AN EQUILIBRIUM ANALYSIS OF CENTRAL BANK INDEPENDENCE AND INFLATION

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Abstract

A dynamic equilibrium model is constructed to analyze the implications of different degrees of central bank independence. In the main model, each period agents are permitted to vote on the desired inflation and labor taxes in order to finance a specified level of government spending. In this case multiple perfect-foresight equilibria arise, which depend on the initial conditions of the economy. It is shown that agents will choose to levy only one tax at a time, rather than selecting some version of a "tax-smoothing" policy. One of these equilibria display cycles which exhibit fluctuations in output, investment, and the inflation rates as a result of permitting agents to vote. If instead of having agents vote each period on these parameters, inflation and labor taxes in the model are set at fixed levels, these fluctuations do not appear.

I. INTRODUCTION

There has been a considerable and persistent debate in many countries concerning the optimal degree of independence which should be provided for the overseers in control of monetary policy on the one hand, and the alternative branches of government on the other. The current paper presents a very simple dynamic general equilibrium framework in which this issue can be studied. In particular, it is shown that if agents can vote each period on the optimal level of money creation, which is interpreted as an extreme version of the absence of central bank independence, the resulting equilibrium of the economy may be one in which the inflation rate, as well as other economic aggregates, display persistent fluctuations, and there is a relatively high *average* level inflation. This might be interpreted to mean that letting the legislative branch of government control monetary policy could be bad in that it would lead to a great deal of aggregate volatility. This is potentially an important development because, to date, there are very few dynamic general equilibrium optimizing models which seek to analyze the impact of central bank independence. It is also shown that this economy can display multiple equilibria, with some of these equilibria exhibiting limiting cycles, and some without cycles. Different initial conditions, or fully anticipated exogenous shocks are shown to be able to cause these cyclical equilibria to arise.

In many developing and advanced countries, it seems that there is a continuing debate as to how they should structure their central banks so as to provide the "optimal" monetary policy to facilitate the attaining the highest possible welfare for the citizens of the country. Proponents of central bank independence cite the empirical analyses of this issue which appear to find that more independent central banks tend, on average, to have lower rates of inflation (see Bade and Parkin (1982), and Cukierman, Webb, and Neyapti (1992)).[1] However, because of the computational or analytical complexities involved, it has been very difficult to construct models that are able to analyze this question. In this paper a very simple model of the impact of central bank independence, or lack thereof, is presented.

The goal of this paper, however, is not to analyze the choices that individuals will make in constructing their governmental institutions since this would seem to be a formidable task. Rather, the goal is to characterize the behavior of an economy under alternative institutional arrangements so that insight can be gained concerning the comparative dynamic effects of these different arrangements.

There has been a great deal of related work done recently in which the government policies are determined endogenously, in a similar spirit to that studied below. Tabellini (1991) studies the behavior of government debt in an economy in which policies are determined by majority rule. Tabellini and Alesina (1990) study an economy in which agents vote on the composition of government spending. Alesina (1988) provides a detailed set of references to this growing literature.[2] Cukierman (1992) presents a rigorous analysis of the issues involved in studying and modelling central bank independence. From an empirical perspective, Bade and Parkin (1982), and Cukierman, Webb and Neyapti (1992) also provide a detailed analysis of the apparent empirical relationship between the apparent independence of central banks in various countries, and the tendency for these same economies to experience low rates of inflation.[3]

One goal of this paper is to illustrate the importance of analyzing the impact that the *political* structure can have on the behavior of a dynamic economy. An economy in which policy parameters are fixed according to some socially optimal criterion can behave *very* different from the same economy in which a mechanism exists to permit economic agents to endogenously *choose* the level of these parameters. In this latter instance, important considerations such as the distribution of wealth may influence the level of the policy parameters, which in turn can then influence the future distribution of wealth and the level of these policy parameters. As is shown below, this can then produce economic behavior that would not be present in the absence of the endogenous policy formulation. Therefore, this analysis is a step in the direction of linking the normative and positive analyses of government policies.

The remainder of this paper is organized as follows. In the next section the physical and political structure of this very simple economy is described in detail. The economy is inhabited by a population of overlapping generations, each of whom lives for three periods only. Agents work in their first two periods of life, and invest in capital for the last two periods. There is a reserve requirement imposed on all such investment so that some fraction of investment must take the form of holding government issued fiat currency. Each period the government must finance a fixed level of real expenditures. In the benchmark model, at each date agents vote on the appropriate levels of labor taxation and the inflation tax, and it is assumed that the majority determines the levels of these parameters.

In Section III a series of examples are presented. It is shown that there can exist multiple steady-state equilibria, which depend on the initial conditions of the economy. The implications for the level of investment and output are studied. It is shown that in one of the equilibria the inflation tax can fluctuate *dramatically* in the model, with the agents collectively voting to use the labor tax, *or* the inflation tax, but never both. This provides some motivation for why one might expect the antithesis of the usual tax smoothing behavior. It is also shown how perfectly-foreseen temporary exogenous disturbances can have persistent and permanent effects on the equilibrium, and on the endogenous policy variables. In the other equilibrium there are no such fluctuations, and the agents choose to finance government spending through a labor tax instead. This can also be interpreted as an equilibrium in which the central bank policy is to minimize inflation, and therefore there is no endogenous policy formulation. Section IV contains some final remarks.

II. THE ECONOMIC ENVIRONMENT AND THE EQUILIBRIUM

The economy is one in which time is discrete and is indexed by t = 1,2,... Each period there is a generation of agents of size N who enter the economy, and are present there for three periods. For convenience it will be assumed that N=1. An agent who enters the economy in period t will be said to be a member of generation t, and is present in the economy in periods t, t+1, and t+2. Agents have *perfect foresight* concerning the future. Each member of generation t wishes to consume some of the single consumption good in period t+1, and t+2. That is to say, they do not consume in the first period of life. Agents have one unit of labor effort to supply inelastically in period t and in t+1, and which will produce $w_{1,t}$ and $w_{2,t+1}$ units of the consumption good in periods t and t+1 respectively. These wages are measured in units of the consumption good.

There is a productive capital (or storage) technology in the economy that can be used to transfer the consumption good from one period to the next. This technology is operated by a single financial intermediary.[4] The technology is constant returns to scale, so that in any period t, one unit of the consumption good can be invested so that it will yield x_{t+1} (> 1) units of the consumption good in period t+1, which can then be consumed. Agents who are members of generation t will wish to consume in future periods, and can do so by investing in the intermediary in that period. The intermediary, however, faces a government-imposed reserve requirement on these deposits. For each deposit made in the intermediary, it must hold a proportion of (α) units in the form of fiat currency, which has been issued by the government, and the remaining ($1-\alpha$) units are then invested in capital. Hence individual agents hold the title to assets of financial intermediaries. Only the intermediaries hold the currency and the agents hold currency through the intermediary.[5]

Let M_t then denote the aggregate supply of fiat currency at the beginning of period t, and let p_t denote the price of the consumption good in units of currency in period t. In the regimes considered below, at the beginning of each period t, the rate of money supply growth for that period will be denoted as $\mu_{t+1} = (M_{t+1} - M_t)/M_t$. The government can change the money supply in order to finance government consumption. With this information in mind, the gross rate of return to deposits with the intermediary in period t is then $r_{t+1} = (1-\alpha)x_{t+1} + \alpha(p_t/p_{t+1})$. That is, the gross rate of return to capital is a linear combination of the rates of return to capital and that of money. Now obviously the government can use inflation as a levy on capital. Therefore, this will then be referred to as the inflation tax, and henceforth the inflation rate will be denoted by $\pi_{t+1} = (p_{t+1}/p_t) - 1$.[6]

A member of generation t has a utility function that will be described as follows

$$\frac{(c_{2,t+1})^{1-\rho}}{1-\rho} + \frac{\beta\,(c_{3,t+2})^{1-\rho}}{1-\rho},$$

where $c_{s,t}$ represents consumption by an agent in period t who is currently in period s of his life. Of course, $(1/\rho)$ is meant to measure the intertemporal elasticity of substitution of consumption for an agent, and $\rho>0$, $\rho\neq1$.[7] In period t each member of generation t supplies their unit of labor inelastically. The agent has his labor income taxed at a rate τ^{ℓ}_{t}. The agent will then invest the remaining income, so that the period t budget constraint for such an agent is then

$$k_{2,t+1} = w_{1,t}(1-\tau^{\ell}_{t}).$$

Here $k_{s,t+1}$ represents the investment in capital purchased in period t by an agent, who is currently in period (s-1) of his life, and which is then taken into period t+1.

A member of generation t who enters period t+1 with $k_{2,t+1}$ units of capital then collects the return on this investment, in units of the consumption good, in the amount of r_{t+1} per unit of capital. This divisible return on investment can be consumed, and investment for the future periods can also then be undertaken. The amount of this investment is denoted by $k_{3,t+2}$. The agent also inelastically supplies his unit of labor, and collects wage income of $w_{2,t+1}$ and pays taxes on this income at the rate of τ^{ℓ}_{t+1}.[8] Hence, his second period budget constraint can then be written as follows

$$c_{2,t+1} = (k_{2,t+1}r_{t+1}) + w_{2,t+1}(1-\tau^{\ell}_{t+1}) - k_{3,t+2}.$$

In the last period of the agent's life, he will consume the total value of his after tax capital holdings, since he is not able to work. His budget constraint for this period is then written as follows

$$c_{3,t+2} = k_{3,t+2}r_{t+2}.$$

Aggregate output is then measured as the quantity of goods created in a period by both factors, labor and capital, and is written as[9]

$$Y_t = (1 - \alpha)(k_{2,t} + k_{3,t})x_t + (w_{1,t} + w_{2,t}).$$

The second part of this expression reflects labor income, and the first part reflects the output produced through from saving, of which (1-α) is the fraction actually invested in capital. The tax rate that appears in the budget constraints (τ^{ℓ}_t), as well as the inflation rate (π_t), have yet to be determined. Although the agents will later take these parameters as given, it is assumed that at the beginning of every period t, the members of generation t-2, t-1, and t vote on the size of these policy variables. It is also assumed that these parameters cannot be negative. After these policy variables are determined, the agents maximize utility subject to their budget constraints while acting as price takers, and taking as given the behavior of other agents, including the behavior of future generations.

Since money is held as a reserve requirement in the financial intermediary it is necessarily the case that the following equilibrium condition be satisfied[10]

$$\alpha(k_{2,t} + k_{3,t}) = \frac{M_t}{p_t}. \tag{1}$$

In any period t the government must spend G_t units of the consumption good on its own consumption. This must be financed by utilizing the labor tax, or the inflation tax, or some combination of both. Hence the government budget constraint can then be written as follows

$$G_t = \alpha(k_{2,t} + k_{3,t})\left(\frac{\pi_t}{1+\pi_t}\right) + (w_{1,t} + w_{2,t})\tau^{\ell}_t. \tag{2}$$

The first component of this expression is the tax base for the inflation tax, multiplied by the inflation tax rate. The second component is the revenue derived from labor taxation. It is now instructive to begin with the analysis of the optimization problem faced by a member of generation t-1. Such an agent must maximize the utility function, as given by

$$\frac{(c_{2,t})^{1-\rho}}{1-\rho} + \frac{\beta\,(c_{3,t+1})^{1-\rho}}{1-\rho}, \tag{3}$$

subject to the constraints

$$c_{2,t} = (k_{2,t}r_t) + w_{2,t}(1-\tau_t^\ell) - k_{3,t+1},$$

and

$$c_{3,t+1} = k_{3,t+1}r_{t+1}.$$

The solution to this problem is easily seen to be

$$c_{2,t} = \left(\frac{1}{1+\theta_t}\right)\left[k_{2,t}r_t + w_{2,t}(1-\tau_t^\ell)\right], \qquad k_{3,t+1} = \left(\frac{\theta_t}{1+\theta_t}\right)\left[k_{2,t}r_t + w_{2,t}(1-\tau_t^\ell)\right]. \tag{4}$$

where $\theta_t = (\beta r_{t+1}^{1-\rho})^{1/\rho}$. Substituting equations (4) back into the utility function (3) then yields the following indirect utility function

$$V_t(\tau_t^\ell, \pi_t) = \left[\frac{1}{(1-\rho)}\right]\left[k_{2,t}r_t + w_{2,t}(1-\tau_t^\ell)\right]^{1-\rho}\left[1 + \beta^{\frac{1}{\rho}} r_{t+1}^{\left(\frac{1-\rho}{\rho}\right)}\right]. \tag{5}$$

This equation defines the utility, at the beginning of period t, of a generation t-1 agent. For convenience this value function is written as a function of the variables (τ^ℓ_t, π_t) that are chosen at the beginning of period t, since $r_{t+1} = (1-\alpha)x_{t+1} + \alpha/(1+\pi_t)$. However, it should be clear that this value function is also dependent on the levels of the contemporaneous labor income, the capital stock, return to capital, and additionally, the levels of *future* policy variables. The agent who is a member of generation t-1 must maximize equation (5) subject to equation (2), subject to the constraints that π_t, $\tau^\ell_t \geq 0$. Now, substitution of a version of equation (2) into equation (5) yields a value function for members of generation t-1, at the beginning of period t, which is a function of the labor tax rate (τ^ℓ_t) and the inflation rate (π_t).

The voting behavior of most of the population is easily described. The young agents in any period will choose to have all government spending financed by the inflation tax since they hold no capital, and their sole source of income is derived from their labor. The old agents will in turn choose the opposite: they will want to have only a labor tax since they earn no labor income but instead hold only capital. Hence, the determination of the equilibrium tax rates will then be made by the middle-aged agents. These middle-aged agents then will prefer the values of (τ^{ℓ}_{t}) and (π_t) which maximize their value function (5) subject to the government budget constraint (2).[11]

It is assumed that when agents make their voting decisions, they are playing a Nash game against future generations. That is, they choose (τ^{ℓ}_{t}, π_t) while taking as given the voting behavior and investment decisions of other agents in present and future generations. Clearly there is no uncertainty or incomplete information about the behavior of other agents since this is an economy of perfect foresight. After having voted and determined the equilibrium tax rates, they act as price takers when making their consumption and investment decisions.

To make the specification of the equilibrium nature of the economy more formal, it may be useful to proceed with the following definition.

Definition: A *Perfect Foresight Competitive Equilibrium* for this economy is a collection of non-negative sequences $\{x_t, G_t, w_{1,t}, w_{2,t}, k_{2,t-1}, k_{3,t-1}, c_{2,t}, c_{3,t}, \pi_t, \tau^{\ell}_{t}\}^{\infty}_{t=1}$, such that for $t \geq 1$, the following conditions are satisfied:

i) For members of generation t-1, given the levels of $\{x_s, G_s, w_{1,s}, w_{2,s}, k_{2,s}, k_{3,s}, \pi_{s+1}, \tau^{\ell}_{s+1}\}^{\infty}_{s=t}$, the period t parameters (π_t, τ^{ℓ}_{t}) are chosen to maximize the value function as given by equation (5), subject to the government's budget constraint (2).

ii) Given the policy parameters (π_t, τ^{ℓ}_{t}), the return to capital (r_t, r_{t+1}), and endowments $(w_{1,t}, w_{2,t})$, the quantities $(k_{2,t}, k_{3,t}, c_{2,t}, c_{3,t})$ maximize the utility function, subject to the budget constraints. This implies the decision rules described by equation (4) are satisfied.

iii) The government budget constraint (2) holds for each period.

iv) The money market equilibrium condition (1) is satisfied in each period.

The specification of the equilibrium is somewhat complex, since the agents are taking the contemporaneous state variables, as well as future choice variables as given when making their voting decisions. Subsequently, they act as price takers when making their consumption and savings decisions. It is possible to analytically characterize the behavior of the value function (5) as the parameters π_t and τ^{ℓ}_t are varied, but this turns out not to be a very instructive exercise. Rather than proceed with an analysis of this sort in this somewhat general setup, it will be much more instructive to examine a few examples, and this is done in the following section.

III. SAMPLE ECONOMIES

At this point it will be illustrative to explore the dynamic behavior of the model. Although some analytical characterization of the solution can be performed, this does not adequately or easily lead to an understanding of the dynamic behavior of the economy. In spite the relative simplicity of the economy, this difficulty is due to the choices available to agents, and due to the infinite horizon of the economy. Instead, it would appear to be more fruitful to gain insight by analyzing the following examples.

Example #1: This example illustrates the multiple equilibria that are present in the model, as well as the fact that agents will occasionally choose to levy an inflation tax - or capital levy - in order to finance government spending. Consider the following parameterization for the economy: $w_{1,t} = w_{2,t} = 20$, $G_t = 2$, $x_t = 1.05$, $\rho = 2.0$, $\alpha = .10$, $\beta = .95$. There are two initial conditions for the economy: $k_{2,1} = 18.5$, and $k_{3,1} = 21$. Figure 1 shows the resulting behavior of the capital stocks in this example. Figure 2 shows the behavior for the labor tax and the inflation tax. Obviously, in this example agents are choosing to finance government spending through either the labor tax, or the inflation tax, but not both simultaneously. The labor tax fluctuates between 5% and zero, while the inflation rate fluctuates between 132% and zero.[12] As a result, the level of real output also fluctuates in this equilibrium, taking values of 80.666 in odd periods, and 80.925 in even periods.

The reason why these fluctuation occur is as follows. Inherent in the decision to be made by the middle-aged agents is a consideration of the level of government consumption to be financed and tax burden to be levied, and the way that agents can minimize their welfare loss from these taxes. In the first period the oldest agents are relatively rich in capital, and consequently the middle-aged agents wish to have capital taxed through the inflation tax, and not to tax labor at all. Since the labor income of the young in period 1 is then not taxed, these latter agents are relatively capital-rich in period 2, and therefore they vote to tax labor in this period - the reverse of what happened in period 1. This behavior subsequently repeats itself every two periods after this.

In each period the middle-aged agents weigh the relative (utility) costs imposed by levying the labor and inflation taxes. These same agents are susceptible to paying both taxes if they hold any capital, and so it seems natural that they would choose to vote for the tax that maximizes their welfare.[13] Although the levels of $w_{1,t}$ and $k_{3,t}$ do not *directly* affect the decisions of a member of generation t-1, since they are not a component of his wealth, these variables do influence the voting behavior of these agents *indirectly*. The higher are these variables, the greater the capabilities to a member of generation t-1 of minimizing his own tax burden by foisting it instead on the members of either the older or younger generations. For example, the higher (lower) is $w_{1,t}$ relative to $w_{2,t}$, and the lower (higher) is $k_{3,t}$ relative to $k_{2,t}$, the more (less) likely it will be that the member of generation t-1 will vote in period t to tax labor (capital).

It should also be stated that in the absence of positive government spending, there would not be any fluctuations for this economy, and instead there would be a single stationary equilibrium. Similarly, it can easily be seen that the magnitude of the present fluctuations are closely related to the size of the level of government spending. That is, the higher the level of G_t, the greater is the magnitude of the fluctuations.

Example #2: This example is exactly the same as in the previous one except that the initial conditions are different. In this case $k_{2,1} = 18$, and $k_{3,1} = 17$. The resulting paths for the capital stocks are shown in Figure 3. In the initial period the middle-aged agents are capital-rich, and therefore they choose to have labor taxed in period 1, rather than choose the inflation tax as in the previous example. In the subsequent period, the old agents are still not sufficiently capital-rich to convince the middle-aged agents to choose a high level of inflation, and therefore a labor tax is employed again. This behavior continues forever, with a labor tax rate of 5% being implemented in every period.

Obviously, the behavior of the economy in this example is identical to that which would arise if there were a rule or law that mandated that all government spending be financed through the labor tax, and the inflation rate always be set to zero, irrespective of the initial conditions.[14] Clearly the result from such a policy would be an equilibrium in which cycles do not appear in the level of output, capital stock, inflation rate, or the rate of return to capital. In light of the behavior observed in Example #1 (and Example #3 below), it is possible to conclude that, within a choice-theoretic general equilibrium model, removing all forms of central bank independence can potentially lead to higher average rates of inflation, as well as *fluctuations* in the inflation rate and other aggregates, than would otherwise be the case if central bank were left to pursue a strict zero inflation policy on its own.

Example #3: This example is again exactly the same as the first one, with the exception of the initial conditions for the capital stock. In this instance $k_{2,1} = 25$, and $k_{3,1} = 20$. The resulting path for the capital stocks is illustrated in Figure 4. Obviously the result is that the model exhibits a cyclical equilibrium that appears to be identical to that in Example #1. However, this is not quite the case. In the first example the inflation tax is levied in odd periods, while the labor tax is imposed in even periods. In the present example, although the cycles still exist, the opposite is the case. The reason for this is that here the middle-aged agents begin period 1 with relatively plenty of capital, and therefore choose to tax labor in this period. From then on the reasoning behind the cyclical equilibrium is identical to that in the first example.

<u>Example #4:</u> In this example, the economy is identical with that studied in Example #2, with the exception of a perfectly-foreseen labor productivity shock in period 10. In particular, the parameterization of the economy is as follows: $w_{1,10} = 21$, and otherwise $w_{1,t} = w_{2,t} = 20$, $G_t = 2$, $x_t = 1.05$, $\rho = 2.0$, $\alpha=.10$, $\beta = .95$. There are two initial values for the economy: $k_{2,1} = 18$, and $k_{3,1} = 17$. The levels of labor income are constant, except for period 10, in which case there is a 5% increase in the labor income of the young agents. Figure 5 shows the paths for the capital stocks in this example, while Figure 6 shows the paths for the inflation and labor taxes. This example illustrates how an expected exogenous disturbance is capable of changing the steady-state behavior of the economy, and moving the economy from the non-cyclic to the cyclical equilibrium. The reverse behavior is also possible in that an expected exogenous shock can move the economy from the cyclic equilibrium to the non-cyclic equilibrium.

This example illustrates the importance that voting, and therefore endogenous policy formulation, plays in the model. If the tax rates were fixed arbitrarily in this example, the economy, which began in a non-cyclic steady-state, would converge back to this steady-state a few periods after the temporary exogenous disturbance. The voting, or endogenous policy formulation, is then critical in producing the observed fluctuations.

IV. FINAL REMARKS

It would seem indisputable that political considerations are an important factor that help determine how policy parameters are formulated within market economies. Yet there are relatively few dynamic models that have these parameters determined endogenously, with agents participating in the political structure. It may not be clear a-priori, how incorporating these features into a dynamic economy will alter the behavior of the economy, but the previous analysis suggests that the changes produced can potentially be dramatic.

The framework described above has shown that introducing majority voting into the determination of tax rates can also interject instability or fluctuations in various aggregates. Agent's different levels of capital and labor income influence their preferences concerning the levels of labor and inflation taxes. This analysis has been conducted within a framework in which the fluctuations would not arise in the absence of the voting on the levels of the policy parameters. Additionally, no externalities or "backward-bending" supply curves for saving were necessary ingredients in producing the cyclical equilibria.

One might justifiably ask which features of the examples are critical. Within certain bounds, allowing different values of intertemporal substitution, as determined by the value of $(1/\rho)$, will not change the basic nature of the results. However, it is not always easy to construct equilibria when low values of ρ are chosen. The reason for this is that in this instance the substitution effect of a change in the interest rate becomes very strong relative to the wealth effect. One might also question how the results would change if, say, the levels of capital and labor influenced the productivity of each other as when, for example, a Cobb-Douglas technology is employed. In this case the fluctuations observed above are still present, but are slightly different in magnitude. In particular, because of the interaction of the two factors in production, the model does not converge as quickly to its cyclic or non-cyclic equilibria. What is important in the present framework is the endogenous voting, and not the way that output is produced.

As has been emphasized by such as authors as Barro (1979), it would seem appropriate that governments should pursue a type of tax-smoothing policy in order to minimize the intertemporal costs of distortional taxation. As shown here however, as well as in Huffman (1993), tax smoothing is apparently not something that one might expect to naturally arise in environments in which agents, acting in their own private self-interest, can partially determine the policies that affect their decisions.

It is left as an open question as to how the political structure can influence the behavior of the economy along other dimensions. The foregoing analysis suggests that it might be interesting to study other issues within the context of a dynamic model with these sorts of political considerations. For example, one might analyze the levels of public debt or deficits that might arise. Alternatively, one might study the way in which governments might finance their deficits, and what the appropriate level of money/bond combination that is appropriate. Additionally, this type of model could also be used to study how political considerations could be used to study the trade-off between distortional taxation on the one hand, and future growth on the other.

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FOOTNOTES

1. Although, as demonstrated in Cukierman, Webb and Neyapti (1992), and Cukierman, Kalaitzidakis, Summers, and Webb (1993), it can be a considerable task to characterize how independent many central banks actually are. This is also a very important issue because it is closely related to the issue of policy coordination between the different branches of government. Obviously the issue of policy coordination arises when some policy-makers have a great deal of independence from other policy-makers.

2. What is missing from much of the existing literature, and what is the main points of the present paper, is an explanation of how policies implemented in one period influence the distribution of wealth in such a manner as to also influence the policies that are chosen in future periods. Also, much of this literature contains analyses of models which are finite horizon economies. The model studied in the present paper has an infinite horizon, and as such permits an analysis of how the endogenous variables evolve over time in reaction to various disturbances. Alesina and Spear (1988) use the overlapping generations model to construct a model of electoral competition.

Boldrin (1993), and Krusell and Ríos-Rull (1993a, 1993b) study the impact that voting can have in models where factors of production can be accumulated. However, they do not address the possibility of cyclical fluctuations as is the focus of the present paper.

3. Alesina and Summers (1993) point out that although there appears to be a negative relationship between the degree of central bank independence and the average rate of inflation, there appears to be no such discernable relationship between the degree of independence and a measure of real economic performance.

4. One potential reason for this may be that there is a minimal investment level that is necessary before any investment returns a positive amount. This minimal investment level is then more than the potential endowment of any single agent in the economy.

5. One could alternatively assume that the agents directly hold the currency as a reserve requirement against these deposits with the intermediary.

6. Of course, the issues of time-inconsistency are being avoided. However, it is not clear how or if these problems would arise within the context of a model in which policies are endogenously determined through voting.

7. Huffman (1993) studies a model in which $\rho=1$, which is to say that utility is logarithmic, so that the agents investment decisions are independent of the equilibrium interest rate.

8. It would be relatively straightforward to incorporate an endogenous labor decision into the agents optimization problem by changing the first period utility function to $[c_t - (\ell_t)^{\omega}]^{1-\rho}$, where ℓ_t is period t labor effort, and $\omega > 1$. However, adding this feature would not appear to add anything substantive to the current analysis.

9. Since N=1, there is no need here to distinguish between individual and aggregate quantities.

10. Since $x_t > 1$, and $\pi_t \geq 0$, the agents would never voluntarily hold money since the rate of return on money is dominated by that of capital.

11. It is also assumed that there is no mechanism that would permit agents at one date to commit to their votes in future dates. Obviously, allowing this would complicate the analysis by adding many more strategic considerations.

12. This may seem to be an extreme level of inflation, but this level can be made smaller or larger by changing the reserve requirement or the agent's discount factor.

13. In Huffman (1993) the capital stock is fixed and hence there is an endogenous price for capital. It is shown within this environment that the value function of the middle-aged agents, as a function of the percentage of the government consumption financed through the two taxes, is *convex*. Naturally, in their voting the agents always choose corner solutions with *either* the labor tax *or* a capital tax employed, but never both. In the present case, preferences over taxes are single-peaked, but they always move to corner solutions.

14. It is not necessarily the case that the non-cyclic equilibrium will always have the agents choosing the labor tax in each period. It depends upon the relative sizes of capital and labor income available to middle-aged agents. The logic behind this result is perhaps best illustrated in Huffman (1993).

Figure 1

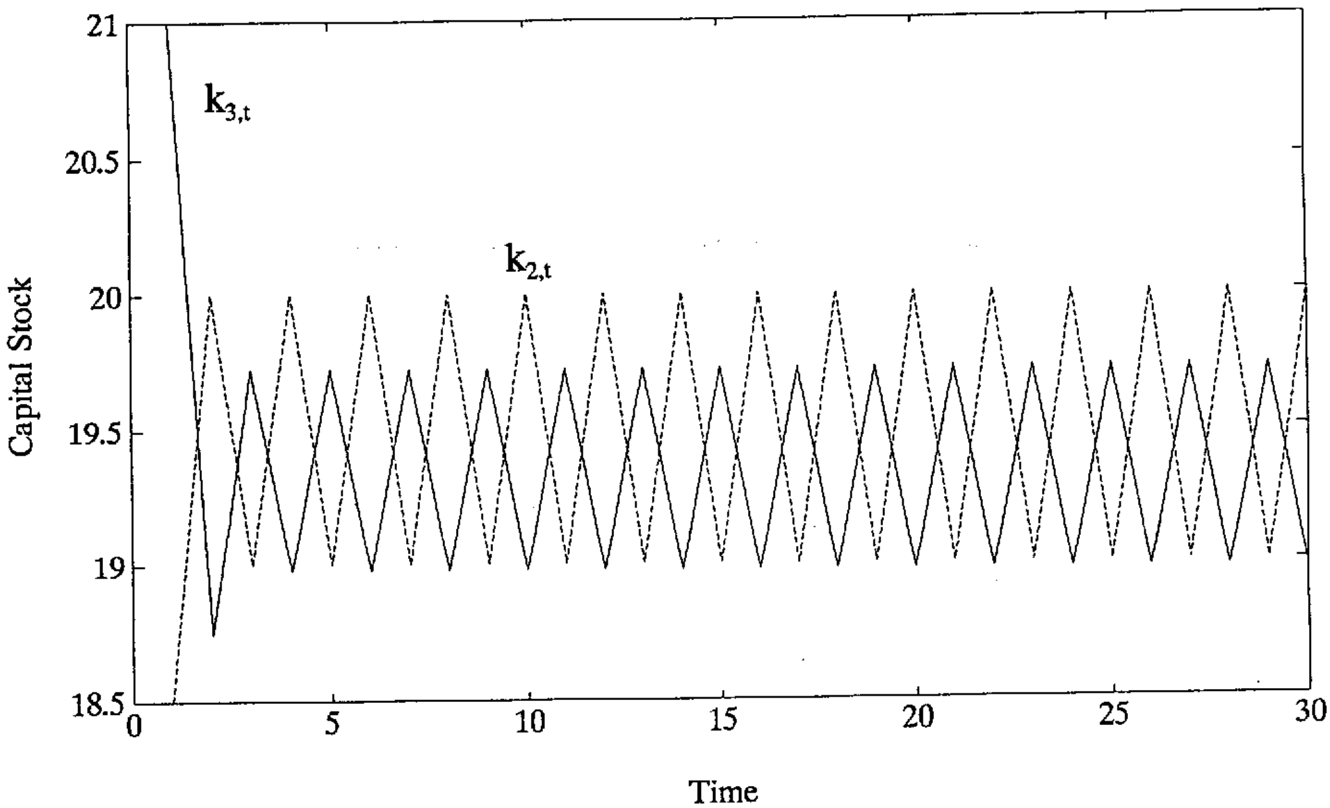
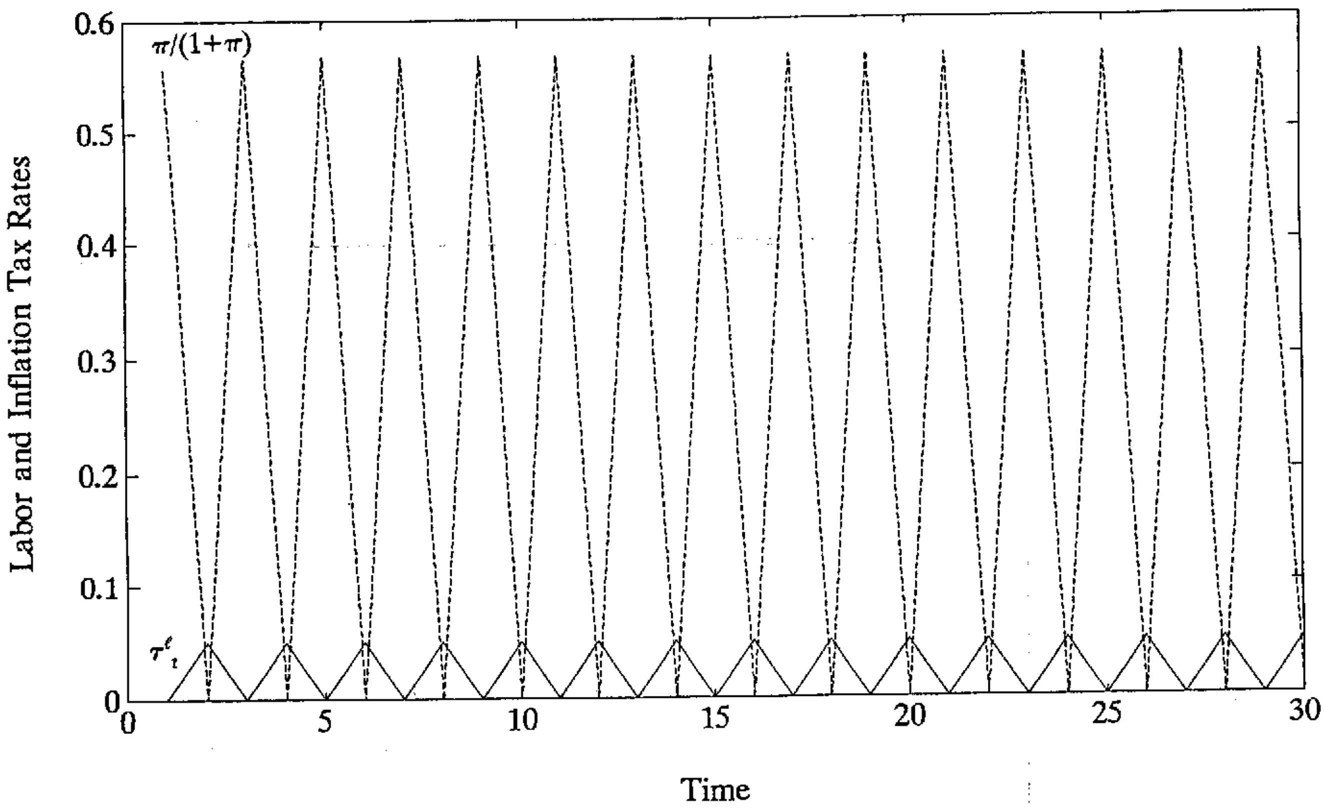


Figure 2



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Labor and Inflation Tax Rates
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Figure 3

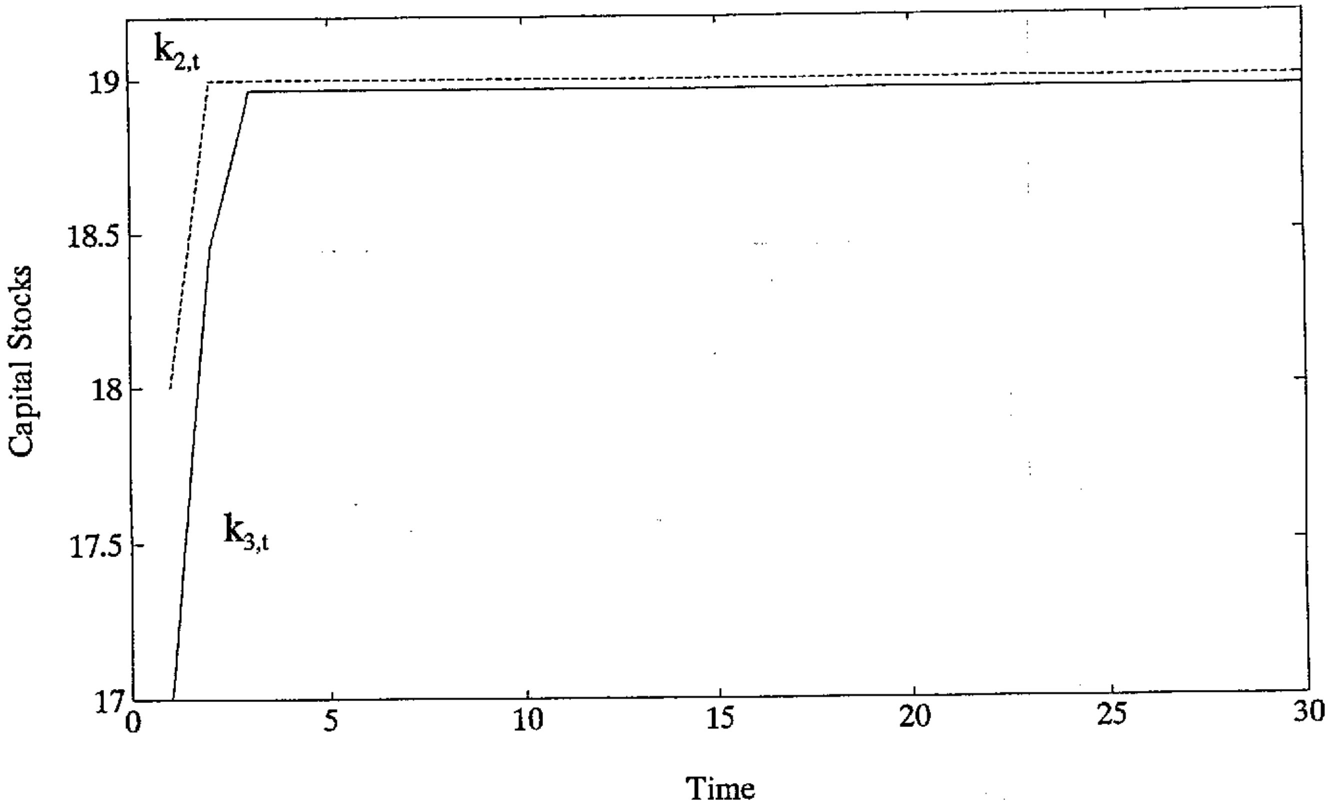
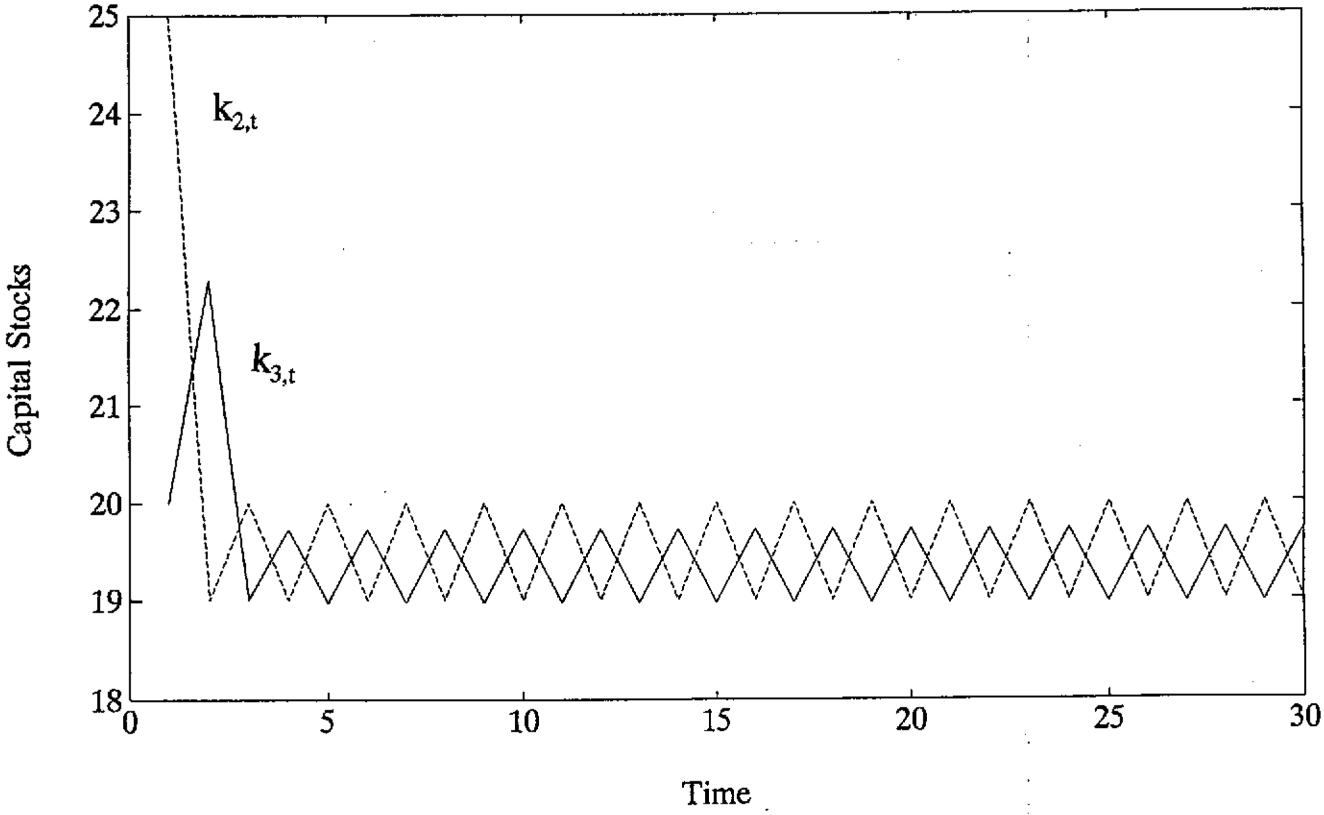


Figure 4



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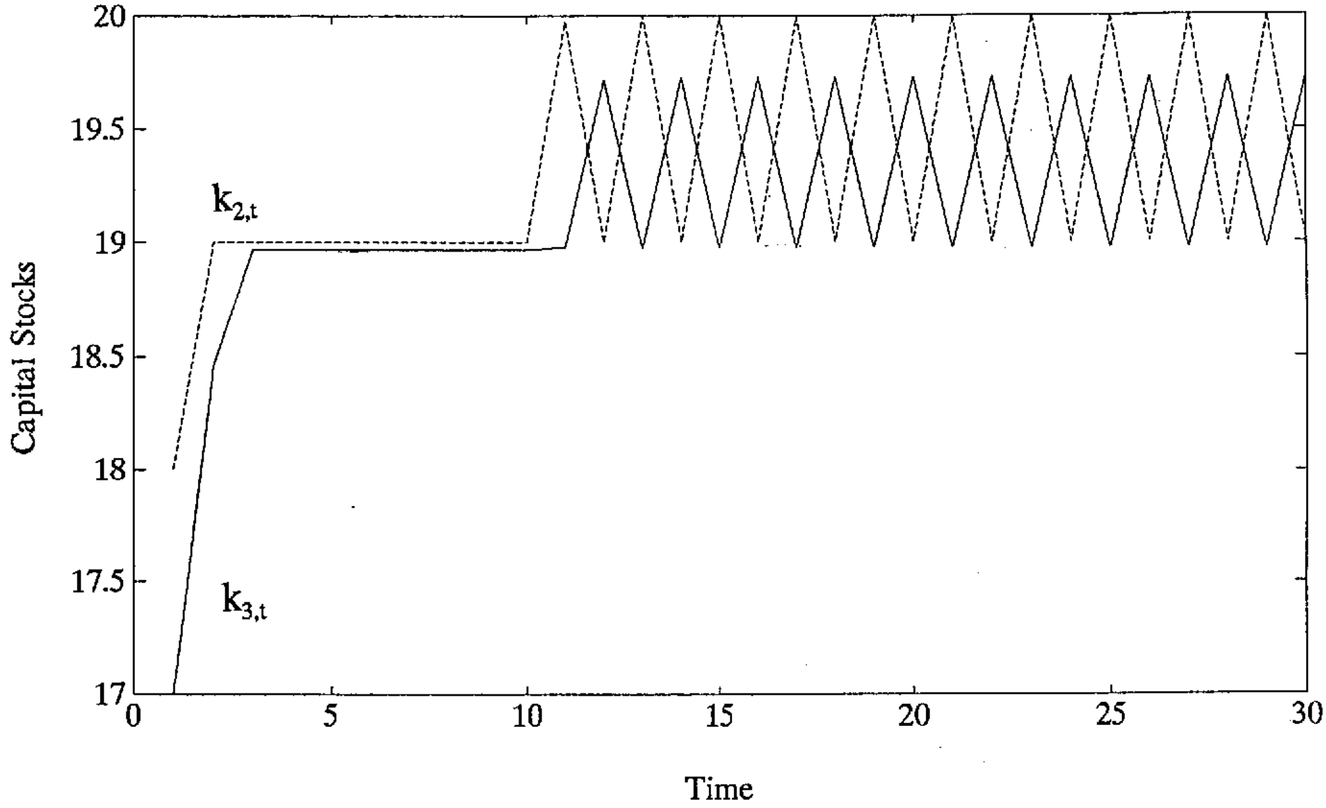
Capital Stocks
Time

Figure 5



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Capital Stocks
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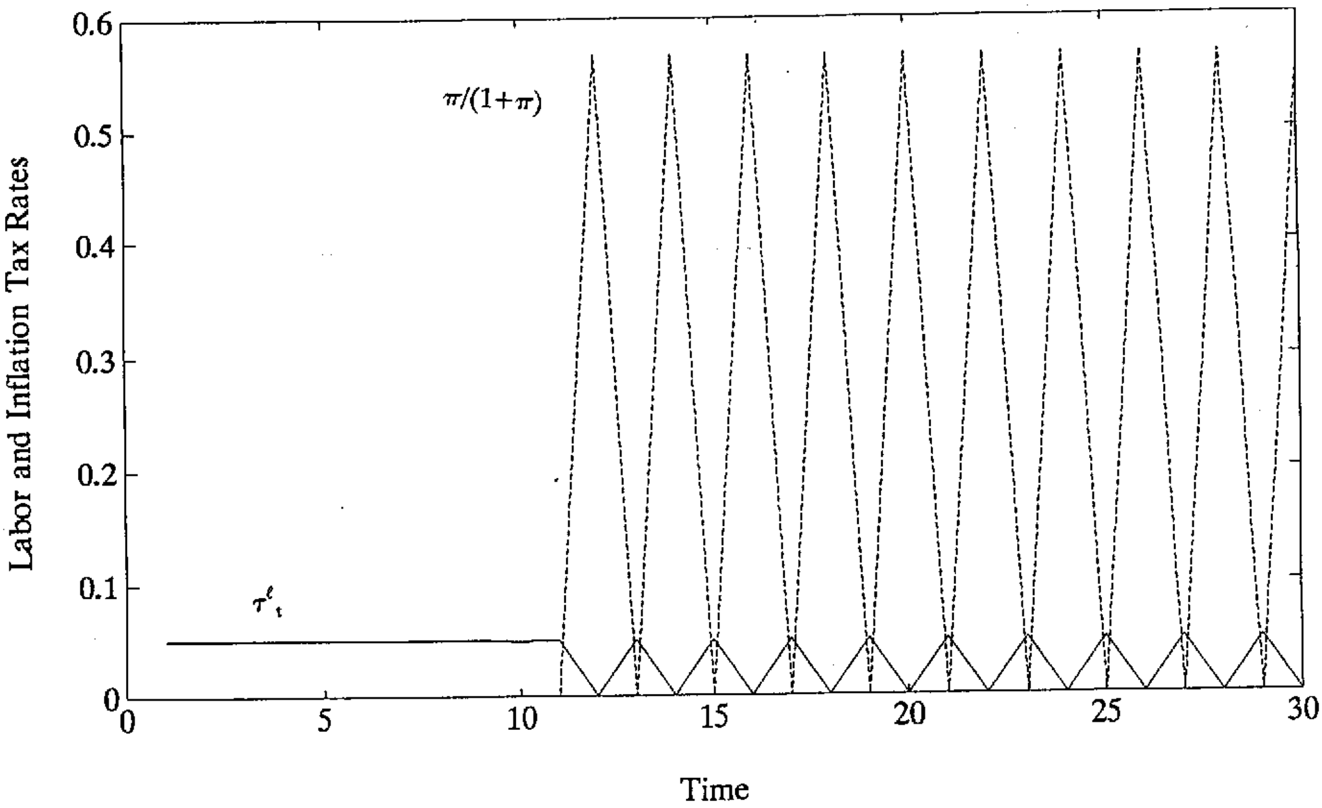
$k_{3,t}$

Figure 6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Labor and Inflation Tax Rates
Time
π/(1+π)
τ^{ℓ}_{t}

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