Lecture 6. Overborrowing and the Tobin Tax

Applied International Economics.

Gabriel Marin

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The Model

In this model

Objectives

- An economy with an upward supply of funds, left by its own, overborrows relative to the planners solution
- Understand how a tax on borrowing can induce the private sector to act optimally

Assumptions

- Endowment economy
- Two periods
- Single tradable good
- Increasing real interest rate

Budget constraints

For the two periods we have

$$c_1 = d_1, \tag{1}$$

$$c_2 = y_2 - (1 + r^s)d_1, \tag{2}$$

where d_1 is the net external debt; $y_2 > 0$ is output in period 2, and r^s is the real interest rate charged by international creditors. We assume for simplicity that output in period 1 is zero, to ensure that consumers borrow in the first period. Combining the budget constraints yields:

$$\frac{y_2}{(1 + r^s)} = c_1 + \frac{c_2}{(1 + r^s)}. \tag{3}$$

Households

The households' utility function has the following form:

$$W = log(c_1) + \beta log(c_2), \tag{4}$$

The first-order conditions (assuming $\beta(1 + r) = 1$) are:

$$\frac{1}{c_1} = \lambda, \tag{5}$$

$$\frac{\beta}{c_2} = \frac{\lambda}{1 + r^s}, \tag{6}$$

Combining them we get:

$$\frac{1}{c_1} = \beta(1 + r^s)\frac{1}{c_2} \tag{7}$$

An upward-sloping supply of funds

In Lecture 1 we assumed that the economy could borrow at a constant real interest rate. Now we assume that the economy has the following upward sloping supply of funds:

$$r^S = r + f(d_1), \; f(0) = 0, \; f'(d_1) > 0. \tag{8}$$

The larger the debt, the higher the interest rate charged by creditors. This feature seeks to shed light on the idea that the larger the country's debt, the more likely it will default.

Solution

Solution

Substitute the Euler equation into the budget constraint and consider $\beta = 1/(1+r)$ to obtain:

$$\frac{c_2}{c_1} = \frac{1+r+f(d_1)}{1+r}. \tag{9}$$

Since c_1 must be positive, it follows that $d_1 > 0$, which implies $f(d_1) > 0$. Therefore,

$$c_2 > c_1. \tag{10}$$

Contrary to our basic model, this economy is unable to smooth consumption over time. While it borrows to consume in the first period, it is unable to borrow enough to consume the same at both periods since borrowing more increases the interest rate.

Planner’s problem

The planner's problem

Suppose now you have a central planner that knows that the economy's borrowing level will determine the interest rate. To solve this problem, substitute Equations (1, 2) into the lifetime utility and considering Equation (7), we obtain:

$$W = log(d_1) + \beta log\{y_2[1 + r + f(d_1)]d_1\}. \tag{11}$$

We have only one state variable d_1. The planner will choose d_1 to maximize the consumer's lifetime utility, which yields the following first-order condition:

$$\frac{1}{d_1} = \beta \frac{1 + r + f(d_1) + f'(d_1)d_1}{y_2 - [1 + r + f(d_1)]d_1}. \tag{12}$$

The planner's problem (continued)

Using Equation (8), the denominator of Equation (12) can be written as $y_2 - (1 + r^s)d_1$. Moreover, using both budget constraints and $\beta = 1/(1 + r)$, we can simplify Equation (12) to

$$\frac{c_2}{c_1} = \frac{1 + r + f(d_1) + f'(d_1)d_1}{1 + r}. \tag{13}$$

Similar to the competitive equilibrium, the planner would not choose to smooth consumption over time. The question that matters to us is how does the planner solution compares to the one in the competitive equilibrium? For that we have:

$$(\text{Planner})\frac{c_2}{c_1} = \frac{1 + r + f(d_1) + f'(d_1)d_1}{1 + r} > \frac{1 + r + f(d_1)}{1 + r} = \frac{c_2}{c_1}(\text{CGE}), \tag{14}$$

which implies that $c1/c2$ is lower under the planner equilibrium. In other words, the private sector tends to overconsume in the first period (borrow too much) relative to the second period when there is no social planner. The reason is due to the fact that when making borrowing decisions, individual consumers do not take into account the fact the their individual decisions affect the interest rate charged to the country as a whole.

Tobin tax: An example

We now show an example of the idea that, by imposing a tax on borrowing, the government can replicate the planner's solution. Suppose that the upward sloping supply of funds takes the following linear form:

$$r^s = r + \alpha d_1. \tag{15}$$

From Equation (13), the planner's solution satisfies:

$$\frac{c_2}{c_1} = \frac{1 + r + 2\alpha d_1}{1 + r}. \tag{16}$$

Suppose now that the government imposes a tax on borrowing, payable in the second period, that is increasing in the amount of borrowing:

$$\tau(d_1) = \frac{\alpha}{2} d_1. \tag{17}$$

In other words, the more a consumer borrows, the higher is the tax rate that he/she pays.

Tobin tax (continued)

The budget constraints are as follows:

$$c_1 = d_1, \tag{18}$$

$$c_2 = y_2 - (1 + r^s + \frac{\alpha}{2} d_1) d_1. \tag{19}$$

Substitute both constraints into the lifetime utility:

$$W = log(d_1) + \beta log(y_2 - (1 + r^s + \frac{\alpha}{2} d_1) d_1). \tag{20}$$

Differentiate with respect to d_1 we obtain:

$$\frac{1}{d_1} = \beta \frac{1 + r^s + \alpha d_1}{y_2 - (1 + r^s + \frac{\alpha}{2} d_1) d_1}. \tag{21}$$

After some rearranging we obtain:

$$\frac{c_2}{c_1} = \frac{1 + r + 2\alpha d_1}{1 + r}. \tag{22}$$

Exactly the same condition as the planner! Hence, the choice of c_1 and c_2 will be the same as the planner with a Tobin tax as the one described.

In summary

- In the presence of an upward-sloping supply of funds, the market solution will entail overconsumption and overborrowing.
- By imposing a tax on borrowing, the government can induce consumers to borrow the optimal amount.