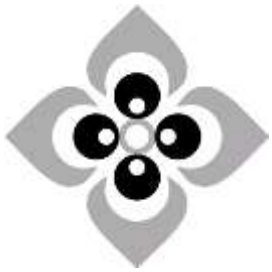

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[Government Budget Constraints]

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Lecture No. & Title:	3(three): Government Budget Constraints

Government Budget Constraints

Introduction:

Hello friends, in this session, we will discuss about the constraints of the government budget.

Whenever we talk about the government budget, we start from the case of balanced budget in which revenues equal expenditures. But the budget will not remain in balanced condition always due to the fact that government may deliberately create a deficit by decreasing taxes or increasing expenditure.

So in this session we will discuss about the deficits, debt, spending and taxes as these four conditions are the constraints of the government budget.

Deficits and Debts:

First we will discuss about the definitions of deficits and debts in a layman's language.

Debt is a stock concept used to show what the government owes because of the past deficits while deficit is a flow concept used to show the extent of government borrowings during a given year.

This budget deficit can be written in arithmetic form:

$Deficit_t = rB_{t-1} + (G_t - T_t)$ ---------- (1)

In this equation:

- B_{t-1} expresses government debt at the end of year t-1;

  r is the real interest rate which is assumed constant here and hence, rB_{t-1} is equal to the real interest payments on the government debt in year t.
- G_t represents government spending on goods and services during year t.
- T_t shows net tax which is taxes paid minus transfer payments during year t.

Hence, from the above discussion, we can now state that budget deficit is equal to spending which includes interest payments on debt, minus taxes net of transfers.

Equation (1) has several characteristics-

- By this equation, we measure interest payment as real interest payment that is the product of the nominal interest rate and the existing debts because the official measures of the deficit use actual interest payments which is incorrect and can be seriously misleading.

  Official measure of the deficit-

  Deficit=iB+ (G-T)

  In this equation,

  iB shows the nominal (actual) interest payment

  G shows spending on goods and services

  T shows taxes minus transfer payments

  This equation of official measure shows a correct measure of the cash flow position of government but it is not an accurate measure to show the changes in real debt, that is, the change in how much the government owes, expressed in terms of goods. If it is positive then it means government is spending more than it is receiving and hence must issue new debt. And if the case is reverse that is negative then it means government buys back previously issued debt.

  This can be shown by the help of taking real interest payment and this method of measuring deficit is sometimes called as inflation-adjusted deficit.

- Another characteristic of this equation is that G shows the spending on goods and services excluding transfer payments. Instead, it is subtracted from T.

Now, the government budget constraint can be stated simply as "the change is government debt during year t is equal to the deficit during year t".

$B_t - B_{t-1} = deficit_t$ ---------- (2)

The above equation shows that if the government runs a deficit, then government debt increases and if government runs a surplus, government debt decreases.
Now, using the above two equations i.e. (1) and (2), we can rewrite the government budget constraint as-

$B_t - B_{t-1} = rB_{t-1} + (G_t - T_t)$ ---------- (3)

This equation shows that budget constraint links the changes in government debt to the initial level of debt and to current government spending and taxes.
For the sake of convenience, we can decompose the deficit into-

- Interest payments on the debt i.e. rB_{t-1}
- Primary deficit, i.e. $G_t - T_t$ which is the difference of spending and taxes.

Now, we can rewrite the equation (3) as-

$$B_t - B_{t-1} = (rB_{t-1}) + (G_t - T_t)$$

In the equation:
$(B_t - B_{t-1})$ shows change in the debt
(rB_{t-1}) shows the interest payments
$(G_t - T_t)$ shows primary deficit
Reorganizing the equation we get-

$$B_t = (1+r)\, B_{t-1} + (G_t - T_t) \text{ ---------- (4)}$$

This equation shows that the debt at the end of year t is equal to (1+r) times the debt at the year t-1 plus the primary deficit during the year t.

Implications:

Current Vs Future Taxes:

To see the implications, we will first consider a one year decrease in taxes for the path of debt and future taxes.
We suppose that there is a situation until year 1 when the government budget is balanced, and hence initial debt is equal to zero.
Now we will discuss it with an example where during year 1, government decreases taxes by 1 billion dollars for 1 year. Hence, at the end of the year 1 the debt is B_1 which is equal to 1 (B_1=1)

Full Repayment In Year 2:

Suppose, the government decides to repay fully the debt during year 2, the budget constraint for year 2 is given by the equation-
$B_2 = (1+r)B_1+(G_2-T_2)$
Now if the government repaid the debt fully by the year 2, then at the end of the year 2, the debt is equal to zero. (B_2=0)
Replacing B_1 by 1 and B_2 by 0 gives a new equation-
$T_2-G_2 = (1+r)\ 1 = (1+r)$
The government must run a primary surplus equal to (r+1) to repay the debt fully during year 2.
Government can do this in any of the two ways:

- A decrease in spending
- An increase in taxes

Here it is assumed that the adjustments will be through taxes, and hence the path of spending is unaffected. For this, the decrease in taxes by 1 during year 1 must be offset by an increase in taxes by (1+r) during year 2.
Full repayment in year 2: T_1 decreases by 1; T_2 increases by (1+r).
The path of taxes and debt corresponding to this case is given in figures-

Full Repayment In Year t:

Now suppose that the government decides to wait till year t to repay the debt.
The primary deficit is zero during the year 2, hence the debt at the end of the year 2 is –
$B_2 = (1+r)\ B_1+0= (1+r)\ 1= (1+r)$
At the end of the year 3, the debt is-
$B_3 = (1+r)\ B_2+0= (1+r)\ (1+r)\ 1= (1+r)^2$
Debt grows at a rate equal to the interest rate, as long as the government keeps a primary deficit equal to zero, and hence, the debt at the end of year (t-1) is given by-

$B_{t-1}= (1+r)^{t-2}$ ----------(5)

The budget constraint for the year t (the year in which the government decides to repay the debt)-

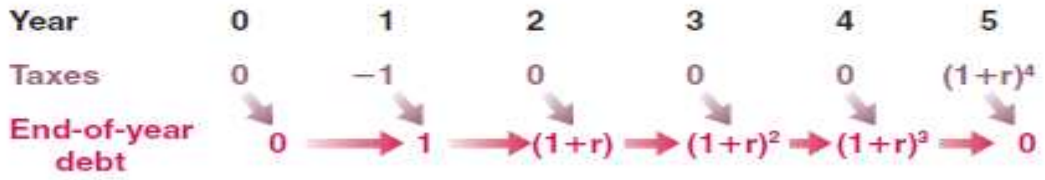
$B_t= (1+r)B_{t-1}+(G_t-T_t)$

If debt is fully repaid during the year t, then B_t that is debt at the end of the year t is zero.
Replacing B_t by zero and B_{t-1} by its expressions from equation (5) gives-

$0 = (1+r)\ (1+r)^{t-2}+(G_t-T_t)$

Reorganizing the equation-
$T_t-G_t= (1+r)^{t-1}$
The equation shows that, the government must run a primary surplus equal to (1+r)t-1 during the year t to repay the debt.
The path of taxes and debt where debt is repaid in year 5 is given in figure-

(b) Debt Reimbursement in Year 5



With the above examples we can conclude:

- A decrease in taxes must eventually be offset by an increase in taxes in future, if government spending is unchanged.
- The longer the government waits to increase taxes, or the higher the real interest rate is, the higher the eventual increase in taxes must be.
-

Debt Stabilization In Year t:

Debt stabilization means changing taxes or spending in such a way that debt remains constant from then on.
Now we will see what will be the conditions if the government only stabilizes the debt. Suppose government decides to stabilize the debt from the year 2 which means the debt at the end of year 2 and thereafter remains at the same level as it was at the end of year 1.
The budget constraint equation-

$B_2 = (1+r)B_1 + (G_2 - T_2)$----------(6)

With the assumption that debt is stabilized in the year 2,

$B_2 = B_1 = 1$---------- (7)

Replacing equation (7) in (6)

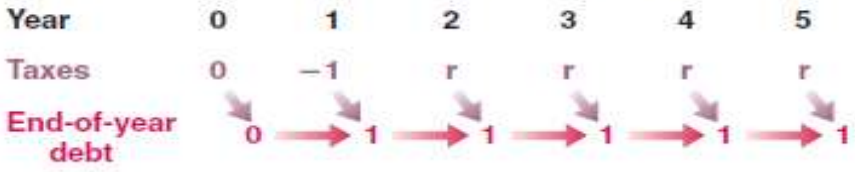
$1 = (1+r) + (G_2 - T_2)$

Reorganizing the equation-

$T_2 - G_2 = (1+r) - 1 = r$

The path of taxes and debt is shown in figure:

(c) Debt Stabilization in Year 2



The above example yields second set of conclusions-

- The legacy of past deficits is higher government debt
- The government must eliminate the deficit to stabilize the debts

The Evolution Of Debt To GDP Ratio:

In the above section we have focussed on the evolution of the level of debt. But to focus on the ratio of debt to output is more sensible because in any economy output grows over time.

To see the change, we will take the equation 4 from above that is- $B_t = (1+r)\, B_{t-1} + (G_t - T_t)$ which will give the evolution of the **debt-to-GDP-ratio**.

First we will divide both sides of equation by real output, Y_t,

$$B_t / Y_t = (1+r)\, B_{t-1} / Y_t + (G_t - T_t) / Y_t$$

Now, multiply the numerator and the denominator by Y_{t-1}

$$B_t / Y_t = (1+r)\, (Y_{t-1}/Y_t)\, B_{t-1} / Y_t + (G_t - T_t) / Y_t$$

In the above equation, all terms are now in terms of ratios to output, Y.

To simplify this equation, we assume that output growth is constant and denote the growth rate of output by g, so

(Y_{t-1}/Y_t) can be written as $1/(1+g)$.

By the use of approximation we get-

$(1+r)/(1+g) = 1+r-g$

By the help of above two assumptions, we write the above equation as-

$$B_t / Y_t = (1+r-g)\, B_{t-1} / Y_t + (G_t - T_t) / Y_t$$

Reorganizing the above equation we get-

$$B_t / Y_t - B_{t-1} / Y_{t-1} = (r-g)\, B_{t-1} / Y_t + (G_t - T_t) / Y_t \quad \text{_____(8)}$$

Equation (8) gives us following information-

The left side of the equation shows the change in the debt ratio over time which is equal to the sum of two terms:

- The first term is the difference between the real interest rate and the growth rate multiplied by the initial debt ratio.
- The second term is the ratio of the primary deficit to GDP.

Conclusion:

When we compare the 8th equation ($B_t/Y_t - B_{t-1}/Y_{t-1} = (r-g)\, B_{t-1}/Y_t + (G_t-T_t)/Y_t$) which shows the evolution of the ratio of debt to GDP with the 3rd equation ($B_t - B_{t-1} = rB_{t-1} + (G_t-T_t)$) which shows the evolution of the level of debt. The difference is the presence of (r-g) in equation --- (8).

This difference shows the situation when primary deficit is zero. Debt will then increase at a rate equal to the real interest rate, r. But if GDP is growing as well, the ratio of debt to GDP will grow more slowly. It will grow at a rate equal to the real interest rate minus the growth rate of output (r-g).