $\tau_1=\tau_2$). The same outcome can be achieved with a uniform wage tax. Moreover, if $R\neq\delta$ so saving is non-zero, a non-uniform wage tax is superior with a higher (lower) wage tax set in the second period if saving is negative (positive) at the optimal rates. When wage tax rates are set optimally, consumption taxes are redundant so the rates can be set equal to zero[4].

---

[4]See Rogers (1987) for details. The Ramsey optimal wage tax structure satisfies $\theta_1\cdot R\cdot(1-\theta_2)\cdot(1-\theta_1)^{-1}= \theta_2\cdot\delta\cdot(1-\theta_1)\cdot(1-\theta_2)^{-1}$. The equality between the marginal willingness to pay for public consumption and the marginal utility cost of incremental revenue can be solved for the absolute levels of the tax rates.

The time consistent tax policy is found by the usual backward induction argument. The problem faced by the government in the second period is given by:

$$(8) \qquad \max_{\tau_2,\theta_2,G_2} \quad V_2(\tau_2,\theta_2,\bar{K})+A(G_2) \text{ s.t. } B(\bar{\theta}_1,\bar{\tau}_1,\theta_2.\tau_2,\bar{G}_1,G_2,\bar{K})=0$$

where saving and the first period policy variables are fixed (fixed variables are indicated with an over-bar). The first order conditions for the optimal policy variables in the second period are found as solutions to the first order conditions $\frac{\partial V_2}{\partial i} = \phi\cdot\frac{\partial B}{\partial i}$ for instrument $i=\theta_2,\tau_2$ and $A'(G_2) = R\cdot\phi$ where $\phi > 0$ is the multiplier on the government budget constraint. This multiplier can be interpreted as the marginal second-period utility cost of an extra present value unit of government revenue.

Let θ_2^*, τ_2^*, and G_2^* denote the optimizing values of the policy variables in period 2 and let $V_2^*(\bar{\tau}_1,\bar{\theta}_1,K(\bar{\theta}_1,\theta_2^*),\bar{G}_1)$ denote the maximized second period indirect utility as a function of the fixed (as of the second period) first period policy variables. Again using the envelope theorem, we see that i) $V_2^*(\cdot)$ does not depend on the second period tax rates except through the impact of θ_2^* on saving, reflecting rational expectations, and ii) the derivatives of $V_2^*(\cdot)$ with respect to the first period policy variables are given by

$$(9) \qquad \frac{\partial V_2^*}{\partial i} = \phi\cdot\frac{\partial B}{\partial i} + \left(\lambda_2 + \phi\cdot\frac{\partial B}{\partial K}\right)\cdot\left(\frac{\partial K}{\partial i} + \frac{\partial K}{\partial \theta_2}\cdot\frac{\partial \theta_2^*}{\partial i}\right)$$

for instrument $i=\theta_1,\tau_1$ and G_1. Finally, we can express the government's problem as of the first period (at which time K and first period policy instruments are variable) as:

$$(10) \qquad \max_{\tau_1,\theta_1,G_1} \quad V_1(\tau_1,\theta_1,K(\theta_1,\theta_2^*)) + A(G_1) + \delta\cdot V_2^*(\tau_1,\theta_1,K(\theta_1,\theta_2^*),G_1).$$

The optimal values for the first period policy variables satisfy the first order conditions $\frac{\partial V_1}{\partial i} = \delta\cdot\frac{\partial V_2^*}{\partial i}$ for instrument $i=\theta_1,\tau_1$ and $A'(G_1) = \delta\cdot\phi$. The first order conditions for problems (8) and (10) are then solved along with the household and government budget constraints for the optimal values of the policy variables.

The explicit solution for the time consistent tax policy is not essential for the main argument so I sketch a description of the time consistent tax policy here with the details relegated to the Appendix. As shown in the Appendix, the first order conditions and the government budget constraint can be solved for a unique value of $\Theta = (1-\theta_2)/(1-\theta_1)$. Further, the solution to problem (8) requires that the second period consumption tax (subsidy) be imposed at the same rate at which second-period wages are subsidized (taxed) if K is non-zero. In this way a lump-sum tax is imposed on saving if positive (negative). If K=0, this requirement is relaxed. The first order conditions for the choice of τ_2 and τ_1 in problems (8) and (10) respectively imply that consumption taxes, if levied, should be levied at the same rate in both periods, just as in the Ramsey solution[5]. Consequently, the first period wage tax rate must exceed the second period wage tax rate if positive revenue is to be raised.

As mentioned earlier, a uniform wage tax is equivalent to a uniform consumption tax. This means that adding (subtracting) a constant to the wage

---

[5]This follows directly from the time consistency of consumption tax rates.

tax rates in both periods and subtracting (adding) the same constant from the consumption tax rates yields an equivalent policy. This implies that we can always set one of the four tax rates equal to zero in the time consistent solution. For example, when $K \neq 0$ we can set $\theta_1 = 0$ so that the time consistent policy reduces to a uniform consumption tax coupled with an equal second period wage subsidy. Alternatively, we could set the consumption tax and wage subsidy equal to zero and solve for a first period wage tax as the sole source of government revenue. In either case the choice between second period consumption and second period leisure is undistorted.

If $K=0$ at the optimal value of Θ, we can set consumption tax rates equal to zero and solve for positive wage tax rates in both periods. The wage tax in period 2 will be greater (less) than that in the first period depending on whether δ is less (greater) than R--that is whether the consumer dis-saves or saves in the absence of the taxes.

4. Tax Policy in an Overlapping Generations Economy.

In this section households are identical as of their birthdays, but taxpayers are heterogeneous because they are in different periods of their lifecycles. In each period the government levies taxes on two types of taxpayers--the old, who are in the second period of their lifecycle and the young who are in the first. I assume exogenous growth in the population at the rate of interest so there are R times as many households in a particular generation as in the one succeeding it. This assumption eliminates arbitrage possibilities between the technological and biological rates of interest.

A difficulty that now arises is the specification of the government's objective function. In the representative taxpayer model, the identification of the government's objective function with the utility of the representative taxpayer is relatively innocuous and can be interpreted consistently as the objective of either a benevolent social welfare maximizing government or a "selfish" politically-motivated one. Even an exploitative government may wish to minimize the burden of a given level of tax revenues collected if it must face an electorate of the same identical taxpayers. In the heterogeneous taxpayer case, the specification of the government objective function is not as simple. A social welfare maximizing perspective requires the government consider the utilities of the as-yet-unborn generations as well as the extant ones. On the other hand, a politically motivated government may not be equally responsive to the utility changes of the different types of living taxpayers, and not at all to the unborn except through the preferences of the living taxpayers.

I finesse these and other issues by maintaining the assumption that the objective of the government in every period is to maximize the lifetime utility of the (*ex ante*) identical households in perpetuity. Whether this objective is one that actual governments would choose is problematic because households in different stages of their lifecycles do not have the same concerns and government policy may depend on the relative political power of households with different demographic characteristics. For this reason, the objective is best thought of as a normative one rather than a political one. The assumption of a "benevolent" government sharpens the paradox of time consistency in policy making, however, so the assumption will suffice in this regard. Further, it rules out time consistency arising from changes in government preferences over time as in Strotz (1956)[6]. Most importantly, from my perspective, it makes the problem identical, except for interpretation, to the representative taxpayer case allowing me to "free ride" on results derived by Rogers.

It is necessary to distinguish the vintage of a household from the period of its lifecycle. Let $V_t^v(\cdot)$ denote the single-period, indirect utility function of a household of vintage v (i.e., born at the beginning of period v) at time t. In every period t the government faces old taxpayers who have the indirect utility function $V_t^{t-1}(\cdot)$ and young taxpayers who have the indirect lifetime utility function $V_t^t(\cdot) + \delta \cdot V_{t+1}^t(\cdot)$. Let θ_t^v and τ_t^v denote the wage and consumption tax rates on households of vintage v at time t. The assumption that the tax rates can depend on household vintage represents the government's ability to levy direct taxes on households--that is, tax rates that are tailored to household characteristics including its age (date of birth).

Government consumption is a Samuelsonian public good so both generations enjoy $A(G_t)$ from the public expenditure in period t. The t period government budget constraint can be written

$$\tau_t^{t-1} \cdot C_t^{t-1} + \theta_t^{t-1} \cdot (1-N_t^{t-1}) + \tau_t \cdot C_t^t + \theta_t^t \cdot (1-N_t^t) - G_t = 0. \quad (11)$$

Because the objective of the government is to maximize steady state lifetime utility and because preferences and the technology remain constant, there is

---

[6]Calvo and Obstfeld (1988) show that unless living and unborn households are treated symmetrically in the government's social welfare function, a preference-based time inconsistency can arise even with lump-sum taxes and transfers.

no role for debt policy so the government balances its budget each period.

In the case where commitment is possible, the problem is identical to the Ramsey problem in the representative taxpayer model. The tax rates levied on the old households have already been committed by the previous government while the present government (or for that matter any past government) sets present and future tax rates for the young households and the current level of the public good. Lifetime utility is maximized in this problem with a Ramsey-optimal tax regime where wage tax rates differ between old and young households assuming $R \neq \delta$. Direct taxes, which allow cohort-specific rates, are superior to indirect taxes, which do not.

The time consistency issue arises because the government cannot commit future tax rates for the young households. In period t a government can control $V_t^{t-1}(\theta_t^{t-1}, \tau_t^{t-1}, R^{-1} \cdot \bar{K}^{t-1})$ the utility of the representative old household (born at the beginning of period t-1) which is in the final period of its life with committed saving, and $V_t^t(\theta_t^t, \tau_t^t, K^t)$, the first period utility of the representative young household (born at the beginning of period t). It can also determine (through its choice of first period tax rates on young households) how much saving the young household will do therebye indirectly affecting the second period utility the young household will enjoy given that the tax rates it faces when it is old are determined in the same way that the current government sets the tax rates on the current old.

The correspondence between the tax policy chosen by the government in a period of time in the overlapping generations economy and the tax policy chosen by the government over the two periods of the household's lifecycle in the representative taxpayer case can be seen as follows. The government in period t+1 will choose the tax rates on the vintage t household in the same way that the period t government chooses the tax rates on the vintage t-1 households. Preferences are identical so the function $V_t^{t-1}(\cdot)$ is the same as $V_{t+1}^{t}(\cdot)$. The only difference is that the size of the t-1 vintage population is R times the t vintage population because of secular growth. This means we can replace C_t^{t-1} with $R\cdot C_{t+1}^{t}$ and N_t^{t-1} with $R\cdot N_{t+1}^{t}$ in equation (11), $R^{-1}\cdot K^{t-1}$ with K^t in $V_t^{t-1}(\cdot)$, and treat the problem as equivalent to one where a single government chooses tax rates in both periods for households of vintage t. The important thing is that the second period tax rates are chosen after the household has committed its saving decision, while the first period tax rates and the household saving decision are chosen with the knowledge that these tax rates will prevail. The saving level is determined from (6) with θ_t^t replacing θ_1 and the rational expectation of θ_{t+1}^{t} replacing θ_2.

If household saving is non-zero,the analysis in section 3 (and the Appendix) suggests that the resulting tax structure will be one in which government imposes a uniform consumption tax rate on old and young households with a cohort specific wage subsidy at the same *ad valorem* rate on the old households. Alternatively, the government could raise all of its revenue from a wage tax on young households. If saving is zero at the chosen tax rates, wage taxes are imposed on both age groups but with a lower tax rate on the old if $\delta > R$.

5. Conclusions About Time Consistency and the Structure of Taxation.

With direct taxation, the tax rates levied on the old and the young households can be made cohort specific, while indirect taxes are levied on transactions and must be the same for both young and old households. If the future tax rates to be levied on the current young can be credibly committed, direct taxation is superior to indirect taxation because the Ramsey optimal tax structure calls for differential wage tax rates on households according to the stage of their lifecycle. However, this same "flexibility" leads to time inconsistency. The future tax rates that the government will promise the young are not the same as the tax rates the government wants to levy on old.

Because indirect taxes have to be levied at the same rate on the young and old households alike, it follows that the tax rates will be uniform over time. Thus an indirect tax structure, whether on wages or consumption, is uniform, and its relative merits can be established from calculations done in Rogers. While the indirect tax structure is clearly inferior to the Ramsey-optimal direct tax structure in accordance with the conclusion of Atkinson and Stiglitz (1976), it may well be superior to the time consistent direct tax structure for the same reason that the (uniform) consumption tax is found superior to the time-consistent wage tax.

In some respects the conclusion about the relative merits of direct and indirect taxation is "stronger" than the conclusion about the relative merits of taxing consumption versus wages. First, the time consistency of the consumption tax rates depends on the preference structure. For preferences other than Cobb-Douglas, tax rates on consumption may not be time consistent, introducing the same problem for consumption taxes that exists for wage taxes. In this case indirect consumption taxes may be welfare superior to direct consumption taxes. That is, it is the choice of indirect over direct taxes rather than consumption over wage taxes that is the important choice.

A second point concerns the taxation of capital which I have simply assumed away. Capital can be taxed under an indirect tax structure by including producer durables in the tax base. In terms of the barter model considered above, this would be equivalent to putting a tax on the purchase of capital by young households. It is fairly easy to see that the government would not want to put a tax on the *ex ante* saving decision of young households. Perhaps this explains why the exclusion of producer durables is considered an element of good sales tax design whereas capital income is included under direct taxation.

Finally, in Rogers' analysis and my own there is the unresolved issue of why the government can commit the tax structure (i.e., to tax consumption rather than wages or levy indirect taxes rather than direct taxes) but not tax rates. Even if consumption tax rates (or indirect tax rates) are time consistent, what prevents the government from putting in an *ex post* optimal wage tax/subsidy (or cohort-specific direct tax/ subsidy)? The cost of changing the tax structure may be an important factor in this regard, and again the conclusion about indirect versus direct taxes is stronger than for consumption versus wage taxes. Even if a direct consumption tax system of the Kaldor-Bradford type has time consistent tax rates, the cost of introducing (say) a cohort-specific earned income tax credit or special tax provisions for the older taxpayers would be low. In contrast, indirect tax systems such as a value added tax have an entirely different administrative structure. Thus a government relying on indirect taxes could introduce cohort-specific tax provisions only at the cost of putting a direct tax system in place.

To conclude, it is the infeasibility of using the indirect tax system to discriminate among households in different stages of their lifecycles[7] and the cost of introducing another administrative structure, rather than the structure of preferences, that allows the government to credibly commit future tax rates with indirect taxation. As in Rogers, my conclusion is supports that of Kydland and Prescott (1977). That is, constraints on discretionary behavior, in this case on the freedom to set tax rates on the basis of household characteristics, may be welfare improving[8].

---

[7] Actually, if there are many goods and the consumption bundle varies systematically over the life cycle of the household, time inconsistency might arise within an indirect tax structure through the mechanism of differential tax rates on goods. Thus, for example, a uniform (across goods) indirect tax may not be time consistent.

[8] This conclusion is not general, however. Calvo and Obstfeld (1988) analyze an overlapping generation economy where it is a constraint on government policy making--the inability to levy cohort-specific lump-sum taxes and transfers--that gives rise to a form of time inconsistency.

References

Atkinson, A. B., and J. E. Stiglitz, "The Design of Tax Structure: Direct Versus Indirect Taxation," Journal of Public Economics, 1976, 55-75.

Brock, W. A., and S. Turnovsky, "Time Consistency and Optimal Government Policies in Perfect Foresight Equilibrium," Journal of Public Economics, 13 (1980), 183-212.

Calvo, G. A., "On the Time Consistency of Optimal Policy in a Monetary Economy," Econometrica, 1978, 1411-1428.

Calvo, G. A. and M. Obstfeld, "Optimal Time-Consistent Fiscal Policy With Finite Lifetimes," Econometrica, 1988, 411-32.

Chamley, C., "Efficient Taxation in a Stylized Model of Intertemporal General Equilibrium," International Economic Review, (1985), 451-68.

Chari, V. V., P. J. Kehoe, and E. C. Prescott, "Time Consistency and Policy," in Modern Business Cycle Theory, R. J. Barro (ed.), Harvard University Press, Cambridge MA, 1989.

Fischer, S., "Dynamic Consistency, Cooperation and the Benevolent Dissembling Government," Journal of Economic Dynamics and Control, 2 (1980), 93-107.

Kydland, F. E. and E. C. Prescott, "Rules Rather than Discretion: The Inconsistency of Optimal Plans," Journal of Political Economy, 1977, 473-92.

______________ and ________________, "Dynamic Optimal Taxation, Rational Expectations and Optimal Control," Journal of Economic Dynamics and Control, 2 (1980), 79-91.

Kotlikoff, L. J., T. Persson, and L. E. O. Svensson, "Laws as Assets: A Possible Solution to the Time Consistency Problem," American Economic Review, 1988, 662-67.

Lucas, R. E. Jr., and N. L. Stokey, "Optimal Fiscal and Monetary Policy in an Economy Without Capital," Journal of Monetary Economics, 1983, 55-93.

Persson, T., and L. E. O. Svensson, "International Borrowing and Time Consistent Fiscal Policy," Scandanavian Journal of Economics, 1 (1986), 273-95.

Rogers, C. A., "Expenditure Taxes, Income Taxes, and Time-Inconsistency," Journal of Public Economics, (1987), 215-30.

Strotz, R. H., "Myopia and Inconsistency in Dynamic Utility Maximization," Review of Economic Studies, 1956, 165-180.

Appendix

For the case of the representative taxpayer, consider first the government's problem in the second period as given by (8). The first order conditions describing the optimal policy choices in the second period are:

$$\text{(A.1)} \qquad A'(G_2) = R\cdot\phi.$$

$$\text{(A.2)} \qquad \lambda_2\cdot C_2 = \phi\cdot\left(C_2 - \theta_2\cdot\frac{\partial N_2}{\partial \tau_2} + \tau_2\cdot\frac{\partial C_2}{\partial \tau_2}\right)$$

$$\text{(A.3)} \qquad \lambda_2\cdot(1-N_2) = \phi\cdot\left((1-N_2) - \theta_2\cdot\frac{\partial N_2}{\partial \theta_2} + \tau_2\cdot\frac{\partial C_2}{\partial \theta_2}\right).$$

We can differentiate equations (3) and (4) to obtain

$$\text{(A.4)} \qquad dC_t = \frac{C_t}{(1+\tau_t)\cdot Y_t}\cdot\left[-Y_t\cdot d\tau_t - (1+\tau_t)\cdot R^{t-1}\cdot d\theta_t + (-1)^t\cdot(1+\tau_t)\cdot dK\right]$$

$$\text{(A.5)} \qquad dN_t = \frac{(-1)^t\cdot N_t}{Y_t}\cdot\left[dK + \frac{K\cdot d\theta_t}{(1-\theta_t)}\right].$$

Substitution into (A.2) yields $\lambda_2\cdot(1+\tau_2) = \phi$ which is substituted into (A.3) which simplifies to $K\cdot\left(\frac{\theta_2 + \tau_2}{1-\theta_2}\right) = 0$. This implies that in the second period the government chooses tax rates $\theta_2 = -\tau_2$ if $K \neq 0$. Thus, providing saving is non-zero, the time consistent policy taxes (subsidizes) second period consumption at the same rate that it subsidizes (taxes) second period wages.

We can also use (A.4) and (A.5) along with the envelope theorem to obtain

$$\text{(A.6)} \qquad A'(G_1) = \delta\cdot\phi$$

$$\text{(A.7)} \qquad \frac{\partial V_2^*}{\partial \tau_1} = \phi\cdot\frac{C_1}{(1+\tau_1)}$$

$$\text{(A.8)} \qquad \frac{\partial V_2^*}{\partial \theta_1} = \phi\cdot\left(\frac{C_1}{Y_1} + \frac{K\cdot N_1}{(1-\theta_1)\cdot Y_1}\right) + \left(\lambda_2 + \phi\cdot Z\cdot\frac{dK}{d\theta_1}\right)$$

where

$$(A.9)\quad Z = \sum_{t=1}^{2} R^{t-1}\cdot\left(\tau_t\cdot\frac{\partial C_t}{\partial K} - \theta_t\cdot\frac{\partial N_t}{\partial K}\right)=\beta\cdot\left(\frac{\tau_2-\tau_1}{(1+\tau_1)\cdot(1+\tau_2)}\right)+(1-\beta)\cdot\left(\frac{\theta_1-\theta_2}{(1-\theta_1)\cdot(1-\theta_2)}\right)$$

and $\frac{dK}{d\theta_1} = \frac{\partial K}{\partial\theta_1} + \frac{\partial K}{\partial\theta_2}\cdot\frac{\partial\theta_2^*}{\partial\theta_1} = \frac{1}{1+\delta}\cdot\left(R\cdot\frac{\partial\theta_2^*}{\partial\theta_1} - \delta\right).$

Now consider the government's problem in the first period shown as problem (10). Using (A.7) the first order conditions with resect to τ_1 simplifies to $\lambda_1\cdot(1+\tau_1) = \delta\cdot\phi$. Using $\lambda_1 = \delta\cdot\lambda_2$, we get $\tau_1 = \tau_2$. That is, any consumption tax/subsidies are imposed at a uniform rate in both periods. If $K \neq 0$, we can use $\tau_1 = \tau_2 = -\theta_2$ to reduce the first order necessary condition for θ_1 to $\frac{\partial\theta_2^*}{\partial\theta_1} = (1-\theta_2^*)\cdot(1-\theta_1)^{-1}$. This can be integrated to obtain the right-hand-side as a constant which is denoted Θ.

When $K\neq0$, the policy solution is obtained as follows. From equations (2) and (6) we can use $\lambda_2\cdot(1+\tau_2) = \phi$ and $\tau_2 = -\theta_2$ to obtain

$$(A.10)\qquad \phi = \frac{\Theta\cdot(1+\delta)}{\delta\cdot(1+R\cdot\Theta)} .$$

Second, if $A'(G_t) = \alpha\cdot G_t^{-1}$ as in Rogers, then (A.1) and (A.6) yield $G_1 + R\cdot G_2 = (1+\delta)\cdot\alpha\cdot(\delta\cdot\phi)^{-1}$ and we can combine the household and government budget constraints to obtain:

$$(A.11)\qquad \phi = \frac{(1-\beta)\cdot(1-\Theta) - \alpha\cdot(1+\delta)}{\delta\cdot[1-(1/\Theta)]}.$$

Together (A.10) and (A.11) can be solved for Θ^* as the root of a quadratic equation determined by the parameters α, β, δ and R. Since a uniform component of a wage tax is equivalent to a uniform consumption tax at the same rate, we can set $\tau = -\theta_2 = 0$ so the solution $\Theta^* = (1-\theta_1^*)^{-1}$. Alternatively, we can set $\theta_1 = 0$ and the time consistent policy requires setting a uniform consumption tax rate in each period coupled with second period wage subsidy both at rate Θ^*-1.

If K=0, there is no requirement that $\tau = -\theta_2$ so the equivalence of the uniform components of wage and consumption taxes can be used to set $\tau = 0$ without implying $\theta_2 = 0$. Equations (6) can be solved for $R\cdot(1-\theta_2) = \delta\cdot(1-\theta_1)$ which equals ϕ^{-1} by the first order conditions on the setting of the consumption tax rates. This immediately implies $\theta_1>\theta_2$ if $\delta>R$. Further, the government budget constraint can be simplified to $\theta_1 + R\cdot\theta_2 = \frac{\alpha\cdot(1+\delta)}{\beta\cdot\delta\cdot\phi}$. Substitution for ϕ and θ_2 gives $\theta_1 = (\alpha+\beta)^{-1}\cdot\left[\alpha + \beta\cdot\left(\frac{\delta-R}{1+\delta}\right)\right]$.