6. Deficits and inflation: seignorage as a source of public sector revenue

We have discussed the positive and normative issues involved in deciding between alternative ways (current taxes vs. debt i.e. future taxes) of financing a given path of government expenditure. In what follows, we will discuss a third way of financing government expenditure: seignorage.

The government budget constraint establishes a link between deficits and money creation. This provides important insights into some important issues:

1. Why do we observe positive rates of inflation in the long run?
2. Why do countries with high budget deficits often end up with high inflation?

and the related question of:

3. to what extent money financing can be a substitute for tax financing of a given path of government expenditure?

1 Why is the long run rate of inflation positive (I)?

How can we explain that inflation is positive in the long run? From the money market equilibrium condition

$$\frac{M}{P} = L(.), \tag{1}$$

we can see that for the price level to be growing over time it must be that the nominal supply of money is growing faster than the demand for real balances. In the long run wages and prices are likely to be flexible and people expectations more or less correct. So why should the monetary authority increase the supply of nominal balances at a rate which is systematically higher than the rate at which the demand for real balances expands?

If the classical dichotomy holds, the money supply just determines the price level and it is not clear why a growing price level should be preferred to a constant

or declining one. Furthermore, the nominal interest rate is the price to consumers, the opportunity cost, of holding money. As noted by Friedman (1969), if the marginal cost of printing money is small - suppose it is zero - and there are no distortions in the economy, social optimality requires the interest rate to be zero too. So the optimal rate of inflation should be such as to equalize the nominal return on the two bonds; i.e. to set $i = 0$.

Friedman's rule: the optimal rate of inflation is $\pi = -r$ where r is the real interest rate.

So why do we observe posive long-run inflation?

1. One explanation comes from the government intertemporal budget constraint. If $r > g$, solvency requires

$$b_{t-1} = \sum_{i=t}^{\infty} \frac{\tau_i - g_i + \sigma_i}{(1+r)^{i+1-t}}, \qquad (2)$$

   i.e. the current stock of debt cannot exceed the PDV of future surpluses + seignorage.

   If seignorage is zero, equation (2) implies that for a given path of government expenditure the PDV of taxes has to satisfy the above equation. Yet, once we allow for positive seignorage we have one more degree of freedom. For a given path of government expenditure, the above equation pins down only the PDV of the **sum** of taxes plus seignorage. So, seignorage is a substitute for taxes. An increase in the PDV of deficits requires an increase in the PDV of seignorage for the government budget constraint to be satisfied.

   If raising taxes to finance high levels of government expenditure is unfeasible for economic (primitive tax collection systems, limited tax base) or political (maintaining popularity) reasons, a country may have to resort to money printing to remain solvent.

2. Furthermore, if all taxes are distortionary than it may be efficient to use different taxes, including inflation which is a tax on real money balances, up to

the point wher their social marginal cost is equalized [Phelps (1973)]. This second point is controversial, though. Under certain, not necessarily general, conditions Friedman's rule is optimal even if taxes are distortionary.

1.1 Seignorage and the inflation tax

Real seignorage σ_t is given by

$$\sigma_t = \frac{\Delta M_t}{P_t} = \frac{\Delta M_t}{M_t}\frac{M_t}{P_t} = \mu_t \frac{M_t}{P_t}, \tag{3}$$

it increases with the rate of money creation μ_t and with the amount of real balance that people are willing to hold M_t/P_t. An increase in the amount of seignorage revenue σ necessary to ensure solvency requires an increase in the rate of money creation for a given demand for real balances.

Positive rates of inflation may just be the consequence of the need to finance budget deficits.

This link is especially clear in the case of high inflation countries: high rates of inflation are often associated with big deficits and debts.

Intuitively, high rates of money creation should result in high inflation. Yet, we want to understand the extent to which this happens. Let us look at how much of given rate of money creation μ results in inflation. Suppose, for simplicity, that the classical dichotomy holds, so that the equilibrium level of output and the real interest are determined by equilibrium of the labour and goods market. In order to determine the effect of money creation on inflation we then just need to look at the money market. For simplicity, let us take a money demand equation consistent with the quantity theory of money

$$\frac{M}{P} = \frac{Y}{V(r + \pi^e)} \tag{4}$$

and consider a situation in which μ has been constant for some time and is expected to be constant for the foreseeable future. Equilibrium requires the two sides

of the above equation to grow at the same rate or

$$\frac{\Delta M}{M} - \frac{\Delta P}{P} = \frac{\Delta Y}{Y} - \frac{\Delta V}{V}. \tag{5}$$

If μ is constant also the rate of inflation must be constant and if, actual and expected inflation coincide, also velocity will be constant. So, equation (5) can be rewritten as

$$\mu - \pi = g. \tag{6}$$

As long as output grows at a positive rate (thus resulting in higher demand for real balances) not all money growth results in inflation. In fact, it is

$$\pi = \mu - g. \tag{7}$$

Only the increase in the nominal money supply in excess of the increase in the demand for real balances is inflationary. For the same reason seignorage is related to, but does not coincide with the inflation tax.

The inflation tax is the loss in real wealth associated with inflation; i.e.

$$Inflation\ tax = \pi \frac{M}{P}. \tag{8}$$

Confronting equation (8) with (3) shows that the inflation tax differs from seignorage. Seignorage is positive even if inflation is zero as long as people want to increase their real money holding. Only when $g = 0$ the two coincide.

1.2 Limits to the monetary financing of deficits

At first sight the government intertemporal budget constraint suggests that any PDV of deficits can be financed by seignorage or, equivalently, that countries will always be solvent as they can always finance their deficits by printing money.

In fact, this is not the case. Excessive rate of money creation may result in lower rather than higher seignorage revenue.

For simplicity assume that the money demand is

given by

$$\frac{M}{P} = Y[a - b(r + \pi^e)]. \tag{9}$$

This is equivalent to equation (4) with velocity given by

$$V = \frac{1}{[a - b(r + \pi^e)]}. \tag{10}$$

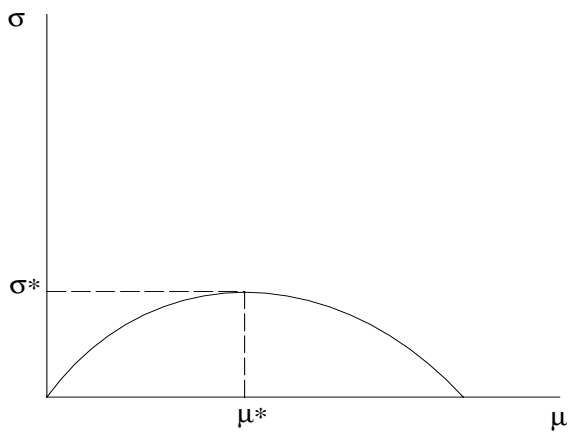
If the economy is in long run equilibrium and expectations are realized we know that it is

$$\pi^e = \pi = \mu - g. \tag{11}$$

So we can write real seignorage as

$$\sigma = \mu\frac{M}{P} = \mu Y[a - b(r + \mu - g)]. \tag{12}$$

A higher rate of money creation μ has an ambiguous effect on σ. It increase σ for given real balances, but it also reduces real money demand (hence equilibrium real balances) for given g by increasing expected inflation. People economize on real balances as the opportunity cost of holding them ($i = r + \pi^e$) increases. A



higher μ increases seignorage only to the extent that it does not reduce real money holdings more than proportionally. This mechanism is reminescent of a Laffer curve. Increasing tax rates boosts revenues at an unchanged tax base, but may reduce the tax base with a negative effect on revenue.

In fact it is possible to show that increasing the rate of money creation μ above a certain level reduces rather than increases σ.

We can easily determine the maximum level of seignorage revenue that the government can extract; that is the upper bound on the possible monetary financing of deficits by maximizing equation (12) with respect to μ, the variable that is under the control of the monetary authority.

The FOC for seignorage maximization is given by

$$\frac{d\sigma}{d\mu} = a - b(r + \mu - g) - b\mu = 0, \tag{13}$$

which corresponds to a rate of money creation

$$\mu^* = \frac{a - b(r - g)}{2b}. \tag{14}$$

Substituting in equation(12) we find that the associated maximum amount of real seignorage is

$$\sigma^* = \frac{[a - b(r - g)]^2}{2b}. \tag{15}$$

So a country cannot finance any deficit by money printing and is bankrupt if the government budget constraint is satisfied only with a level of seignorage in excess of σ^*. On the other hand, a country which is printing money at a rate $\mu < \mu^*$ can always resort to money financing.