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LAWS AS ASSETS:
A POSSIBLE SOLUTION TO THE TIME CONSISTENCY PROBLEM

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ABSTRACT

This paper presents a new solution to the time-consistency problem that appears capable of enforcing ex ante policy in a variety of settings in which other enforcement mechanisms do not work. The solution involves formulating a law, institution, or agreement that specifies the optimal ex ante policy and that can be sold by succesive old generations to succesive young generations. Each young generation pays for the law through the payment of taxes. Both old and young generations have an economic incentive to obey the law. For the old generation that owns the law, breaking the law makes the law valueless, and the generation suffers a capital loss. For the young generation the economic advantage of purchasing the existing law exceeds its cost as well as the economic gain from setting up the law.

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1. Introduction

As is now well understood, the requirement that policies be time consistent leads to outcomes that are suboptimal relative to those that precommitment would sustain. An example considered by Fischer (1980) is capital taxation in a two-period model. In that model a second period capital levy is first best from the perspective of period two, but third best from the perspective of period one. Since there is nothing in Fischer's model to enforce a government commitment against second period capital taxation, the ex post desire to engage in first best taxation drives the ex ante economy from a second to a third best outcome.

Researchers have suggested a variety of ways to enforce optimal commitment policies. Kydland and Prescott (1977) argue for rules rather than discretion. Barro and Gordon (1983) and a number of subsequent writers (see Rogoff (1986)) introduce government reputation as a mechanism to enforce commitment. Lucas and Stokey (1983) and Persson, Persson and Svensson (1986) show that, assuming partial commitment to honoring its bonds, governments can devise financial instruments whose market values fall if ex post policy deviates from ex ante policy. The capital loss the government would suffer from deviating from ex ante policy deters such deviations.

This paper presents a new solution to the time-consistency problem that appears capable of enforcing ex ante policy in a variety of settings in which other enforcement mechanisms do not work. The solution involves formulating a law (or institution or agreement) that specifies the optimal ex ante policy and that can be sold by successive old generations to successive young generations. Each young generation pays for the law by paying a larger share of taxes than it would otherwise do. Both old and young generations have an economic incentive to obey the law. For the old generation that owns the law, breaking the law makes the law valueless, and the generation suffers a capital loss. For the young generation the economic advantage of purchasing the existing law exceeds its cost as well as the economic gain from setting up a new law.

Fischer's model extended to include overlapping generations provides a convenient device for illustrating the potential asset nature of laws. Assume, to keep matters simple, that only the elderly consume the public good. Since the old and young have no common interests they live side by side, but have seperate governments called councils. These councils are democratically elected each period, and since the members of any generation are identical, each council simply carries out the current unanimous wishes of its constituents. Each generation's council has the right to tax its constituents and is obliged to supply the public good when its constituents are old.

Assume now that the ex ante second best, but time inconsistent tax structure involves no capital taxation. In contrast, the third best, time consistent tax structure clearly involves capital taxation, because each individual when old will wish his council to levy an ex post nondistortionary tax on capital. Since the capital tax will be anticipated when young, saving will be distorted, implying a third best rather than second best level of welfare.

In this model each generation is self governing and cannot be bound by any "rules". Reputation requires, as far as we can see, the government to be an agent separate from its constituency, with separate preferences. In our model we consider the government simply as a representative of its constituency, with the same preferences as the identical consumers it represents. Reputation, therefore, does not work. The partial commitment approach, while resembling our solution in several respects, requires invoking some degree of precommitment. Since such precommitment is not suggested by the model, it is not a very satisfying solution here.

Enforcement through the sale of a law can arise in the following way. Suppose one particularly enterprising leader of the young, after tedious discussions with her electorate, draws up a law which states that the generation holding the law is exempt from capital taxation. The enterprising leader of the young ensures her electorate that in the next period, when their generation (called the first generation) is old, she will approach the council of the young (called the second generation) and offer to sell the law in exchange for tax revenue from the young to help pay for the public good of the old. She argues convincingly that after agreeing on an acceptable amount of tax revenue, the council of the second generation young will purchase the law knowing (1) that the law will protect the second generation from second period (and third best) capital taxation because selling the law to the subsequent young (the third generation) will be more beneficial in terms of additional tax receipts than the second period efficiency gains from capital taxation and (2) that the cost of purchasing the law less its resale value is less than the transactions costs to the second generation of negotiating about the creation of their own law.

As demonstrated below, there is, in fact, an equilibrium in which the law is sold from one generation to the next, no generation wishes to abrogate the law, and, if the law is destroyed by chance, it will be immediately reconstituted. The result is that the second-best optimum with lower capital taxes and more saving can be enforced.

In contrast to the analyses of Lucas and Stokey (1983) and Persson, Persson, and Svensson (1986) in which potential capital losses on government financial assets deter deviations from ex ante policy, the assets in this paper are agreements which may or may not be written down as explicit laws. Thus, in our example, no physical law or certificate is required, simply an understanding that the quid pro quo for the old to maintain the tradition (institution) of no capital taxation is for the young to contribute the appropriate share to pay for the public good of the old. Probably the paper's closest antecedent is Eaton's (1985) analysis of banks' repayment enforcement. In Eaton's paper failure of banks to pursue defaulters leads to a reduction in their stock values.

The paper examines the sale of laws using a simple linear two period model that yields analytical expressions for second and third-best tax structures. The linear model is attractive because excess burdens are additive; indirect utility in distorted regimes differs from the first best level of utility by the sum of excess burdens. Section 2 presents the model, while section 3 presents the unobtainable first-best optimum, the unenforceable second best optimum, and the time-consistent third-best optimum. Section 4 demonstrates how a saleable law comes into existence and how such a law can enforce the second best. These points are illustrated with a numerical example. Section 5 discusses extensions and broader implications of our results.

2. The Model

The model is a lifecycle overlapping generations model with production and investment. There is one good, and labor. Production is linear, and output of goods in period t, Y_t, depends on the input of capital in period t-1, K_{t-1}, and labor in period t, L_t, according to

$$Y_t = RK_{t-1} + wL_t, \quad R > 1 \text{ and } w > 0. \tag{2.1}$$

The gross rate of return to capital, R, is constant, as is the average and marginal product of labor, w. Capital depreciates completely in one period, so the net rate of return to capital, the real interest rate, is constant, equal to R-1 and positive. The competitive (before-tax) wage rate equals w.

A new generation of identical consumers is born in each period. Each consumer lives for two periods, labelled 1 and 2. A young consumer has preferences described by the linear utility function

$$u(c,\ell,d,m) = D(c - \lambda\ell) + d - \mu m, \quad \lambda > 0,\ \mu > 0 \text{ and } D > 0, \tag{2.2a}$$

where c and d are consumption when young and old, ℓ and m are labor supply when young and old, λ and μ are the constant marginal rates of substitution between leisure and consumption when young and old, and D is the gross rate of time preference (equal to one plus the rate of time preference). Utility is normalized so that the marginal utility of consumption in period 2 is unity. The feasible set of consumption and labor supply is given by

$$0 \le \underline{c} \le c,\ 0 < \underline{\ell} \le \ell \le \bar{\ell},\ 0 \le \underline{d} \le d, \text{ and } 0 < \underline{m} \le m \le \bar{m}. \tag{2.2b}$$

That is, there are nonnegative lower limits $\underline{c}$ and $\underline{d}$ on consumption when young and old, and positive upper and lower limits on labor supply when young and old.

There are taxes on labor in periods 1 and 2 and on savings. A young consumer faces budget constraints

(2.3a) $c + s = (w - \tau)\ell$, $s \geq 0$, and

(2.3b) $d = (R - \theta)s + (w - \sigma)m$,

where s is savings, and τ, σ and θ are absolute taxes on labor when young, labor when old, and savings. By assumption borrowing is not allowed.[1] Therefore savings is restricted to be nonnegative.

Given the linear utility function, it is easy to derive saving and labor decisions. Maximizing the utility function subject to the fesibility set and the budget constraints gives

$$(2.4) \qquad s = \begin{cases} (w-\tau)\ell - \underline{c} & \text{for } R-\theta \geq D \text{ and} \\ 0 & \text{for } R-\theta < D \,, \end{cases}$$

$$(2.5) \qquad \ell = \begin{cases} \bar{\ell} & \text{for } (w-\tau)\max(\frac{R-\theta}{D}, 1) \geq \lambda \text{ and} \\ \underline{\ell} & \text{for } (w-\tau)\max(\frac{R-\theta}{D}, 1) < \lambda \,, \end{cases}$$

$$(2.6) \qquad m = \begin{cases} \bar{m} & \text{for } w-\sigma \geq \mu \text{ and} \\ \underline{m} & \text{for } w-\sigma < \mu \,. \end{cases}$$

What matters for the saving decision is only the relation between the after-tax rate of return, $R-\theta-1$, and the rate of time preference, $D-1$. When the after-tax rate of return is larger than the rate of time preference, the consumer consumes the minimum amount $\underline{c}$ when young and saves the maximum amount. The maximum saving is the difference between his after-tax wage $(w-\tau)\ell$, which depends on the labor supply when young according to (2.5), and the minimum consumption. When the after-tax rate of return falls short of the rate of time preference, saving is equal to its minimum, which is zero since

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1 Borrowing could be allowed, without affecting the qualitative results.

we assume no borrowing. When the after-tax return equals the rate of time preference, saving is indeterminate. In this case we assume that the consumer saves the maximum amount.

Similarly, what matters for the labor supplies is only the relation between the after-tax wage rate and the rate of substitution between consumption and leisure. With regard to labor supply in the first period, (2.5), one has to take into account that there are two marginal rates of substitution to consider. When $R-\theta > D$, consumption in the first period is constant and at its minimum. Then the relevant marginal rate of substitution is between leisure in the first period and consumption in the second period, $D\lambda$, and the relevant after-tax wage rate is $(R-\theta)(w-\tau)$, measured in second period goods. If instead $R-\theta < D$, saving is zero and consumption in the first period equals after-tax income in the first period. Then the relevant marginal rate of substitution is λ, and the relevant after-tax wage rate is $w-\tau$. This combined gives (2.5). If the after-tax wage rate is greater than the marginal rate of substitution, the best thing is to work the maximum hours. If the after-tax wage rate is smaller than the rate of substitution, the best thing is to work the minimum hours. If the after-tax wage rate is equal to the rate of substitution, the consumer is indifferent between working as much as possible, and as little as possible, or anything in between. We assume in this case that he works the maximum hours.[2]

We also assume that the wage rate is larger than the rates of

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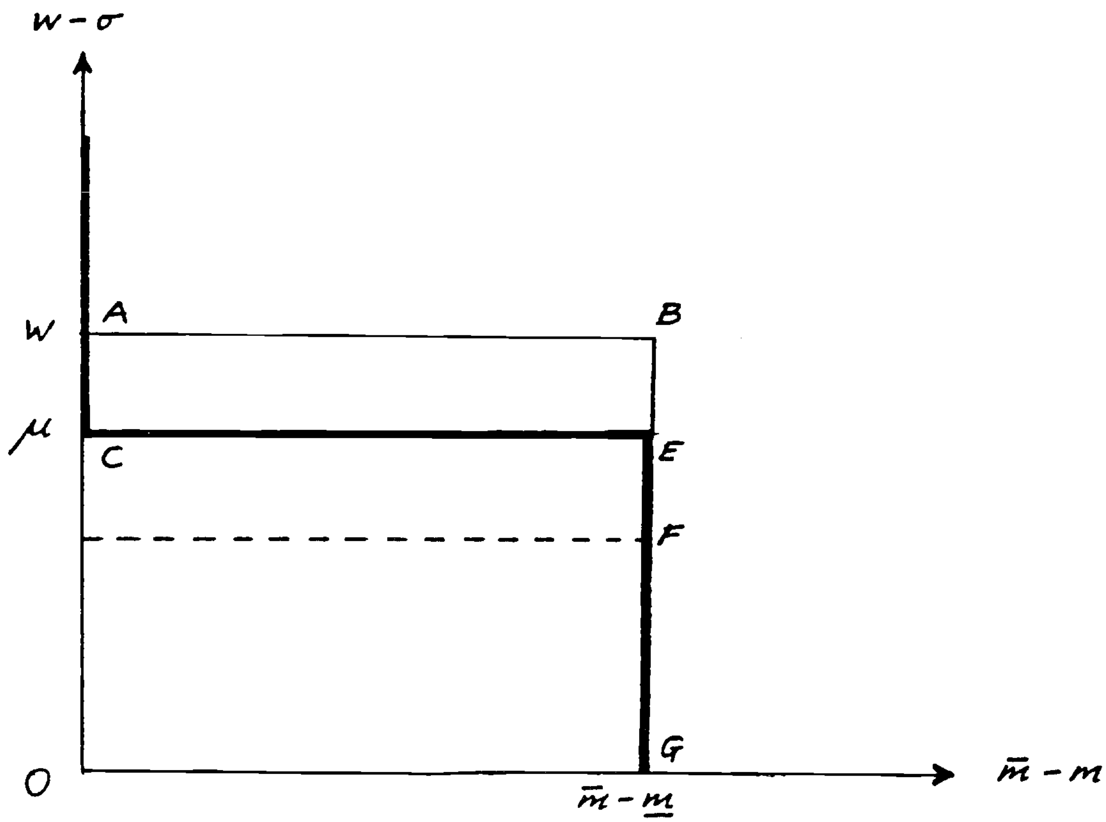
2 With regard to second period labor supply in (2.6), $w-\sigma$ and μ is the relevant after tax wage rate and marginal rate of substitution, both when $R-\theta > D$ and when $R-\theta < D$, since in the latter case saving is zero and second period consumption is not necessarily at its minimum.

Figure 1



substitution between leisure and consumption and that the return to capital is larger than the rate of time preference:

(2.7) $w > \lambda$, $w > \mu$, and $R > D$.

In the absence of taxes the consumer would work the maximum hours when young and old, and he would save the maximum amount when young.

Figure 1 further illustrates consumer behavior. The bold line shows the compensated (and uncompensated, since they are identical here) demand for leisure when old, $\bar{m}-m$, as a function of the net wage rate, $w-\sigma$. If the net wage rate is larger than the rate of substitution between consumption and leisure, μ, the consumer works the maximum hours, $\bar{m}$, and leisure is zero. If the net wage rate is smaller than μ, the consumer works the minimum hours, $\underline{m}$, and leisure is at its maximum, $\bar{m}-\underline{m}$. The before-tax wage rate w is larger than μ by assumption, and, in the absence of a tax on labor, the consumer when old would be in equilibrium at point A in the diagram. For sufficiently high taxes on labor, the net wage would fall below μ, and the consumer would work the minimum hours and be in equilibrium at some point F on the vertical line EG. An equilibrium at the minimum hours is inefficient. The value of the leisure to the consumer is the area of the rectangle OCEG, equal to $\mu(\bar{m}-\underline{m})$. The cost to the society of the leisure is the area of the rectangle OABG, equal to $w(\bar{m}-\underline{m})$. The deadweight loss is the area of the rectangle CABE, equal to $(w-\mu)(\bar{m}-\underline{m})$.

3. The First Best, the Second Best and the Third Best

Below we consider equilibria when generations interact. First, however, we examine equilibria when each generation is economically independent. As mentioned, the representative body of a generation is called the council. In each period, there are two councils, one representating the young and one representing the old. The council of a given generation supplies a fixed amount of public goods, g, to its generation when the generation is old and finances this second period expenditure by taxing its generation in both periods. Before discussing equilibria with distortionary taxation, we describe the first-best optimum that would result if the council had access to lumpsum taxes. Let the council impose a second period lumpsum tax equal to g on the old and set all other taxes equal to zero. Then in the first-best optimum with lumpsum taxation (denoted with a * superscript) labor supply when young, labor supply when old, and saving are at their maxima. Thus

(3.1) $\ell^* = \bar{\ell}$, $m^* = \bar{m}$ and $s^* = w\bar{\ell} - \underline{c}$.

Consumption when young is at the minimum. Consumption when old is equal to savings plus wages when old minus the lumpsum tax. Hence, the utility level for the generation is

(3.2) $u^* = D(\underline{c} - \lambda\bar{\ell}) + Rs^* + w\bar{m} - g - \mu\bar{m}$.

We use this equilibrium as a reference case in discussing equilibria with distortionary taxes.

Let us now assume that the council does not have access to lumpsum taxes. Instead it has the right to tax labor and savings of its generation as well as to borrow or lend. The council faces the budget constraints

(3.3a) $0 = \tau\ell + b$ and

(3.3b) $g + Rb = \theta s + \sigma m$,

where b is the council's borrowing from the young in period 1. The two constraints can be collapsed into one intertemporal budget constraint

(3.4) $g = R\tau\ell + \theta s + \sigma m$.

Consider first the case in which the council can commit itself in period 1 to given taxes in period 2. As suggested by the discussion of Figure 1, for sufficiently low taxes there is no distortion of the labor and saving decisions. We assume that the maximum nondistortionary taxes on labor and savings fall short of the required public expenditure:

(3.5) $$g > R(w-\lambda)\bar{\ell} + (w-\mu)\bar{m} + (R-D)\bar{s}.$$

The maximum nondistortionary absolute taxes are $\tau = w-\lambda$ and $\sigma = w-\mu$ on labor in period 1 and 2, and $\theta = R-D$ on savings, and the maximum amount of savings, s, when the consumer faces the maximum nondistortionary tax on labor in period 1, $\bar{s}$, is

(3.6) $$\bar{s} = \lambda\bar{\ell} - \underline{c}.$$

Without (3.5) the optimum taxation problem would be trivial. With (3.5), the council is forced to increase one or several taxes above their maximum nondistortionary levels. If the tax on labor supply in period 2 is increased, labor supply drops to its minimum, causing a deadweight loss equal to $(w-\mu)(\bar{m}-\underline{m})$. If the tax on savings is increased, saving drops to zero, causing a deadweight loss equal to $(R-D)\bar{s}$. If the tax on labor in period 1 is increased, first period labor supply drops to its minimum, causing a deadweight loss of $D(w-\lambda)(\bar{\ell}-\underline{\ell})$.[3] We now assume that the deadweight loss from distorting period 2 labor is smaller than the other distortions:

(3.7) $$(w-\mu)(\bar{m}-\underline{m}) < \min[D(w-\lambda)(\bar{\ell}-\underline{\ell}),(R-D)\bar{s}].$$

This means that the council prefers to increase taxes on labor in period 2, rather than to increase taxes on savings or period 1 labor. We next assume

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3 Notice that D multiplies the expression $(w-\lambda)(\bar{\ell}-\underline{\ell})$. This is because utility is normalized so the marginal utility of consumption when old is unity.

that increasing taxes on period 2 labor above the distortionary level provides enough revenue to finance public expenditure :

(3.8a) $\quad g < R(w-\lambda)\bar{\ell} + w\underline{m} + (R-D)\bar{s}.$

We later assume that distortionary taxation of labor in period 2 raises enough revenue to pay for g in the case when no saving is forthcoming; hence

(3.8b) $\quad g < R(w-\lambda)\bar{\ell} + w\underline{m}.$

Given these assumptions, labor supplies and saving in the second-best optimum under commitment are

(3.9) $\quad \ell = \bar{\ell},\ m = \underline{m},$ and $s = \bar{s}.$

The tax rates (denoted by an overbar) are

(3.10) $\quad \bar{\tau} = w-\lambda,\ \bar{\theta} = R-D,$ and $\bar{\sigma} = (g - R\bar{\tau}\bar{\ell} - \bar{\theta}\bar{s})/\underline{m}.$

The only distortion is that labor in period 2 has dropped to its minimum. Consequently, the utility level for the generation is

(3.11) $\quad \bar{u} = u* - (w-\mu)(\bar{m}-\underline{m}).$

It falls short of the first-best utility level by the deadweight loss from distorting labor supply in period 2.

The second-best optimum under commitment is unenforceable. There is nothing in the model that enforces the commitments to particular taxes in period 2. Indeed, since capital is predetermined in period 2, the council in period 2 has an incentive to deviate from the preannounced policy and levy a non-distortionary tax on capital if it can thereby avoid a distortionary tax on second period labor. Such will be the case if, as we assume, the savings tax base, $R\bar{s}$, is sufficiently large to make it possible to lower labor taxes in period 2 to the nondistortionary level; that is,

(3.12) $\quad g < R(w-\lambda)\bar{\ell} + (w-\mu)\bar{m} + R\bar{s}.$

If (3.12) holds and capital equals $\bar{s}$, the council in period 2 would optimally set the tax on savings equal to

$$(3.13) \qquad \hat{\theta} = [g - R(w-\lambda)\bar{\ell} - (w-\mu)\bar{m}]/R\bar{s}.$$

By (3.5) it follows that $\hat{\theta}$ is large enough to reduce the net rate of return below the rate of time preference:

$$(3.14) \qquad R-\hat{\theta} < D.$$

Equation (3.14) implies that a young consumer anticipating the council's behavior would not save (see (2.6)). The reduction of saving from $\bar{s}$ to zero produces a deadweight loss equal to $(R-D)\bar{s}$, and erodes the tax base in period 2. The council is left with no choice but to levy a tax on labor in period 2 above the distortionary level.

It follows that the third-best optimum without precommitment will have the following taxes (denoted by a "^")

$$(3.15) \qquad \hat{\tau} = w-\lambda = \bar{\tau} \text{ and } \hat{\sigma} = (g - R\bar{\tau}\bar{\ell})/\underline{m} > \bar{\sigma},$$

in addition to the tax $\hat{\theta}$ on savings. Note that our assumption (3.8b) ensures that there exists a tax on labor in period 2 which fulfulls (3.15). The labor and saving decisions yield

$$(3.16) \qquad \ell = \bar{\ell},\ m = \underline{m} \text{ and } s = \underline{s} = 0.$$

The utility level is

$$(3.17) \qquad \hat{u} = \bar{u} - (R-D)\bar{s} = u* - (w-\mu)(\bar{m}-\underline{m}) - (R-D)\bar{s}.$$

Compared to the unenforceable second-best optimum, the third-best optimum has an additional deadweight loss, namely the saving distortion.

4. Enforcing the Second-Best Optimum through the Sale of a Law

We now propose a mechanism that enforces the second-best optimum, namely the sale of a law (or an agreement or an institution). The law has the following two clauses:

(L.§1) This clause exempts the old from capital taxation (either explicit or implicit) above the prespecified level $\theta = R-D$.

(L.§2) This clause mandates that the young contribute a specified sum Q to help finance the public good consumed by the old.

We assume that each young generation can set up a law like (L.§1-2) at a transactions cost T. Notice that <u>if</u> the law is obeyed by the (councils of) succeeding generations, each young generation effectively purchases the law from the coexisting old generation.

We now show that there exists an equilibrium with the properties that, starting from a lawless society, a law is set up by an initial generation and, that once set up, it is obeyed by all subsequent generations. Furthermore, every council acts individually, rationally, and expectations are never falsified. In the language of game theory, the equilibrium is subgame perfect.

The intergenerational game has sequential moves in each period. The young decide whether to purchase the existing law after the old have decided on the tax structure. We could think of the councils of the young and the old forming a joint government and bargaining about the price of the law, that is about Q. We do not study the details of this bargaining process, but since we are dealing with a stationary environment it seems reasonable to treat Q as a constant. Our results below will give the possible range for the price of the law, however.

Assume now that all generations (councils) follow an identical strategy, namely

(S.1) When young, set up a new law of the form (L.§1-2)

(a) if a law does not exist, or

(b) if the existing law has ever been broken.

(S.2) When young, obey the existing law, that is buy it for Q, if it has never been broken.

(S.3) When old, obey the law.

In the subsequent discussion we derive conditions which guarantee that no generation has an incentive to deviate unilaterally from the strategy (S.1) - (S.3). This is exactly what is required in a subgame perfect equilibrium.

To understand how the law comes into being, suppose the economy is initially lawless and consider the economic incentives to establish the law. The first generation of young to devise the law has the special advantage of not having to purchase the law. On the other hand, it has to bear the transactions cost of establishing the law. The budget constraints confronting the council of the first generation of young to set up the law are

(4.1a) $\quad 0 = \tau\ell + b$ and

(4.1b) $\quad g - Q + Rb = \theta s + \sigma m$,

where including Q in (4.1b) assumes that the second generation follows (S2). The budget constraints of each member of the first generation are given in (2.3). The transactions cost is T utils, incurred when young, but measured in second period utility. We assume that the transactions cost for establishing a new law is the same for all generations irrespective of whether a law has existed or not.

The first generation levies respective nondistortionary taxes (denoted by f, for first instituting the law) of θ^f on savings and τ^f on first period labor supply, where

(4.2) $\quad \theta^f = R-D = \bar{\theta}$ and $\tau^f = w-\lambda = \bar{\tau}$.

The corresponding tax on labor in period 2, σ^f, is distortionary and is given by

(4.3) $\quad \sigma^f = (g - Q - R\bar{\tau}\bar{\ell} - \bar{\theta}\bar{s})/\underline{m} < \bar{\sigma}$.[4]

The labor and saving decisions resulting from this choice of taxes are

(4.4) $\quad \ell = \bar{\ell}$, $m = \underline{m}$, and $s = \bar{s}$,

and the utility level of the first generation is thus

(4.5) $\quad u^f = \bar{u} + Q - T$.

Note that this utility level is just the second best level of utility less the transactions cost plus the value Q obtained from selling the law to the second generation.

The first generation of young will institute the law -- that is, follow (S.1a) -- if instituting the law increases their utility above the third best optimum, that is, if:

(4.6a) $\quad u^f \geq \hat{u}$,

According to (3.15), (4.6a) requires

(4.6b) $\quad Q + (R-D)\bar{s} \geq T$.

Condition (4.6) states that the gain from the sale of the law plus the reduction in the saving distortion from achieving a second best tax structure must exceed the transactions cost of establishing the law.

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4 This applies if $\sigma^f > w-\mu$, in which case the second period labor distortion remains. If $\sigma^f < w-\mu$, the distortion is eliminated and the first generation is even better off.

We must also show that once the first generation is old it does not have an incentive to break the law -- that is, to deviate from (S.3). If this generation obeys the law when it is old, its utility when old is

(4.7) $\quad v^f = \bar{v} + Q,$

where $\bar{v}$ is the period 2 utility in the unenforcable second-best optimum Thus the gain in old age utility from obeying the law relative to the unenforceable second best is Q, the receipt from the sale of the law. If the first generation breaks the law in their second period it will impose the following taxes

(4.8) $\quad \tilde{\sigma} = w-\mu$ and $\tilde{\theta}^f = [g - R(w-\lambda)\bar{\ell} - (w-\mu)\bar{m}]/R\bar{s} = \hat{\theta}.$

Second period utility in this case, $\tilde{v}^f$, is $\bar{v}$ plus the elimination of the second period labor distortion, $(w-\mu)(\bar{m}-\underline{m})$

(4.9) $\quad \tilde{v}^f = \bar{v} + (w-\mu)(\bar{m}-\underline{m}).$

The necessary condition for the first generation to obey the law in period 2 is

(4.10a) $\quad v^f \geq \tilde{v}^f,$

which implies

(4.10b) $\quad Q \geq (w-\mu)(\bar{m}-\underline{m}).$

When faced with the law set up by the first generation, the second generation, according to (S.2), buys the law from the first generation. For this to hold the second generation must prefer purchasing the existing law to (1) not purchasing the existing law and establishing their own law and to (2) pursuing the third best optimum. If the second generation's council purchases the existing law and is able to resell the law, its council faces the following budget constraints

(4.11a) $Q = \tau\ell + b$ and

(4.11b) $g - Q + Rb = \theta s + \sigma m$,

which together imply

(4.12) $g + (R-1)Q = R\tau\ell + \theta s + \sigma m$.

Equation (4.12) points out that the second generation's council effectively rents the law for the amount (R-1)Q since it purchases the law when young and resells it when old. Given (4.12) the optimal tax rates are the nondistortionary taxes on first period labor supply and saving, $\bar{\tau}$ and $\bar{\theta}$, and the distortionary tax σ^c (the c superscript denotes continuing to obey the law) on second period labor supply, determined by

(4.13a) $\sigma^c = [g + (R-1)Q - R\bar{\tau}\bar{\ell} - \bar{\theta}\bar{s}]/\underline{m} > \bar{\sigma}$.

Since the second generation achieves the unenforceable second best optimum except that it has to rent the law, its utility u^c is

(4.14) $u^c = \bar{u} - (R-1)Q$.

For the second generation to be willing to purchase the law rather than create its own, u^c must exceed u^f; hence,

(4.15a) $u^c \geq u^f$.

If (4.15a) holds (4.6) insures that u^c exceeds the third best optimum $\hat{u}$.

Conditions (4.5), (4.14), and (4.15a) imply

(4.15b) $T \geq RQ$.

In words, (4.15b) requires that the cost of creating a new law exceeds the gain from not having to purchase the old law.

The second generation must also prefer to obey the law when they are old; that is, prefer not to deviate from (S.3). Consequently, v^c, the second generation's utility when old if it purchases the law must exceed $\tilde{v}^c$, the utility when old if it reneges and levies a tax on capital. Compared to the unenforceable second best, the consumption of the second generation in period 2 if it obeys the law is smaller by the amount of rent on the law. Hence,

$$v^c = \bar{v} - (R-1)Q. \tag{4.16}$$

If the second generation breaks the law it foregoes the contribution Q from the third generation and imposes taxes according to

$$\tilde{\sigma}^c = w-\mu \text{ and } \tilde{\theta}^c = [g + RQ - R(w-\lambda)\bar{\ell} + (w-\mu)\bar{m}]/R\bar{s} > \hat{\theta}. \tag{4.17}$$

Each member of the second generation will respond to these second period taxes by working full time, and their second period utility will be

$$\tilde{v}^c = \bar{v} - RQ + (w-\mu)(\bar{m}-\underline{m}). \tag{4.18}$$

The condition for preferring to obey the law is

$$v^c \geq \tilde{v}^c, \tag{4.19a}$$

or

$$Q \geq (w-\mu)(\bar{m}-\underline{m}), \tag{4.19b}$$

which is identical to (4.10).

Finally, we have to verify that the second generation would not deviate from (S.1) if the first generation in fact did not set up a law when young or broke the law when old. Faced with no existing law, the second generation would have the same problem as the first. Consequently, if condition (4.6) holds, (S.1a) is optimal. Faced with a broken law, the second generation could contemplate deviating from (S.1b) either by pursuing the third best optimum, or by purchasing the law even though it had been broken. If (4.6) holds, setting up a new law is better than the third best. In contrast, purchasing the broken law would be worse than the third best because, according to (S.1b), the law could not be resold to the third generation leaving the second generation with third best utility $\hat{u}$ less RQ. The above argument shows that the threat of punishment facing the first generation is not empty. If the first generation breaks the law when old, it is indeed optimal for the second generation to carry out the punishment inherent in (S.1b).

An alternative justification for (S.1b) that does not require invoking punishment behavior, albeit selfish punishment behavior, by future generations is simply to view transactions costs in the following way. Since the old and young generations have formed a government, a decision of the old to break the law would impose transactions costs on the young who will have to participate in negotiations about the capital levy. Once the young see that they will have to bear the transactions cost of redrafting the existing law, they will decide they are better off setting up their own law. Thus transactions costs may be such that once a law/institution is broken, it is in effect destroyed and cannot be subsequently sold. In this case strategy (S.1b) follows automatically since it is impossible to purchase a law/institution that no longer exists.

In summary, we have found that deviations from (S.1), (S.2), and (S.3) by the first and second generations are indeed ruled out by conditions (4.6), (4.10), and (4.15). Because the third and subsequent generations are in the same situation as the second generation, the conditions (4.6), (4.10) and (4.15) apply to them as well. We have therefore shown that, provided these conditions hold, there is a perfect equilibrium in which the law (L.§1-2) is instituted once and then sold from generation to generation. The conditions to be fulfilled in such an equilibrium can be reexpressed as the following inequalities

$$(4.20) \qquad (w-\mu)(\bar{m}-\underline{m}) < T/R < \frac{R-D}{R-1}\bar{s}$$

$$(4.21) \qquad T - (R-D)\bar{s} < Q < T/R.$$

The transactions cost T must satisfy inequality (4.20). For given T, any Q in the interval (4.21) will do.

To obtain a sense of the potential range of Q satisfying these constraints consider the following parameter values:

$R = 2$, $D = 1.8$, $\bar{s} = 1$, $w = 1$, $\mu = .85$, $\bar{\ell} = \bar{m} = 1$, $\underline{m} = .9$, and $T = .04$.

Since one period is roughly 30 years of real time, setting R equal to 2 is equivalent to assuming an annual real interest rate slightly greater than 2 percent. According to these parameters pretax national income in both the unenforceable and the enforceable second best steady states is 2.9, since the young earn 1, the old earn .9, and capital income is 1. Income in the third best steady state is only 1.9 reflecting the loss of capital income. The labor supply distortion in the second period is .015, or slightly more than one half percent of total second best income. According to (4.20) T must exceed .03, which is slightly more than one percent of second best income. This value of T may seem large, especially if one considers that income in this model corresponds roughly to income over a thirty year period. However, the costs of setting up complex institutions have, at times, been very substantial, including, in the extreme, costly wars to settle disputes. If T is assumed to equal .04, then Q must lie between .02 and .015.

A sale of laws equilibrium may also be supported without transactions costs. Suppose that there are no transactions cost and that each generation adopts the following strategy

(S.4) When young

(a) set up a new law if a law has never existed

(b) obey the law if it exists and has never been broken, that is buy it for Q

(S.5) When young, pursue the 3rd best policy if the law has ever been broken (that is, if (S.4b) or (S.6) has ever been violated).

(S.6) When old obey the law if it exists.

It is straightforward to verify that this strategy supports a subgame perfect sale of law equilibrium, provided that Q lies in the interval given by

(4.22) $$(w-\mu)(\bar{m}-\underline{m}) < Q < \frac{R-D}{R-1}\bar{s}.$$

The strategy (S.4) - (S-6) is in the nature of a Friedman (1971) "trigger strategy", in that a deviating generation is punished by the succeding generations reverting to the "stage-game equilibrium".[5] By (S.1b) there is something of a trigger strategy element also in our equilibrium with transaction costs. In the equilibrium with transactions costs, however, a deviating generation is not punished by the succeeding generation reverting to the "stage-game equilibrium", which here is the third best. Instead it is punished by the suceeding generation setting up a law of its own, which is the second best and Pareto optimal equilibrium given that lumpsum taxes are infeasible.

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5 Trigger strategies abound in the literature that uses reputation to enforce ex ante optimal policies. Despite the formal similarities, there are conceptual differences between the arguments. In the reputation argument the disincentive to deviate is the threat of future policy failures. Here the disincentive to deviate is instead the threat of an immediate capital loss on the policy maker's asset.

5. Extensions, Broader Implications, and Conclusion

One obvious question to raise at this stage is whether the sale of laws can enforce time consistent taxation in other optimizing models. Among neoclassical intertemporal models Barro's (1974) altruistic, infinite horizon model is the principal alternative to the life cycle model, so it may be useful to consider the sale of laws in that model. As is well known, the main distinction between the two models is that in contrast to the life cycle model, intergenerational redistribution per se in Barro's model is of no economic consequence. Hence, current old generations will not care about the price at which they sell laws to the next generation since they know that changes in that price simply redistribute between themselves and their children. It appears then that the sale of laws cannot enforce time consistent taxation in the Barro model.

A second question about extensions of our model is whether it covers other types of taxes. The answer appears to be yes. There is no reason to preclude the writing of laws or the making of agreements that cover the entire array of feasible direct and indirect taxes on goods and assets. Laws or agreements could also extend to investment incentives, changes in which can lead to capital losses and thus constitute covert government asset taxation (see, for example, Auerbach and Kotlikoff, (1987, Chapter 9)).

A third question is whether the sale of laws can enforce time consistency of policies other than fiscal policies in a life cycle model. Again the answer appears to be yes. Monetary policy is a good example. It should also be possible to solve the surprise-inflation problem with a law or agreement or institution determining the rate of money creation. If such a law or agreement or institution is sold to the next generation, the temptation to run a surprise inflation may be outweighed by the potential loss of revenues from the sale of the anti-inflation law or agreement or institution.

The sale of laws could also enforce Pareto improving intergenerational transfers, such as unfunded social security, when the economy is beyond the Golden Rule level of capital accumulation. The enforcement problem here, of course, is that each young generation might choose to renege on the existing system and instead set up its own intergenerational transfer program. The same type of enforcement problem arises in Samuelson's (1958) consumption loan model; in that model each young generation, in the absence of an enforcement mechanism, would choose to issue its own money rather than transfer to the current old by accepting their money.[6]

While our model assumes that only the old consume the public good, it appears to generalize to include joint consumption of the public good by young and old. Payment from the young to the old may also occur under the guise of contributions to finance unfunded social security benefit payments or, more generally, by the young adopting debts of the old.[7]

Finally, the notion of selling agreements to enforce time consistency may have wider applications. Take as an example seniority based wage scales in unionized firms. In establishing unions initial older union workers may

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6 Engineer (1986) adopts our framework to show how transfer institutions such as money may be enforced in Samuelson's consumption loan model.

7 The intergenerational transfer associated with the sale of laws will also have an independent effect on savings, reducing savings in the sale of laws equilibrium below that in the unenforceable second best. While third best savings in our model is zero, it seems possible that, in a less stylized model, savings in the third best could exceed savings in the sale of laws equilibrium.

institute a steep wage-tenure profile to maximize their own lifetime earnings. Steep wage-tenure profiles can reward those with substantial tenure and avoid sharing sizeable amounts of rents with new union hires who are willing to take less than they can earn elsewhere when young in exchange for higher wages in middle and old age. Time consistency problems may arise in such union contracts. Suppose first, there are young, middle age, and older union members, second, that the union is controlled by the oldest union members, and third, that the only other group capable of reestablishing a union are the middle age workers. If a steep wage tenure profile is established the oldest union members will, at any point in time, have an incentive to renege on their promised pay increases to middle age members and simply hire (or have the firm hire) more lower paid young workers. Breaking their law in this manner may, however, reduce or eliminate their ability to attract new workers. Since the older workers' payments in excess of their marginal product may be financed, in large part, by paying younger workers less than their marginal product, tearing up the union agreement by reneging on pay increases to middle age workers may be too costly. The other group that could break the union agreement is current middle age workers. If they could costlessly toss out current old members and garner the excess wage payments to the oldest members for themselves by setting up a new union they would. However, if the transactions cost of such action exceed the gain a new union will not occur.

To conclude, the sale of laws, agreements, and, more broadly, institutions appears to provide ex post enforcement of behavior preferred ex ante in a range of public and private contexts. These arrangements need not be explicit, and the payment for their purchase may be made in a variety of forms. As a consequence it may prove difficult to refute empirically this subtle resolution of the time consistency problem.

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