Tax Distortions in a Neoclassical Monetary Economy in the Presence of Administration Costs

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Abstract

This paper uses the neoclassical growth model to evaluate the size of distortions associated with different monetary and fiscal policies designed to finance government expenditures in the presence of administration costs. The model is calibrated to match important features of U.S. data, and used to evaluate welfare costs of monetary and fiscal policies. We find that the presence of administration costs increases the welfare costs of government policies involving different combinations of taxes on capital and labour income, consumption and money holdings. In addition, the welfare implications of tax reforms designed to replace the taxes on labor or capital income with less distorting forms of taxation are altered. Another implication of the results is that in economies with larger costs of administration, revenue replacement through seigniorage would be a more attractive option than other feasible forms of taxation.

1. Introduction

The aim of this paper is to analyse the steady state welfare implications of monetary and fiscal policies within the framework of a neoclassical growth model in which administration of taxes is costly. The model studied here is a simple extension of Cooley and Hansen's (1992) work, which evaluates the size of distortions associated with government policies involving different combinations of taxes on capital and labor income, consumption and also the implicit "inflation tax" on the holdings of money. As in the Cooley and Hansen paper, we construct an artificial monetary calibrated to U.S. data, and compute the welfare gains from tax reforms that are designed to replace the tax on capital and labor income with other forms of taxation.

Introducing administration costs of taxation may be important for obvious reasons. Firstly, we would expect welfare costs of policies to be higher. Secondly, given that there are no administration costs associated with inflation, it is of interest to examine whether tax reforms involving replacing the capital or labor taxes with the inflation tax are associated with relatively lower welfare costs.

As we will show, the presence of administration costs of taxation yields larger estimates of the welfare costs associated with each of the policies considered in the benchmark model without administration costs. In addition, the ranking of alternative policies is altered. Specifically, policies that replace capital and labor taxes with the inflation tax yield larger welfare gains relative to policies that replace them with the consumption tax. This seems to be consistent with some recent empirical evidence which suggests a negative correlation between seigniorage and other forms of taxation. See for example, Click (2000), and Kenny and Toma (1997). A further implication of the model is that economies with larger costs associated with tax administration might find the inflation tax a more attractive option than other forms of taxation.

In the next section of the paper we present the model economy. In Section 3 we discuss the calibration of the model, and the method used to compute the welfare costs associated with various policies. The results of the welfare analysis are presented and discussed in Section 4. Section 5 concludes.

2. The Model

The economy described below is a version of the dynamic general equilibrium model of Cooley and Hansen (1992), modified to incorporate administration costs of taxation. There is a continuum of identical infinitely lived households, with preferences described as follows:

$$\sum_{t=0}^{\infty} \beta^t (\alpha \log c_{1t} + (1-\alpha)\log c_{2t} - Bh_t), \qquad 0<\beta<1,\ 0<\alpha<1. \tag{1}$$

Here the variables c_{1t} and c_{2t} represent the household's period-t consumption of "cash" and "credit" goods respectively. The cash good can only be purchases using previously accumulated cash balances. This ensures that money is valued in the equilibrium. Hours worked h_t enter the utility function in a manner consistent with the "indivisible labor" assumption in Hansen (1985). Households maximize (1) subject to the sequence of budget and cash-in-advance constraints respectively given by

$$(1+\tau_{ct})(c_{1t}+c_{2t}) + x_t + \frac{m_{t+1}}{P_t} \le (1-\tau_{ht})w_t h_t + (1-\tau_{kt})r_t k_t + \tau_{kt}\delta k_t + \frac{m_t}{P_t} + TR_t, \tag{2}$$

and

$$(1+\tau_{ct})c_{1t} = \frac{m_t}{P_t} + TR_t. \tag{3}$$

In equation (2) x_t is investment, and m_{t+1} is the amount of money balances to be carried over to the next period. The sum of household consumption, the amount paid to the government in the form of the consumption tax, τ_{ct} investment and money carried over cannot exceed the after-tax labor and capital income, previously accumulated cash balances and transfers from the government which are respectively represented by the terms on the right hand side of (2). Specifically, τ_{ht} is the tax on labour, w_t is the wage rate, τ_{kt} is the tax on capital k_t, and r_t is the rental rate of capital. The third term reflects the depreciation allowance built into the tax code, where δ is the rate at which capital depreciates. The last term represents lump sum transfers from the government. Also, household investment expenditure in period-*t* is given by

$$x_t = k_{t+1} - (1-\delta)k_t. \qquad 0 < \delta < 1 \tag{4}$$

The representative firm in the economy hires labor and capital from the households to produce a composite consumption-investment good. There is a standard neoclassical aggregate production function of the Cobb-Douglas form, which combines capital (K_t) and labor input (H_t) to yield output (Y_t)[1]:

$$Y_t = K_t^{\theta} H_t^{1-\theta}, \qquad 0 < \theta < 1 \tag{5}$$

The competitive firm maximizes profit, which is given by $Y_t - w_t H_t - r_t K_t$. The first order conditions for the firm's profit maximization problem imply that w_t and r_t are given by:

$$w_t = (1-\theta) K_t^{\theta} H_t^{-\theta}; \tag{6}$$

$$r_t = \theta K_t^{\theta-1} H_t^{1-\theta}. \tag{7}$$

The government raises revenue in order to finance government expenditures G_t by imposing taxes and creating money. The government's monetary policy involves issuing money according to the following rule:

$$M_{t+1} = (1+\mu_{t+1})M_t \tag{8}$$

The government's revenue through seigniorage is then given by $\mu_{t+1} M_t / P_t$, where μ_{t+1} is the monetary growth rate. The fiscal policy of the government involves the taxation of consumption, labor and capital income and is subject to the constraint that the present value of expenditures must equal the present value of revenues. The government's budget constraint is therefore given by

$$G_t = \xi_h \tau_{ht} w_t H_t + \xi_k \tau_{kt} (r_t - \delta) K_t + \xi_c \tau_{ct} C_t + \frac{\mu_{t+1} M_t}{P_t} - TR_t. \tag{9}$$

[1] Capital letters denote aggregate economy wide per capita variables which an individual household regards as being outside its sphere of influence, while lower case letters denote variables specific to the household.

The parameters ξ_h, ξ_k, and ξ_c represent the proportion of tax revenue's from labor, capital and consumption that are left over after costs involved in the administration of these taxes have been incurred. Also, $C_t = C_{1t} + C_{2t}$.

For a value of μ greater than one, both M_t and P_t will grow without bound. In order to make the household's problem stationary, some of the variables need to be transformed. To that end, we define $\hat{m}_t = \frac{m_t}{M_t}$ and $\hat{P}_t = \frac{P_t}{M_t}$. We also restrict our focus to policies under which government expenditures, tax rates, and money growth rates are constant over time. The household's problem can then be reformulated as follows:

$$\max \sum_{t=0}^{\infty} \beta^t (\alpha \log c_{1t} + (1-\alpha) \log c_{2t} - B\, h_t)$$

subject to

$$(1+\tau_c)(c_{1t} + c_{2t}) + x_t + \frac{(1+\mu_{t+1})\hat{m}_{t+1}}{\hat{P}_t} = (1-\tau_h) w_t(K_t, H_t) h_t + (1-\tau_k) r_t(K_t, H_t) k_t + \tau_k \delta k_t + \frac{\hat{m}_t}{\hat{P}_t} + TR$$

$$(1+\tau_c) c_{1t} = \frac{\hat{m}_t}{\hat{P}_t} + TR$$

$$TR = \xi_h \tau_{ht} w_t H_t + \xi_k \tau_{kt} (r_t - \delta) K_t + \xi_c \tau_{ct} C_t + \frac{\mu \hat{M}_t}{\hat{P}_t} - G,$$

Where the three equations above are the transformed versions of the household budget and cash-in-advance constraints and the government budget constraint. In addition, the household's problem must be consistent with the aggregate economy-wide resource constraint, the law of motion for the aggregate capital stock, and the perceived functional relationship between the aggregate per capita state variable and investment, hours worked and the price level[2].

3. Calibration of the Model and Computation of Welfare Costs

In this section we first briefly describe the measure of welfare costs used. In order to compute welfare costs of any given policy, we calculate the percentage change in consumption that is required in order to make the household's steady-state utility equal to that which would obtain when all distortionary taxes were removed and the monetary growth rate were set equal to zero. In particular, we solve for x in the equation

$$\overline{U} = \alpha \log c_1^*(1+x) + (1-\alpha) \log c_2^*(1+x) - Bh^*,$$

Where c_1^*, c_2^*, and h^* are the consumption and labor allocations under the policy in question, and $\overline{U}$ represents the utility level attained when there are no taxes and zero money growth. Solving the above equation yields

$$x = \frac{e^{\overline{U} - Bh^*}}{c_1^{\alpha} c_2^{1-\alpha}} - 1.$$

[2] We do not state all these conditions and define the competitive equilibrium explicitly as the equilibrium concept here is analogous to the one in Cooley and Hansen's (1992) paper.

We now describe the calibration of the model. Since we wish to maintain comparability with our benchmark Coley and Hansen model, we choose the same parameter values as in that study. In particular, we let $\beta = 0.99, B = 2.6, \alpha = 0.84, \theta = 0.36, \delta = 0.02, \mu = 0, \tau_h = 0.23, \tau_k = 0.50$, and $\tau_c = 0$. Regarding the administration cost parameters, accurate estimates that correspond to the interpretation that would be applicable to ξ_h, ξ_k , and ξ_c are, to our knowledge, not available. We therefore set $\xi_h = \xi_k = \xi_c = \xi$, and then let ξ be a free parameter. Specifically, we consider two values for ξ , 0.9 and 0.8, which imply that administration costs account for 10% and 20% of revenues respectively.

4. Welfare Analysis of Alternative Policies

In this section we first compare the welfare costs of various policies that are designed to raise the same amount of revenues in the benchmark model with no administration costs. These policies involve different combinations of taxes on consumption and money growth, and a "base policy" with the tax and money growth parameters described in the previous section. Next, we preform the same analysis for the model with administration costs that are 10% and 20% of revenues respectively. The results of these steady state experiments are presented in Tables 1, 2, and 3, and Figures 1 and 2.

Table 1 replicates the steady state experiments of Cooley and Hansen (1992), and Tables 2 and three presents the same experiments with 10% and 20% administration costs respectively. The columns of these tables show the tax rates and money growth rate corresponding to the policies in question. The first row in each of these tables computes the welfare costs of the base policy, which is associated with an average labor tax rate of 23% and a capital tax rate of 50%. The money growth rates, consumption taxes and lump-sum transfers in this case are zero. The welfare cost of this policy, with no administration costs is 13.3% of GNP. As one would expect, the welfare losses in the presence of administration costs are higher, and this is true of all of the policies we consider.

The other policies considered are essentially tax reforms designed to replace either the capital or labor taxes starting from the base policy while keeping the revenue constant. The welfare costs of all of these policies, as mentioned before, is computed with reference to the policy that raises the same amount of revenue by replacing all taxes with a lump-sum tax. This policy is represented in the second row of the tables. In all of the cases, a policy that replaces the labor or the capital tax with a lump sum tax leads to the largest welfare gains. Again, the welfare improvements from this type of reform are larger in the presence of administration costs. For example, replacing the labor tax with the lump-sum tax decreases the welfare costs from 13.3% to 8.10% in the economy without administration costs, an improvement of 5.2%, which is less than the 6.95% improvement experienced by the economy with 20% administration costs, in which welfare costs decrease from 16.56% to 9.61% of GNP.

A striking difference that emerges from comparisons of the economies is the reversal of the ranking of reforms the replace labor or capital taxes with the consumption or the inflation tax. In the presence of no administration costs, policies that replace the labor or capital tax with the consumption tax improve welfare to a greater extent than policies that replace these taxes with other distorting taxes. In particular, replacing the capital tax with the consumption tax reduces welfare costs to a greater degree than could be achieved if it was replaced by the labor or inflation tax. However, in the presence of administration costs, reforms designed to replace the capital or labor taxes by revenue creation through seigniorage lead to larger welfare improvements compared to the consumption tax.

Figure 1 and 2 summarize the welfare consequences of some of the extreme policies in Tables 1 and 2. In these figures, we also look at the intermediate cases in which the capital and labor taxes are only partially replaced by consumption and inflation taxes. The first panel of Figure 1 looks at welfare reduction from replacing the labor tax with the consumption an inflation taxes for the economy with no administration costs, and the second panel presents the economy with 10% administration costs. As pointed out earlier, revenue replacement using the inflation tax leads to larger welfare gains in the presence of administration costs. Figure 2 illustrates the same result in the case of the capital tax, although in relatively less striking form.

5. Concluding Remarks

In this paper we examined the welfare implications of monetary and fiscal policies in the presence of costly administration of taxes. Based on our steady state analysis, some interesting qualitative and quantitative differences emerged relative to the standard case. Firstly, the size of distortions associated with all types of taxes increases with costly administration. The results here seem to suggest that economies with larger inefficiencies associated with tax administration are likely to experience larger benefits from such tax reforms. Secondly, the ranking of reforms designed to replace the capital and labor taxes, with other less welfare-reducing forms of taxation is altered. The implication of the model in this paper is that in economies with larger costs of administration, revenue replacement through seigniorage would be a more attractive option than other feasible forms of taxation.

References

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Table 1

Steady State Welfare Effects of Policies with no Administration Costs

Alternative Policies	τ_h	τ_k	μ	τ_c	τ	Welfare Cost (% of GNP)
Base Policy	.23	.50	0	0	0	13.3
Replace all taxes with						
Lump sum	0	0	0	0	.263	0
Replace labor tax with						
Lump sum	0	.50	0	0	.142	8.10
Inflation tax	0	.50	.293	0	0	12.43
Consumption tax	0	.50	0	.234	0	12.07
Replace capital tax with						
Lump sum	.23	0	0	0	.065	4.07
Labor tax	.343	0	0	0	0	7.77
Inflation tax	.23	0	.145	0	0	6.69
Consumption tax	.23	0	0	.119	0	6.60

Table 2

Steady State Welfare Effects of Policies with 10% Administration Costs

Alternative Policies	τ_h	τ_k	μ	τ_c	τ	Welfare Cost (% of GNP)
Base Policy	.23	.50	0	0	0	14.91
Replace all taxes with						
Lump sum	0	0	0	0	.2365	0
Replace labor tax with						
Lump sum	0	.50	0	0	.1287	8.85
Inflation tax	0	.50	.256	0	0	12.5785
Consumption tax	0	.50	0	.2344	0	13.6724
Replace capital tax with						
Lump sum	.23	0	0	0	.0597	5.1169
Labor tax	.343	0	0	0	0	9.1591
Inflation tax	.23	0	.1287	0	0	7.4010
Consumption tax	.23	0	0	.119	0	7.9810

Table 3

Steady State Welfare Effects of Policies with 20% Administration Costs

Alternative Policies	τ_h	τ_k	μ	τ_c	τ	Welfare Cost (% of GNP)
Base Policy	.23	.50	0	0	0	16.5571
Replace all taxes with						
Lump sum	0	0	0	0	.2103	0
Replace labor tax with						
Lump sum	0	.50	0	0	.1158	9.6148
Inflation tax	0	.50	.2214	0	0	12.7699
Consumption tax	0	.50	0	.2345	0	15.3125
Replace capital tax with						
Lump sum	.23	0	0	0	.0542	6.1834
Labor tax	.3434	0	0	0	0	10.5879
Inflation tax	.23	0	.113	0	0	8.1502
Consumption tax	.23	0	0	.1192	0	9.3981

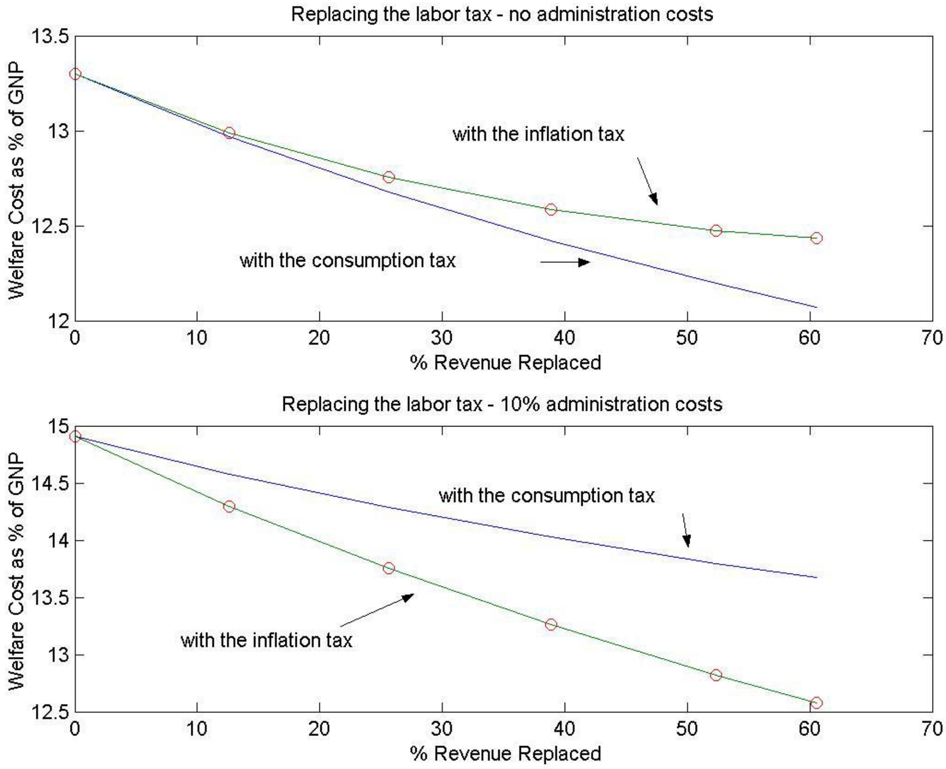
Replacing the labor tax - no administration costs
Welfare Cost as % of GNP
13.5
13
12.5
12
0
10
20
30
40
50
60
70
% Revenue Replaced
with the inflation tax
with the consumption tax
Replacing the labor tax - 10% administration costs
Welfare Cost as % of GNP
15
14.5
14
13.5
13
12.5
with the consumption tax
with the inflation tax

Figure 1

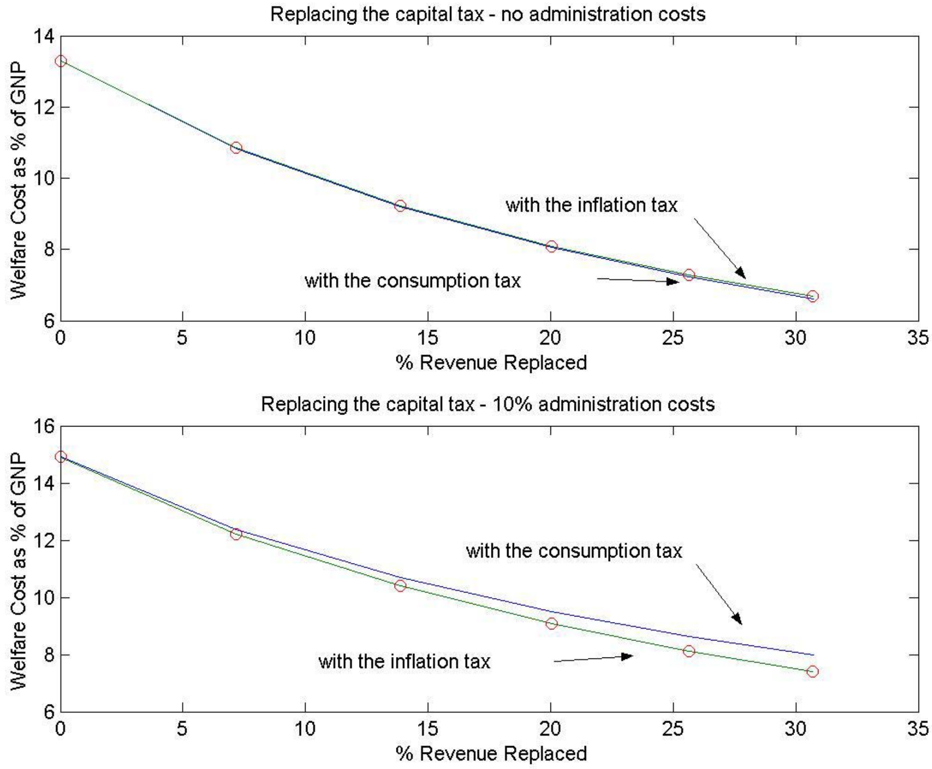
Replacing the capital tax - no administration costs
Welfare Cost as % of GNP
% Revenue Replaced
with the inflation tax
with the consumption tax
14
12
10
8
6
0
5
10
15
20
25
30
35
Replacing the capital tax - 10% administration costs
Welfare Cost as % of GNP
% Revenue Replaced
with the consumption tax
with the inflation tax
16
14
12
10
8
6
0
5
10
15
20
25
30
35

Figure 2