Reading 9
Deficits, Debts, and Inter-Generational Equity

I. What is Debt and What is a Deficit?

All governments borrow to finance their expenditures. One reason for this is that future generations will make use of the public capital created now and therefore they will pay in part for it with their taxes in the future. This is why that governments should only borrow to finance the creation of long-lived public capital (e.g. roads, schools, bridges) and not current expenditures (e.g. salaries, energy bills, etc.).

Government debt can come in the form of government issued bonds or in loans made to government by lending institutions. Most government bonds are issued in their own currency, but this need not be so. Government bonds can be bought by domestic and foreign investors. Bonds issued or loans granted in a foreign currency represent a higher risk since the government cannot create money to cover the servicing of the debt. That is, it cannot monetize the debt. The risk that a government cannot pay back its debts to foreign groups, and therefore defaults on its debts, is called sovereign risk.

Debt is the value of currently outstanding liabilities (bonds and loans) of the government that must be paid back in the future. Debt is a stock and not a flow. However, this stock can change over time. The change in debt is called the deficit. By contrast, **the deficit** is a flow and not a stock. The deficit can change over time, as well. Debts grow larger because of positive deficits. When deficits turn to surpluses, the outstanding debts fall and therefore the debt falls. This of walking up a set of stairs. Each stair's height represents a deficit or and the total height of the stairs from the ground is the debt. To make it even more realistic, imagine each stair on the staircase is of different height (small tall, some short). Here is a simple mathematical formula for the debt (the sum of deficits).

$$\text{Debt}_1 = \text{Deficit}_1 + \text{Deficit}_2 + \text{Deficit}_3 + \text{Deficit}_4 + ...$$

We are assuming that the subscript 1 denotes this year and the subscript 2 denotes last year, and so on. Note that

$$\Delta\text{Debt}_1 = \text{Debt}_1 - \text{Debt}_2 = \text{Deficit}_1$$

This shows how that the time change in a stock is a flow.

Decisions made on the issuance of debt, its maturity, the size of the tranches and timing of the issuances, the underwriting, whether the debt is inflation protected, etc. is made through Ministries of Finance (or Treasury departments). For the case of the US, understanding government budgets requires that you know well the meaning of the following terms – (i)

authorizations, (ii) appropriations, (iii) budget authority, and (iv) outlays. Most governments must work something very close to this, as well.

(i) Authorizations – Whenever the government wishes to spend money on a program, it must first create the program and then limit the program's budget. This is done by an authorization bill. Within the legislation called the authorization, the program being created is described and its overall purpose is described. An _upper limit_ is placed on the program to ensure that it does not spend money wantonly. This alone shows that the US government recognizes the possibility that programs may become oriented only to themselves and their size in the budget, so some limits must be placed on them.

(ii) Appropriations – Once a program has been created, it can then receive an appropriation for a certain length of time that is within the authorized upper limit. The program exists because of the authorization, but the appropriation gives the program the right to spend money. If a program is authorized to exist but no money is appropriated, it cannot spend money.

(iii) Budget Authority – The value of the upper limit authorization and allocation for spending through appropriation are both stated in terms of budget authority. Budget authority is an amount that will eventually be spent during a particular fiscal period.

(iv) Budget outlay – Budget authority leads to the spending of money, but the actual amount spent in a particular fiscal period is called the budget outlay or just outlay.

Budgets are produced by planning agencies under the control of elected members of the government in line with political philosophies, lobbying, party platforms, and political inertia. Budgets are concerned with spending, although some writers include revenues into the budget planning, as well. This is important, since many times by law spending cannot be increased without a cut in other spending or a revenue enhancement.

II. Choices of Funding

Governments, wherever they are located, have limited sources of revenue. We can list these sources in the following manner –

> (i)   taxation at various levels and on different bases
>
> (ii)   borrowing (bonds and loans)
>
> (iii)   money creation
>
> (iv)   rent on and sales of public assets, including privatization of state owned
>
>   enterprises (SOEs)
>
> (v)   profits of SOEs
>
> (vi)   lotteries, and

(vii) foreign aid.

The first three of these sources of revenue are the most important, and certainly the first method of finance is the one used most often (i.e. taxation). In Taiwan, at the central government level, there are twenty separate legislative acts relating to taxation and its collection (all of these are discussed here).

Bonds are a formal way of promising to pay back money (with interest) that has been borrowed. Instead of borrowing, we say that government issues and sells a bond. It then promises to pay a certain amount of interest on this principal borrowed usually twice a year (or semi-annually). There are three things on a bond which do not change over the life of the bond (i) the face value, (ii) the maturity date, and (iii) the coupons or interest payments every six months. For example, in Figure 1 below we have a bond that has face value (FV) equal to $1000. It has a maturity set three years in the future (say November 30, 2020). There will be semi-annual coupons paying $15 each semi-annual period and for three years this means six coupons. These three things do not change on the bond. There are only two things that can change with respect to a bond – the **bond price** (P_b) and the **(YTM) yield to maturity** (r). In fact, as we shall see, these two things are mathematically and inversely related, like petals on a bicycle.

Figure 1

A three-year coupon bond – semi-annual payments

Government Bond
$1000
November 30, 2020

$15	$15	$15
$15	$15	$15

$$P_b = \sum_{i=1}^{5} \frac{\$15}{(1+r)^{i/2}} + \frac{\$15+\$1000}{(1+r)^3}$$

P_b = price of the bond and r = YTM

If $P_b = 1070$, then

$r = 0.003202$ or 0.3202% per annum

You can calculate this using Excel and successive approximations, but an easier way is here, using the following information. Actually, Excel can give you very precise numbers if you are patient in your scanning. It does not take very long either.

Face Value = 1000, Current Price = 1070, Coupon yield = (15 + 15)/1000 = 0.03 or 3% which is referred to confusingly as the annual rate, 3 years to maturity, and semi-annual payments.

The rate of return anticipated on a bond if it is held until the maturity date.

Par Value:	1000
Market Value:	1070
Annual Rate:	3 %
Maturity in Years:	3
Payments:	○ Quarterly ◉ Semi - Annually ○ Annually

Calculate

Yield to Maturity: **0.32%**

III. A Simple Model of Government Budget Dynamics

In the following we want to present a rigorous, but still simplified, model of government budget dynamics using mathematics. The ideas are actually quite simple. You only need to first think about the logic and then think about the economic meaning. If you go beyond this you will find plenty to criticize. This model not mine. Instead, it was given as a problem on the MA qualifier at the University of Chicago many years ago. The poor students taking the qualifier had to come up with the answers in a matter of minutes, whereas you will be able to see the answer step by step. To make things simple, I will create a short video showing this section. You can download the video from my website. This little model is very informative since it lets you consider nearly everything important in discussing the debt (except for international factors).

Questions:

#1. What is the equation for the basic central government budget constraint?

#2. Debt is a stock while a deficit is a flow. Explain.

#3. Raising tax rates must result in lower deficits. Explain why this may _not_ be true.

#4. Lowering government spending must reduce deficits. Explain why this may _not_ be true.

#5.   Suppose the bond in the example above has a price of $980. Find the yield to maturity (YTM).

#6.   Suppose the bond in the example above has a price of $1000. Find the YTM.

#7.   Why does the long run debt to GDP ratio fall when the money supply grows faster?

#8.   What happens to the long run debt to GDP ratio when the real interest rate rises?

#9.

#10.