ECONOMIC RESEARCH REPORTS

ON THE ECONOMICS OF FISCAL POPULISM IN AN OPEN ECONOMY

BY
Jess Benhabib
and
Andres Velasco

RR # 94-22 **June 1994**

C. V. STARR CENTER FOR APPLIED ECONOMICS

NEW YORK UNIVERSITY
FACULTY OF ARTS AND SCIENCE
DEPARTMENT OF ECONOMICS
WASHINGTON SQUARE
NEW YORK, N.Y. 10003

On the Economics of Fiscal Populism
in an Open Economy

Jess Benhabib*
New York University

and

Andrés Velasco*
New York University

May 1994

* We are grateful to the C.V. Starr Center for Applied Economics at NYU for generous support.

Abstract We study a representative agent economy ruled by a benevolent government, and focus on the determination of the optimal size of government and the optimal associated tax rate in an environment in which the government may lack a precommitment technology. We find that if the government can precommit its future actions, it maximizes the welfare of the representative agent in the economy by announcing and implementing a constant tax rate, which we label the "orthodox tax rate". This tax rate turns out to be time inconsistent. Under discretion the government will implement a tax rate that maximizes that period's output. Because of the emphasis on myopic output maximization, we term this the "populist" tax rate. It may be higher or lower than the precommitment optimum, depending on whether the elasticity between private capital and public services in the production function is above or below one. Hence, fiscal populism can be of the standard left-wing variety (discretionary taxes are higher than under orthodoxy) and also of the right-wing variety (discretionary taxes are lower than under orthodoxy). We also explore whether outcomes better than the populist equilibrium can be sustained through the use of trigger strategies. The precommitment outcome may or may not be supported through government reputation depending on parameter values. When the orthodox tax rate cannot be sustained, the best sustainable trajectory of taxes involves a constant tax rate that lies between the orthodox and populist extremes.

I. Introduction

Over the last two decades, the fiscal policy of both developed and developing countries has become increasingly problematic. The most striking fact is that since 1973 many countries have run unprecedented peacetime deficits and accumulated very high levels of debt.[1] But that is not the only problem. In much of the developing world and arguably also in some developed nations such as the United States, public services have been underprovided --while in others (Scandinavia, Europe?) they may have been overprovided at the cost of high distortionary tax rates. In some extreme cases, the label of "fiscal populism" has been applied to countries that run clearly suboptimal or unsustainable fiscal policies.[2]

A large political economy literature has developed to attempt to explain the apparent irrationality of many such fiscal policies. In one strand, models of weak government or segmented policy-making have been developed to explain high levels of spending and the prevalence of pork-barrel projects.[3] In another strand of the literature, inefficient political equilibria explain the inconsistency of the recent debt accumulation with the neoclassical theory of optimal government debt.[4] In all cases, the focus is on the role of heterogeneous agents and groups and on the redistributive aspect of fiscal policy.

By contrast, in this paper we study a representative agent economy ruled by a benevolent government, and ask whether there can be **economic** reasons for the emergence of suboptimal fiscal policies and fiscal populism. In particular, we focus on the determination of the optimal size of government and the optimal associated tax rate in an environment in which the government may lack

---

[1] See Roubini and Sachs (1989).

[2] The concept is an old one, but it has been brought back into vogue recently by Dornbusch and Edwards (1989) and Sachs (1989) in reference to some high-spending Latin American regimes of the 1970s and 1980s.

[3] See, for instance, Weingast, B., K. Shepsle and C. Johnsen (1981) and, more recently, Chari and Cole (1993a and b).

[4] See the recent survey by Alesina and Perotti (1994). See also Velasco (1993).

a precommitment technology.

For this question to well posed, we need a role for government: to provide public services --infrastructure, law and order, defense, health and education-- which presumably enhance the productivity of privately-owned factors of production. But financing for the provision of these services has to be obtained through distortionary taxes, which hinder the efficient allocation of resources and can also detract from the productivity of privately-owned factors of production.

This tradeoff can be particularly acute in the context of an open economy faced with ample international capital mobility. Good infrastructure, an effective court system and timely garbage collection enhance the marginal product of capital and help attract investment funds from abroad, while high tax rates on capital decisively contribute to keep capital away. Both aspects of the tradeoff currently receive much attention in policy analyses. Bill Clinton was elected President on a platform that promised healthcare and educational reform and a new "information superhighway" as the way to foster capital accumulation in the United States;[5] his Republican opponents countered that the new taxes needed to finance these reforms would keep business investment down. The debate is sharpened even further in capital-scarce developing countries. The government that took power in newly democratic Chile in 1990 charged the outgoing military government with leaving behind a huge "social and infrastructure deficit" and proposed to raise taxes to pay for a large increase in public works and educational spending in order to ensure the country remained attractive to investors; conservative economists argued that such policies would not only fail to ensure sustained growth, but would also lead to a decline in investment and capital flight.[6]

This paper takes a new look, from a positive perspective, at this age-old question. We consider an economy in which government-provided services enter the production function, as in Barro (1990). Private agents can invest at home or abroad, but the government can only tax the factors employed in domestic production. In that context, we ask what is the optimal level of government spending and the associated tax rate, and whether such an optimal policy is implementable as the equilibrium of a dynamic game between the government and the private sector.

We find that if the government can precommit its future actions, it maximizes the welfare of the representative agent in the economy by announcing and implementing a constant tax rate.

[5] See the manifesto Putting People First: How We Can All Change America, 1992.

[6] For a review of this debate and the policies that followed, see Laban and Velasco (1993).

Predictably, this rate --which we label the "orthodox" tax rate-- represents a compromise between the desire to spend more and provide more services and the constraint given by the fact that anticipated taxes on capital distort investment decisions.

Less predictably, the orthodox tax rate turns out to be time inconsistent --if the government cannot precommit and instead reoptimizes every period, it will not implement the announced optimal tax when the time comes to do so. The intuition for this result is simple. When computing the precommitment optimum, the government acts as a Stackelberg leader, taking into account how investors' demand for domestic capital varies with the level of the tax. But once capital is already in place, this constraint is no longer binding. At that point it is optimal for the government to implement the tax which maximizes domestic output for a given capital stock. Because of the emphasis on myopic output maximization, we term this the "populist" tax rate. In a rational expectations equilibrium agents correctly predict that the populist rate will be implemented, and lower their holdings of domestic capital accordingly. Hence, in the spirit of Kydland and Prescott (1977), the populist equilibrium under discretion is welfare inferior to the equilibrium under precommitment.

A striking feature of the model is that under discretion the tax rate on domestic capital may be higher or lower than the precommitment optimum. If the elasticity between private capital and public services in the production function is less than one, once capital has entered the country output is maximized by taxing less than under precommitment and providing a lower level of services. If private capital and public services enter the production function elastically, on the other hand, output is maximized by taxing more than under precommitment and providing more public services. Hence, populism can be of the standard left-wing variety (discretionary taxes are higher than under orthodoxy) and also of the right-wing variety (discretionary taxes are lower than under orthodoxy).

We also explore whether outcomes better than the populist equilibrium can be sustained through the use of trigger strategies. The precommitment outcome may or may not be supported through government reputation depending on parameter values. Interestingly, the subjective rate of discount is not one of these parameters: the existence of a discount factor that is arbitrarily close to one does not ensure that the orthodox outcome can be sustained.

When the orthodox tax rate cannot be sustained, other tax rate paths can indeed be supported in a trigger-strategy equilibrium. In particular, we are able to characterize the best sustainable trajectory of taxes, which involves a constant tax rate that lies between the orthodox and populist extremes.

The paper is organized as follows. Section II presents the basic model. Sections III and IV characterize the cases of precommitment and discretion. Section V analyzes the effects of trigger strategies, while section VI concludes.

II. The Underlying Economy

Consider a small open economy whose representative agent has access to two assets: domestic capital k and an internationally traded bond b, whose exogenous and constant gross rate of return is denoted by R.[7]

The representative agent's budget constraint is

$$b_{t+1}+k_{t+1} = Rb_t+y(k_t,g_t)-c_t \tag{1}$$

where c is consumption and y is domestic output. The domestic technology is such that government has a crucial role to play in the provision of public services. As in Barro (1990), domestic output is produced using domestic capital and government-provided services, denoted by g. Production takes place according to

$$y(k_t,g_t) = [\alpha(1-\tau_t)^{-\rho\gamma}k^{-\rho\gamma}+(1-\alpha)g_t^{-\rho\gamma}]^{-1/\rho}, \qquad -1<\rho \quad \text{and} \quad 0<\gamma<1 \tag{2}$$

where $\epsilon\equiv[1/(1+\rho)]$ is the elasticity of substitution in production between private capital and public services and γ is a returns-to-scale parameter.

[7] In what follows we describe and solve the portfolio problem faced by the representative resident of the small open economy. But notice that the portfolio problem (but not the consumption-savings problem) is identical to that faced by a foreign investor considering buying capital in the home economy. Hence, all of our results below concerning investment and international capital movements apply equally to the decisions of domestic residents and foreign investors.

A key assumption is that only domestic capital is within the reach of the taxman.[8] The government taxes domestic capital at the rate τ and uses the revenue to provide services, so that the period-by-period government budget constraint is

$$g_t = \tau_t\, k_t \tag{3}$$

The sequence of moves is as follows. Agents enter period t with holdings b_t and k_t of foreign and domestic capital carried over from the previous period. At the start of the period, the government taxes domestic capital and provides public services. Production then takes place, combining government services and the capital still in private hands. Finally, individuals consume and allocate their savings between the two assets.

The representative individual maximizes the utility function

$$V_0 = \sum_{t=0}^{\infty} \left(\frac{\sigma}{\sigma-1}\right) c_t^{\frac{\sigma-1}{\sigma}}\, \beta^t, \qquad 0<\beta<1, \quad \sigma>0 \tag{4}$$

She is constrained by (1) and also by

$$\underset{t\to\infty}{limit}\; b_t R^{-t} \geq 0 \tag{5}$$

which is the usual no-Ponzi-game condition. Control variables are c and k. Acting atomistically, the representative individual takes the sequences $\{g_t\}_{t=0}^{\infty}$ and $\{\tau_t\}_{t=0}^{\infty}$ as given. Using (1) the individual's objective function becomes

$$V_0 = \sum_{t=0}^{\infty} \left(\frac{\sigma}{\sigma-1}\right) [Rb_t + y(k_t, g_t) - b_{t+1} - k_{t+1}]^{\frac{\sigma-1}{\sigma}}\, \beta^t, \qquad 0<\beta<1, \quad \sigma>0 \tag{6}$$

First order conditions are

[8] The assumption that holdings of the internationally traded bond are untaxed is most natural in cases where b is negative: if the representative agent is a net debtor vis a vis the rest of the world, her interest payments abroad will naturally not be taxed. But even if b is positive this assumption is realistic: many countries (and especially developing countries) find it impossible to tax the assets domestic residents hold abroad.

$$c_t^{-1/\sigma} = R\beta \ c_{t+1}^{-1/\sigma} \tag{7}$$

and

$$k_t^{\gamma-1}\alpha\gamma\left(\frac{y_t}{k_t^\gamma}\right)^{1+\rho}(1-\tau_t)^{-\rho\gamma} = R \tag{8}$$

where (7) is the Euler equation and (8) the standard requirement that the marginal product of both assets be equalized. Notice from (2) that factoring and using (3) we can write

$$y_t = k_t^\gamma \ [\alpha(1-\tau_t)^{-\rho\gamma}+(1-\alpha)\tau_t^{-\rho\gamma}]^{-1/\rho} \equiv k_t^\gamma \ \phi(\tau_t) \tag{9}$$

where $\phi(\tau)$ is a concave function, with a first derivative that may be positive or negative and a unique maximum at $\hat{\tau}$, where $\hat{\tau}$ is defined by $\phi'(\hat{\tau})=0$. Using (9) in (8) and rearranging we have

$$k_t = \left[R^{-1}\alpha\gamma \ \phi(\tau_t)^{1+\rho}(1-\tau_t)^{-\rho\gamma}\right]^{\frac{1}{1-\gamma}} \equiv k(\tau_t) \tag{10}$$

which expresses desired domestic capital holdings as a function of the expected tax rate and the international rate of interest. As long as both of these parameters are expected to be constant, the stock of capital held at home will be constant as well. Notice, moreover, that using (9) and (10) domestic output can be written as $y(\tau_t)=k(\tau_t)^\gamma \ \phi(\tau_t)$.

Given the marginal product of both assets are equalized, the constant rate of return facing the representative agent is R. Hence, and as indicated by (7), consumption grows at a constant rate, which can be rewritten as

$$\frac{c_{t+1}}{c_t} = (R\beta)^\sigma \tag{11}$$

Hence, consumption growth is positive (negative) if R is larger (smaller) than β^{-1}. In what follows we assume $R\beta>1$, so that positive consumption growth takes place.

Solving (1) forward, imposing solvency condition (5) and using (7) we obtain the following consumption function:

$$c_t = \lambda \left[Rb_t + \sum_{s=t}^{\infty} [y(\tau_s) - k(\tau_{s+1})] R^{-(s-t)}\right] \equiv \lambda \; Rw_t \qquad \textbf{(12)}$$

where $\lambda \equiv 1 - \beta^{\sigma} R^{\sigma-1}$ and were we have also defined wealth as the stock of bonds plus the present value of future net domestic output. Hence, individuals consume a fixed proportion of their anticipated wealth. Updating (12) we can write

$$\frac{c_{t+1}}{c_t} = \frac{w_{t+1}}{w_t} = (\beta R)^{\sigma} \qquad \textbf{(13)}$$

where the second inequality comes from (11). Hence, wealth grows at the same rate as does consumption, and the economy always finds itself on a balanced steady state growth path.

III. **The Government's Problem under Precommitment**

Under precommitment, the government's problem consists of choosing at time 0 the whole sequence of tax rates that will be in force for the infinitely long planning period. Using (12) in (6) we can write individual utility as a function of the tax rates as follows:

$$V(b_0) = \lambda^{-1/\sigma} \left(\frac{\sigma}{\sigma-1}\right) \left[Rb_0 + [k_0^{\gamma} \phi(\tau_0) - k(\tau_1)] + \sum_{t=1}^{\infty} [y(\tau_t) - k(\tau_{t+1})] R^{-t}\right]^{\left(\frac{\sigma-1}{\sigma}\right)} \qquad \textbf{(14)}$$

where b_0 and k_0 are just given by history. The government's first order conditions are

$$\frac{\partial V(b_0)}{\partial \tau_0} = 0 \quad => \quad \lambda^{-1} \, c_0^{-1/\sigma} \, \phi'(\tau_0) = 0 \qquad \textbf{(15)}$$

and

$$\frac{\partial V(b_0)}{\partial \tau_t} = 0 \quad => \quad y'(\tau_t) = Rk'(\tau_t), \quad \forall t > 0 \qquad \textbf{(16)}$$

These conditions have a simple interpretation. During the first period, given that the stock of domestic capital is given by history, it is optimal to maximize output y_0 by maximizing $\phi(\tau_0)$. Recall $\hat{\tau}$ is given by $\phi'(\hat{\tau}) = 0$. It is simple to compute that

$$\hat{\tau} = \frac{1}{1+(\frac{\alpha}{1-\alpha})^{\frac{1}{1+\rho\gamma}}} \tag{17}$$

We will refer to $\hat{\tau}$ as the "output-maximizing" tax rate. Notice that if $\rho=0$, so that the production function becomes Cobb-Douglas, we obtain $\hat{\tau}=1-\alpha$, which is the "productive efficiency" condition in Barro (1990).

In the following periods, given that the supply of domestic capital is endogenous and depends on anticipated tax rates, the government acts as a Stackelberg leader, maximizing utility subject to the individual reaction functions (10) and (11). At the core of the government's problem is a tradeoff between maximizing domestic output and minimizing the distortion caused by the tax on domestic capital.

After some tedious algebra, and using the definitions of ϵ and of the $y(\tau_t)$ and $k(\tau_t)$ functions, (14) becomes

$$\frac{\phi'(\tau_t)}{\phi(\tau_t)} = \left(\frac{\epsilon-1}{\epsilon}\right)\left(\frac{\gamma}{1-\tau_t}\right)\left[\frac{1}{\psi(\tau_t)(\frac{1-\gamma}{\gamma})+\epsilon^{-1}}\right] \tag{18}$$

where $\psi(\tau_t)\equiv\phi(\tau_t)^{\frac{\epsilon-1}{\epsilon}}(1-\alpha)^{-1}\tau_t^{\frac{1-\epsilon}{\epsilon}\gamma}$, so that $1<\psi(\tau_t)$. Notice, for future reference, that since $\gamma<1$, the expression $[\psi(\tau_t)(\frac{1-\gamma}{\gamma})+\epsilon^{-1}]$ is always positive. Let $\tau*$ be the value of τ that solves (16). We will refer to $\tau*$, for reasons that will become evident shortly, as the "orthodox" tax rate. That is the tax rate that is chosen from period 1 onwards. Hence, we have

<u>Result 1</u>: The solution to the government's problem under precommitment is: during the initial period choose the output-maximizing tax rate $\hat{\tau}$; after the initial period and forever choose a constant tax rate given by $\tau*$.

If the government implements this optimal program, individual utility is given by

$$V^{p}(b_0) = \lambda^{-1/\sigma}\left(\frac{\sigma}{\sigma-1}\right)\left[Rb_0+[k_0^{\gamma}\phi(\hat{\tau})-k(\tau*)]+(\frac{1}{R-1})[y(\tau*)-k(\tau*)]\right]^{\left(\frac{\sigma-1}{\sigma}\right)} \tag{19}$$

where the superscript "p" stands for precommitment. Notice that this is below the first best level of utility that could be attained by a benevolent central planner who could dictate to private individuals their domestic investment decisions. The inefficiency arises because of the fiscal externality. Since atomistic agents take the provision of public services as given, they do not internalize the effects of public spending on aggregate productivity. Under distortionary capital taxation, that leads them to hold too little domestic capital, and have levels of domestic output and investment that are inefficiently low.

IV. **The Government's Problem under Discretion**

In this case the government's problem is the same as before, except that it is free to reoptimize at every point in time. At time 0, the solutions to problems with and without precommitment coincides: the government maximizes (12) with respect to τ_0, which leads to first order condition (13) and to the result that $\tau_0=\hat{\tau}$. The solutions diverge starting in period (1). Then the government maximizes

$$V(b_1) = \lambda^{-1/\sigma}\left(\frac{\sigma}{\sigma-1}\right)\left[Rb_1+[k_1^{\gamma}\phi(\tau_1)-k(\tau_2)]+\sum_{t=2}^{\infty}[y(\tau_t)-k(\tau_{t+1})]R^{-t}\right]^{\left(\frac{\sigma-1}{\sigma}\right)} \tag{20}$$

with respect to τ_1. Since, from the perspective of period 1, k_1 is given, it is optimal once again to set $\phi'(\tau_1)=0$ and therefore $\tau_1=\hat{\tau}$. Because the supply of domestic capital in period 1 has already been decided upon, the public can no longer react to that period's tax rate. Hence, it is optimal for the government to set τ_1 to maximize period one output. It is easy to see that the same will occur from the vantage point of period 2 and from every successive period.[9] We conclude that the optimal tax path described in Proposition 1 is time inconsistent. Every time it reoptimizes the government will choose the output-maximizing rate, so that $\tau_t=\hat{\tau}\ \forall\ t$. Therefore,

<u>Result 2</u>: **The optimal tax rate under discretion is constant and given by $\hat{\tau}$. Understanding this, the public sets $k_t=k(\hat{\tau})\ \forall\ t>0$. Hence, the discretionary equilibrium is characterized by an expected and actual tax rate equal to $\hat{\tau}$ for all periods.**

What are the consequences of discretion? If it is free always to reoptimize the government falls prey to the temptation of "populism": by attempting to maximize output at every point in time and attain the first best, the government reduces the ex-post marginal private return to domestic investment. Agents with rational expectations understand this, and reduce their holdings of domestic capital. Hence, tax policy induces the "wrong" allocation between foreign and domestic capital.

What is the effect of discretion on the actual level of the tax rate implemented by the government? In most models equilibrium tax rates under discretion are higher than the tax rates that would be chosen under precommitment. Hence, the time inconsistency story is often mentioned as a reason why taxes in the real world may be inefficiently high.[10] That is not necessarily the case in the model of this paper: discretion may lead to tax rates that are inefficiently high or inefficiently low.

To see this recall the tax rate that prevails under orthodoxy is the one that solves (18). Figure 1 plots the function $\phi(\tau)$. By definition of $\hat{\tau}$, this function has a maximum at $\hat{\tau}$. Equation (18) requires that if $\epsilon<1$ then $\phi'(\tau)<0$, and viceversa. Inspection of Figure 1 immediately reveals that Hence, if the elasticity of substitution is smaller (larger) than unity the populist tax rate is below

[9] This intuition is identical to that found in the classic papers by Kydland and Prescott (1977), Calvo (1979) and Fischer (1980).

[10] That result is particularly striking in the literature on the taxation of money balances: Calvo (1978) and Obstfeld (1989). Under precommitment, a government bent on maximizing revenue from inflation typically chooses a finite and constant rate; under discretion, on the other hand, the rate of inflation is typically infinite.

$$
\begin{array}{lllll}
\text{If } \epsilon<1 & \text{and therefore} & \phi'(\tau*)<0 & \text{then} & \hat{\tau}<\tau* \\
\text{If } \epsilon=1 & \text{and therefore} & \phi'(\tau*)=0 & \text{then} & \hat{\tau}=\tau* \\
\text{If } \epsilon>1 & \text{and therefore} & \phi'(\tau*)>0 & \text{then} & \hat{\tau}>\tau*
\end{array}
\qquad (21)
$$

(above) the orthodox tax rate; the two tax rates coincide whenever the elasticity is one (the Cobb-Douglas case).[11] [12] We therefore have

<u>Result 3</u>: Depending on the elasticity of substitution in production between private and public inputs, populism can be of the right-wing or the left-wing variety. Right-wing populism occurs when the elasticity of substitution is smaller than one, so that the tax rate under discretion is below the orthodox rate. Left-wing populism occurs when the elasticity of substitution is above one, so that the tax rate under discretion is above the orthodox rate.

The economics behind this result is straightforward. The expected private after-tax marginal return to domestic capital depends on the tax rate and the volume of government-provided services. Under precommitment, the government takes into account the investor's reaction to anticipated tax rates in deciding upon an announced tax rate. But once capital is in place, one of two things can happen. If private capital and public services enter the production function inelastically $(\epsilon<1)$, output is maximized by taxing less than under precommitment and providing less services. That means that if investors had anticipated the orthodox tax rate, they will be confronted with a populist tax rate that is below what they had expected. If private capital and public services enter the production function elastically $(\epsilon>1)$, on the other hand, output is maximized by taxing more than under precommitment and providing more public services. That means that if investors had anticipated the orthodox tax rate, they will be confronted with a populist tax rate that is unexpectedly high. In both cases, however, the after-tax private return to domestic capital will be below the world rate of interest, leading investors to feel "cheated."

The model can therefore encompass a variety of real-life experiences. It is tempting to

---

[11] That is the case considered by Barro (1990).

[12] For a set of related results, see Leonard (1994).

associate the right-wing populist alternatives with governments that arguably maximized short term capital inflows and output at the expense of an appropriate supply of government services (the United States under Reagan? Chile under Pinochet?) and left-wing populism with the opposite and also common phenomenon (Scandinavian social democracy? Chile under Allende? Perhaps the United States under Clinton?).

What are the welfare implications of populism? In the discretionary equilibrium individual utility is

$$V^{np}(b_0) = \lambda^{-1/\sigma}\left(\frac{\sigma}{\sigma-1}\right)\left[Rb_0+[k_0^{\gamma}\phi(\hat{\tau})-k(\hat{\tau})]+(\frac{1}{R-1})[y(\hat{\tau})-k(\hat{\tau})]\right]^{\left(\frac{\sigma-1}{\sigma}\right)} \tag{22}$$

where the superscript "np" stands for no precommitment. Contrast this with (19), which gives individual utility along the precommitment equilibrium. It is easy to check that $v^{p}(b_0)>V^{np}(b_0)$. Hence, discretion --and its offspring populism, whether of the right-wing or left-wing variety-- are bad for individual welfare.

V. **Doing Better through Reputation**

Can governments ever escape the populist curse? One possibility is the building of reputation --or in the language of game theory, the utilization by agents in the private sector of history-dependent strategies.[13] Consider the case in which the government hopes to sustain through reputation the optimal tax rate under precommitment, $\tau*$. Suppose, moreover, that the public forms expectations according to the following rule:

$$\begin{aligned} &\tau^{e}_{t+1}=\tau* \quad \text{if} \quad \tau_s=\tau*, \quad 1\le s\le t \\ &\tau^{e}_{t+1}=\hat{\tau} \quad \text{otherwise} \end{aligned} \tag{23}$$

where the superscript "e" denotes an expectation. Notice that, given that under both discretion and commitment $\tau_0=\hat{\tau}$, rule (23) does not include the tax rate implemented in period $t=0$.

[13] For the use of such strategies in the context of a related optimal-tax problem, see Chari and Kehoe (1988).

If the government always sets $\tau_t = \tau * \ \forall\ t > 0$, individual welfare starting at any period $t > 0$ is

$$V^P(b_t) = \lambda^{-1/\sigma} \left(\frac{\sigma}{\sigma-1}\right) \left[Rb_t + [k_t^\gamma \phi(\tau *) - k(\tau *)] + (\frac{1}{R-1})[y(\tau *) - k(\tau *)]\right]^{\left(\frac{\sigma-1}{\sigma}\right)} \tag{24}$$

If at the end of period $t-1$ agents had expected $\tau_t = \tau *$, (24) specializes to

$$V^P(b_t) = \lambda^{-1/\sigma} \left(\frac{\sigma}{\sigma-1}\right) \left[Rb_t + (\frac{R}{R-1})[y(\tau *) - k(\tau *)]\right]^{\left(\frac{\sigma-1}{\sigma}\right)} \tag{25}$$

What is the value to the government of deviating from this path? Continue assuming at the end of period t-1 agents had expected $\tau_t = \tau *$. If the government deviates at the start of period t, on the other hand, its best action is to set $\tau_t = \hat{\tau}$ and maximize domestic output $y_t = k(\tau *)^\gamma \phi(\hat{\tau}) > y(\tau *)$. Given rule (23), agents will expect that $\tau_t = \hat{\tau}$ starting the next period and forever. What is the government's best response from t+1 onwards? At any time s such that $s \geq t+1$, the government faces the following problem. Maximize

$$V(b_s) = \lambda^{-1/\sigma} \left(\frac{\sigma}{\sigma-1}\right) \left[Rb_s + [k_s^\gamma \phi(\tau_s) - k(\hat{\tau})] + (\frac{1}{R-1})[y(\hat{\tau}) - k(\hat{\tau})]\right]^{\left(\frac{\sigma-1}{\sigma}\right)} \tag{26}$$

with respect to τ_s, where value function (26) reflects the fact that private agents will expect $\tau = \hat{\tau}$ forever and invest accordingly. For each s such that $s \geq t+1$, the solution to this problem is to set $\tau_s = \hat{\tau}\ \forall\ s \geq t+1$. Therefore, after period t the economy will revert to the stationary discretionary equilibrium, with $\hat{\tau}$ being expected and implemented forever.

During period t, the period of the deviation, forward-looking agents will consume

$$c_t = \lambda \left[Rb_t + [k(\tau *)^\gamma \phi(\hat{\tau}) - k(\hat{\tau})] + (\frac{1}{R-1})[y(\hat{\tau}) - k(\hat{\tau})]\right] \tag{27}$$

Therefore, individual welfare starting the period of the deviation can be written

$$V^d(b_t,\tau*) = \lambda^{-1/\sigma}\left(\frac{\sigma}{\sigma-1}\right)\left[Rb_t+[k(\tau*)^\gamma\phi(\hat{\tau})-k(\hat{\tau})]+(\frac{1}{R-1})[y(\hat{\tau})-k(\hat{\tau})]\right]^{\left(\frac{\sigma-1}{\sigma}\right)} \tag{28}$$

where the superscript "d" stands for deviation and the second argument in the $V^d(.)$ function indicates that the deviation occurs from the tax rate $\tau*$.

The precommitment outcome will be sustainable when $V^p(b_t)\geq V^d(b_t,\tau*)$. Comparing (25) and (28) we see that $V^p(b_t)\geq V^d(b_t)$ if and only if

$$\left(\frac{1}{R-1}\right)[(y(\tau*)-k(\tau*))-(y(\hat{\tau})-k(\hat{\tau}))] \geq [k(\tau*)^\gamma\phi(\hat{\tau})-k(\hat{\tau})]-[y(\tau*)-k(\tau*)] \tag{29}$$

where the RHS is the output gain in period t resulting from the deviation, while the LHS is the present value of the net output loss associated with a return to the discretionary equilibrium starting in period t+1.

Notice that the discount rate, β, does not enter inequality (29). Unlike other reputation-based models, in this model it is not the case that there a discount rate large enough (close enough to one) to ensure that the precommitment outcome is sustainable. The reason is that, given the timing of moves, the current and future output effects of a deviation at time t are already incorporated into consumption at time t. The deviation shifts up or down the whole profile of consumption starting at t, and the shift is only due to the immediate change in the present value of domestic output. Hence, the rate at which utility from consumption in the future is discounted relative to the utility from consumption in the present is irrelevant.

We conclude:

Result 4: The orthodox tax rate and its corresponding equilibrium allocations can be sustained under expectations rule (23) if and only if inequality (29) is satisfied.

Suppose (29) does not hold. What is the best tax rate that can be sustained by reputation?[14] The government's problem in this case is to maximize (14) subject to the incentive compatibility

[14] For an analysis of a similar problem, see Benhabib and Rustichini (1991).

constraint. Rearranging (14) this problem can be expressed as follows. Maximize, with respect to the sequence $\{\tau_t\}_{t=0}^{\infty}$,

$$V(b_0) = \lambda^{-1/\sigma}\left(\frac{\sigma}{\sigma-1}\right)\left[Rb_0+k_0^{\gamma}\phi(\tau_0)+R^{-1}\sum_{t=1}^{\infty}[y(\tau_t)-Rk(\tau_t)]R^{-t}\right]^{\left(\frac{\sigma-1}{\sigma}\right)} \qquad (30)$$

subject to the incentive compatibility constraint

$$V^s(b_t,\{\tau_{t+i}\}_{i=0}^{\infty}) \geq V^d(b_t,\tau_t) \quad \forall t\geq 1 \qquad (31)$$

where the superscript "s" stands for sustainable.[15] Note that maximizing (30) with respect to the sequence $\{\tau_t\}_{t=1}^{\infty}$ implies maximizing the present value of net domestic output $y(\tau_t)-Rk(\tau_t)$. Notice also that the incentive compatibility constraint means that for every level of foreign assets the sequence of expected taxes must be such that the value of continuing along that path is at least as large as the value of deviating from it. Given the structure of (23), this constraint is only relevant from period 1 onwards.

For period zero the solution of this simple: maximize $y(\tau_0)=k_0^{\gamma}\phi(\tau_0)$ by setting $\tau_0=\hat{\tau}$. For any $t\geq 1$ the solution to the government's problem is somewhat more complicated --but we know the solution set is not empty, for $\tau_t=\hat{\tau}$ $\forall t\geq 1$ satisfies the constraints and is feasible by construction. The following lemma is a first crucial step in characterizing the constrained optimum:

<u>Lemma 1</u>: The solution to the problem of maximizing (30) with respect to $\{\tau_1,\tau_2,\tau_3....\}$, subject to (31), involves a constant tax rate $\tau_t=\tilde{\tau}$ $\forall t\geq 1$.

<u>Proof</u>: Let the sequence $\{\tilde{\tau}_t^0\}_{t=1}^{\infty}$ be the solution to the government's problem, where the superscript

---

[15] Notice that in (30) the future values of k are written as a function of the contemporaneous tax rate. That is, the private sector demand function (10) is already incorporated into (30).

"0" indicates that this solution was computed as of time 0. To this solution corresponds a value $V(b_0,\{\tilde{\tau}_t^0\}_{t=1}^{\infty})$ as of time zero, where this value also reflects the fact that $\hat{\tau}$ is implemented at time 0. Notice that from the structure of the problem it is obvious that the optimal path is independent of the initial stock of assets b_0. To see this first recall that the maximization problem amounts to maximizing the present value of net domestic output. Moreover, whether incentive constraint (31) is satisfied or not at any time $t\geq 1$ depends only on the sequence of taxes starting that period, and is independent of the stock b_t.

We can break the optimal path into two subsequences: $\{\tilde{\tau}_t^0\}_{t=1}^{T-1}$ and $\{\tilde{\tau}_t^0\}_{t=T}^{\infty}$, where T is any time greater than 1. Define also the optimal path for taxes computed at the end of period T-1 and implemented starting at T: $\{\tilde{\tau}_t^{T-1}\}_{t=T}^{\infty}$. The proof now proceeds in two steps. First, we show that $\{\tilde{\tau}_t^0\}_{t=T}^{\infty}=\{\tilde{\tau}_t^{T-1}\}_{t=T}^{\infty}$. Suppose this equality does not hold. Then, $V\left(b_t,\{\tilde{\tau}_t^0\}_{t=T}^{\infty}\right) < V\left(b_t,\{\tilde{\tau}_t^{T-1}\}_{t=T}^{\infty}\right)$, since by definition it is optimal to implement $\{\tilde{\tau}_t^{T-1}\}_{t=T}^{\infty}$ from T. The sequence $\{\tilde{\tau}_t^0\}_{t=1}^{T-1}$ would still satisfy the incentive compatibility constraints between times 1 and T-1 if $\{\tilde{\tau}_t^{T-1}\}_{t=T}^{\infty}$ were expected to be implemented as of time T. This follows from the fact that the continuation values are higher under the sequence $\left(\{\tilde{\tau}_t^0\}_{t=1}^{T-1},\{\tilde{\tau}_t^{T-1}\}_{t=T}^{\infty}\right)$ than under $\{\tilde{\tau}_t^0\}_{t=1}^{\infty}$: $V\left(b_s,[\{\tilde{\tau}_t^0\}_{t=s}^{T-1},\{\tilde{\tau}_t^{T-1}\}_{t=T}^{\infty}]\right) > V\left(b_s,\{\tilde{\tau}_t^0\}_{t=s}^{\infty}\right)$ for any $s\in[1,T-1]$. At the same time, the defection values over the same interval are not affected by the choice of taxes over $[T,\infty)$. Therefore, the sequence $\left(\{\tilde{\tau}_t^0\}_{t=1}^{T-1},\{\tilde{\tau}_t^{T-1}\}_{t=T}^{\infty}\right)$ is a feasible sequence from time 1. Furthermore, $V\left(b_0,[\{\tilde{\tau}_t^0\}_{t=1}^{T-1},\{\tilde{\tau}_t^{T-1}\}_{t=T}^{\infty}]\right) > V\left(b_0,\{\tilde{\tau}_t^0\}_{t=1}^{\infty}\right)$. But then we have a contradiction, for the sequence $\{\tilde{\tau}_t^0\}_{t=1}^{\infty}$ could not have been optimal to begin with. Therefore $\{\tilde{\tau}_t^0\}_{t=T}^{\infty}=\{\tilde{\tau}_t^{T-1}\}_{t=T}^{\infty}$, and the trajectory $\{\tilde{\tau}_t^0\}_{t=1}^{\infty}$ is time consistent.

The second and final step consists of showing that $\tilde{\tau}_t=\tilde{\tau}\ \forall t\geq 1$. We note that the sequence $\{\tilde{\tau}_t^0\}_{t=1}^{\infty}$ calculated at time 0 and implemented from time 1 onwards must be identical to the sequence $\{\tilde{\tau}_t^{T-1}\}_{t=T}^{\infty}$ calculated at time T-1 and implemented from T onwards for any $T\geq 1$. This is because the optimization problem from T-1 is identical to the optimization problem from time 0 with a relabelling of time, since the optimal tax trajectory is independent of the stock of initial assets b_T. It follows therefore that $\tilde{\tau}_t = \tilde{\tau}\ \forall t \geq 1$. Q.E.D.

We now proceed to solve for the constant tax rate $\tilde{\tau}$. It is clear that $\tilde{\tau}$ must satisfy:

$$\begin{aligned} &\text{If } \epsilon<1 \quad \text{then} \quad \hat{\tau} \geq \tilde{\tau} > \tau* \\ &\text{If } \epsilon>1 \quad \text{then} \quad \hat{\tau} \leq \tilde{\tau} < \tau* \end{aligned} \tag{32}$$

If such a tax rate is announced and the announcement is believed by agents, individual welfare starting at any $t>0$ is:

$$V^p(b_t) = \lambda^{-1/\sigma}\left(\frac{\sigma}{\sigma-1}\right)\left[Rb_t + \left(\frac{R}{R-1}\right)[y(\tilde{\tau})-k(\tilde{\tau})]\right]^{\left(\frac{\sigma-1}{\sigma}\right)} \tag{33}$$

If at some time $t>0$ the government deviates and implements $\hat{\tau}$ instead, the economy reverts to the discretionary equilibrium starting at time $t+1$. Individual welfare as of period t is

$$V^d(b_t,\tilde{\tau}) = \lambda^{-1/\sigma}\left(\frac{\sigma}{\sigma-1}\right)\left[Rb_t + [k(\tilde{\tau})^{\gamma}\phi(\hat{\tau}) - k(\hat{\tau})] + \left(\frac{1}{R-1}\right)[y(\hat{\tau})-k(\hat{\tau})]\right]^{\left(\frac{\sigma-1}{\sigma}\right)} \tag{34}$$

This is, of course, the deviation value.

The following facts about the values of continuation and deviation are revealing. First, given that we are considering cases in which inequality (29) does not hold, $V^s(b_t) < V^d(b_t,\tilde{\tau})$ if $\tilde{\tau}=\tau*$. Second, $V^s(b_t)=V^d(b_t,\tilde{\tau})$ by construction if $\tilde{\tau}=\hat{\tau}$. Third, the derivatives of the continuation and deviation value functions, computed with respect to $\tilde{\tau}$ and evaluated at $\tilde{\tau}=\hat{\tau}$, are

$$\left.\frac{\partial V^s(b_t)}{\partial \tilde{\tau}}\right|_{\tilde{\tau}=\hat{\tau}} = \lambda^{-1/\sigma}(c_t^s)^{-1/\sigma}\left(\frac{R}{R-1}\right)[y'(\hat{\tau})-k'(\hat{\tau})] \begin{matrix} > 0 \text{ if } \epsilon<1 \\ < 0 \text{ if } \epsilon>1 \end{matrix} \tag{35}$$

and

$$\left.\frac{\partial V^d(b_t,\tilde{\tau})}{\partial \tilde{\tau}}\right|_{\tilde{\tau}=\hat{\tau}} = \lambda^{-1/\sigma}(c_t^d)^{-1/\sigma}\ \gamma\ y(\hat{\tau})\left(\frac{k'(\hat{\tau})}{k(\hat{\tau})}\right) \begin{array}{l} > 0 \text{ if } \epsilon<1 \\ < 0 \text{ if } \epsilon>1 \end{array} \tag{36}$$

Therefore, at the point where the constraint is binding (implying $c_t^s=c_t^d$), a litle algebra reveals these derivatives are such that

$$\left.\frac{\partial V^s(b_t)}{\partial \tilde{\tau}}\right|_{\tilde{\tau}=\hat{\tau}} \gtrless \left.\frac{\partial V^d(b_t,\tilde{\tau})}{\partial \tilde{\tau}}\right|_{\tilde{\tau}=\hat{\tau}} \quad \text{as} \quad y'(\hat{\tau})-Rk'(\hat{\tau}) \gtrless 0 \tag{37}$$

where the RHS inequality makes use of the fact that $y'(\hat{\tau})/y(\hat{\tau})=\gamma k'(\hat{\tau})/k(\hat{\tau})$. Notice, finally, that $y'(\hat{\tau})-Rk'(\hat{\tau})>0$ if $\epsilon<1$, and viceversa. Hence, plotted as a function of $\tilde{\tau}$ and evaluated at $\tilde{\tau}=\hat{\tau}$, the value of continuation is steeper (more positive) in the case of $\epsilon<1$; it is also steeper (more negative) in the case of $\epsilon>1$. What do we conclude about the relationship between $V^s(b_t)$ and $V^d(b_t,\tilde{\tau})$? Consider first the case where $\epsilon<1$, so that $\hat{\tau}<\tau*$ and $y'(\hat{\tau})-Rk'(\hat{\tau})>0$. Starting at $\tilde{\tau}=\hat{\tau}$ and raising $\tilde{\tau}$ slightly, so that we come closer to $\tau*$, both the value of continuation and the value of deviation rise, but the value of continuation rises more quickly. Hence, in the neighborhood just above $\hat{\tau}$, $V^s(b_t)>V^d(b_t,\tilde{\tau})$. At the same time, we know that at $\tilde{\tau}=\tau*$, $V^s(b_t)<V^d(b_t,\tilde{\tau})$. Hence, in the interval between $\hat{\tau}$ and $\tau*$ there exists at least one τ such that $V^s(b_t)=V^d(b_t,\tilde{\tau})$. The $\tilde{\tau}$ for which that will occur solves

$$\left(\frac{1}{R-1}\right)[(y(\tilde{\tau})-k(\tilde{\tau}))-(y(\hat{\tau})-k(\hat{\tau}))] = [k(\tilde{\tau})^{\gamma}\phi(\hat{\tau})-k(\hat{\tau})]-[y(\tilde{\tau})-k(\tilde{\tau})] \tag{38}$$

If this equation has more than one solution for $\tilde{\tau}$, the best sustainable tax rate is the highest sustainable one. That is because, as is evident from (14) and (16), welfare along the whole path starting at time zero is an increasing function of $\tilde{\tau}$, for $\tau*<\tilde{\tau}<\hat{\tau}$, if $\epsilon<1$.

The same arguments, but with opposite sign, hold in the case of $\epsilon>1$. Sustainable tax rates must satisfy (38). If there is more than one root for that equation we pick the lowest $\tilde{\tau}$, for in this case welfare is a decreasing function of $\tilde{\tau}$, for $\hat{\tau}<\tilde{\tau}<\tau*$.

We conclude

<u>Result 5</u>: **Under expectations rule (23), the best sustainable tax rate is constant and solves (38). In case of multiple solutions to (38), the best sustainable tax rate $\tilde{\tau}$ is the highest one if $\epsilon<1$ and the lowest one if $\epsilon>1$.**

Hence, even if the orthodox tax rate cannot be sustained, reputation can help enforce a constant tax rate that is welfare-superior to the populist tax rate that occurs under discretion. It depends on parameter values, however, how close to or far away from the populist tax rate this best sustainable $\tilde{\tau}$ turns out to be. For certain parameter values, we may observe taxes under a reputational equilibrium that are close to the populist level.

VI. Conclusions

Who is right about the best policy to maximize individual welfare? Those who emphasize public services at the expense of higher taxes or those who emphasize lower taxes at the expense of less public services? As is often the case in economics, the truth lies somewhere in the middle: there is a best "orthodox" tax rate that optimizes across this tradeoff. But this orthodox tax rate turns out to be time inconsistent, and therefore not necessarily implementable if the government does not have access to a commitment technology. Without the ability to precommit, the government ends up implementing a "populist" tax rate, which may be higher or lower than the orthodox one. Welfare is lowered as a result. Under trigger strategies, a constant tax rate that is welfare-preferred to the populist tax rate may be implementable, but this sustainable tax rate need not coincide with the orthodox one. As a result, the best outcome under trigger strategies may still be inferior than that which could be attained under precommitment.

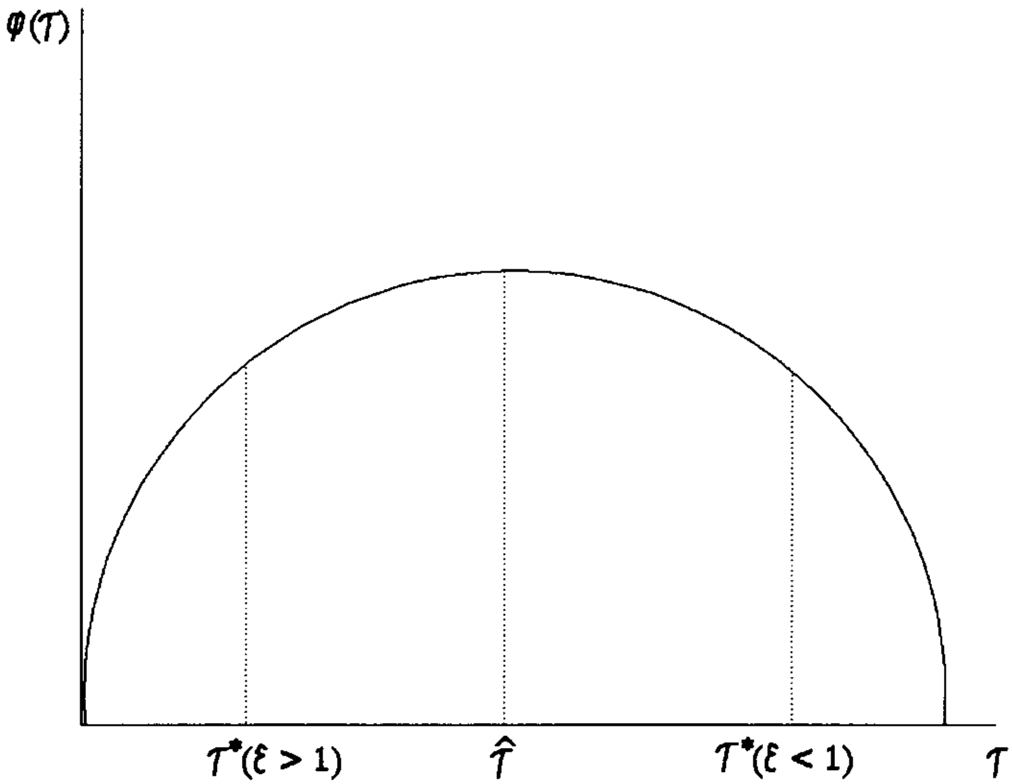

Figure 1

References

Alesina, A. and R. Perotti "The Political Economy of Budget Deficits" NBER Working Paper No. 4637, 1994.

Barro, R. "Government Spending in a Simple Model of Endogenous Growth" Journal of Political Economy, Vol. 98, No.5, 1990.

Benhabib, J. and A. Rustichini "Social Conflict, Growth and Inequality" New York University, C.V. Starr Center for Applied Economics Research Report 91-46, September 1991.

Calvo, G. "On the Time Consistency of Policy in a Monetary Economy" Econometrica, Vol. 46, 1978.

Chari, V.V. and P. Kehoe "Sustainable Plans" Journal of Political Economy, Vol. 98, No. 4, 1990.

Chari, V.V. and H. Cole "A Contribution to the Theory of Pork Barrel Spending" Staff Report 156, Federal Reserve Bank of Minneapolis, 1993a.

____________ "Why are Representative Democracies Fiscally Irresponsible?" Staff Report 163, Federal Reserve Bank of Minneapolis, 1993a.

Clinton, Bill and A. Gore "Putting People First: How We Can All Change America" New York: Times Books, 1992.

Dornbusch, R. and S. Edwards "Macroeconomic Populism in Latin America" NBER Working Paper No. 2986, 1989.

Fischer, S. "Dynamic Inconsistency, Cooperation and the Benevolent Dissembling Government" Journal of Economic Dynamics and Control, Vol. 2, 1980.

Laban, R. and A. Velasco "The Economic Policies of Chile's Democratic Government" Paper presented to the Annual Meeting of the Eastern Economic Association, March 1993.

Leonard, D. "Awareness and Growth" Paper presented at the Richerche Economiche Workshop on Economic Growth, Venice, January 1994.

Obstfeld, M. "Dynamic Seigniorage Theory: An Exploration" NBER Working Paper No. 2869, 1993.

Kydland, F. and E. Prescott "Rules Rather than Discretion: The Inconsistency of Optimal Plans" Journal of Political Economy, Vol. 85, No.3, 1977.

Roubini, N. and J. Sachs "Government Spending and Budget Deficits in the Industrial Countries" Economic Policy, April 1989.

Sachs, J. "Social Conflict and Populist Policies in Latin America" NBER Working Paper No. 2897, 1989.

Tornell, A. and A. Velasco "Why Does Capital Flow from Poor to Rich Countries? The Tragedy of the Commons and Economic Growth" Journal of Political Economy, December 1992.

Velasco, A. "A Model of Endogenous Fiscal Deficits and Delayed Fiscal Reforms" Mimeo, New York University, March 1993.

Weingast, B., K. Shepsle and C. Johnsen, "The Political Economy of Benefits and Costs: A Neoclassical Approach to Redistributive Politics" Journal of Political Economy, Vol.89, August 1981.