EC502 Macroeconomics

Week 16 Seminar: Intertemporal Budget Constraints
Borrowing, Lending and Intertemporal Budget Constraints

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1. Explain..[a)].

Rational expectations

- People behave in ways that maximize their utility or profits
- People have access to all information and they make optimal decisions based on this knowledge
- Outcomes will not differ systematically from what people expect them to be
- People may be wrong some of the time, but on average they will be correct
- People learn from past mistakes by adjusting their forecasting of the future
- Example: Ricardian equivalence

b) Can a consumer spend more than its disposable income at any point in time?

$Y_1 - T_1 < C_1$?

By borrowing future income at the discount rate 1/(1+r) or saving all for future consumption

$$C_1 = (Y_1 - T_1) + \frac{(Y_2 - T_2)}{1+r} \text{ when } C_2 = 0$$
$$C_2 = (Y_1 - T_1)(1+r) + (Y_2 - T_2) \text{ when } C_1 = 0$$

1. Explain..c).

How would the consumer's IBC look like with 3 periods?[1]

$C_1 + C_2 + C_3 = Y_1 + Y_2 + Y_3$

$C_1 + \frac{C_2}{1+r} + \frac{C_3}{(1+r)^2} = Y_1 + \frac{Y_2}{1+r} + \frac{Y_3}{(1+r)^2}$

And N periods?

$C_1 + \frac{C_2}{1+r} + \frac{C_3}{(1+r)^2} + ... + \frac{C_N}{(1+r)^{N-1}} = Y_1 + \frac{Y_2}{1+r} + \frac{Y_3}{(1+r)^2} + ... + \frac{Y_N}{(1+r)^{N-1}}$

[1] Assume $T = 0 \quad \forall t$, such that $Y_t - T_t = Y_t \quad \forall t$

1. Explain...

d) Ricardian Equivalence

- Consumers are forward-looking and so internalize the government's budget constraint when making their consumption decisions
- If government $\downarrow T_1$, you would expect consumption allocation C_1 to change: more disposable income $Y_1 - \downarrow T_1 = \uparrow C_1$
- BUT actually it will **NOT** change as they expect $\uparrow T_2$ in the next period.
- Agents decide over two periods, government goal to keep balanced budget $\downarrow T_1 - G_1 = \frac{G_2 - \uparrow T_2}{1+r}$
- Consumption allocation does NOT change:

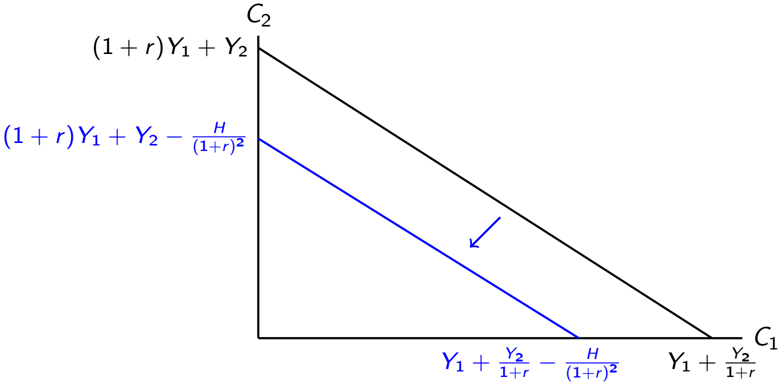
$$C_1 + \frac{C_2}{1+r} = (Y_1 - \downarrow T_1) + \frac{Y_2 - \uparrow T_2}{1+r}$$

- Example: exercise 3

2. Write down the IBC with a bequest for children of H:

- Consider the bequest as future consumption of the children of this agent (consumption after the lifetime of the said individual)

$$C_1 + \frac{C_2}{1+r} + \frac{H}{(1+r)^2} = Y_1 + \frac{Y_2}{1+r}$$



3. Suppose a 2-period economy...

$$Y_1 = 1000, \quad Y_2 = 1200, \quad r = 0.05,$$
$$T_1 = 200, \quad T_2 = 300, \quad G_1 = 300, \quad D_1 = 0$$

a) Calculate government expenditure in period 2

(Substitute with the above values:)

$$G_1 - T_1 + D_1 = \frac{T_2 - G_2}{1 + r}$$

3. Suppose a 2-period economy...

$$Y_1 = 1000, \quad Y_2 = 1200, \quad r = 0.05,$$
$$T_1 = 200, \quad T_2 = 300, \quad G_1 = 300, \quad D_1 = 0$$

a) Calculate government expenditure in period 2

(Substitute with the above values:)

$$\text{IGBC:} \qquad \underbrace{\underbrace{G_1 - T_1}_{\text{primary deficit}} + \underbrace{D_1}_{\text{old debt}}}_{\text{total current expense}} = \underbrace{\frac{T_2 - G_2}{1 + r}}_{\text{next period surplus}}$$

$$300 - 200 + 0 = \frac{300 - G_2}{1 + 0.05} \quad \longleftrightarrow \quad G_2 = 195$$

So discounted future surplus is $(300 - 195)/1.05 = 100$

3. Suppose a 2-period economy...

b) Express consumer's budget constraint

$$C_1 + \frac{C_2}{1+r} = (Y_1 - T_1) + \frac{Y_2 - T_2}{1+r}$$
$$= (1000 - 200) + \frac{1200 - 300}{1 + 0.05} = 1657.14$$

Given rational expectations, we can add both private and public IBC together:

$$C_1 + \frac{C_2}{1+r} = (Y_1 - T_1) + \frac{Y_2 - T_2}{1+r} + T_1 - G_1 - \frac{G_2 - T_2}{1+r}$$
$$= (Y_1 - G1) + \frac{Y_2 - G_2}{1+r}$$
$$= (1000 - 300) + \frac{1200 - 195}{1+0.05} = 1657.14$$

Consumers internalize the government spending plan. - RE

3. Suppose a 2-period economy...

a) Assume $T_1' = 100$ but expenditure is the same. Will the IBC change?

$C_1 + \frac{C_2}{1+r} = (Y_1 - \downarrow T_1) + \frac{Y_2 - \uparrow T_2}{1+r}$

Recall consumers have **rational expectations** so they expect $\uparrow T_2$ to keep balanced budget (Ricardian Equivalence)

- If $G_1 = 300$, $G_2 = 195$, then $T_2' = ??$

  $T_1' - G_1 = \frac{G_2 - T'2}{1+r}$

  solve for new T, T' : T' = 405

  Then use $T_2' = 405$ into the consumer's budget constraint:

  $C_1 + \frac{C_2}{1+r} = (1000 - 100) + \frac{1200 - 405}{1+0.05} = 1657.14$
- No, it won't change as consumers know that T will have to increase in the future for the government to meet its IBC. For consumers, the total disposable income amount has NOT changed: same IBC

4. IBC of a firm

If the real interest rate is 5%, what's the value of a firm that invests £100,000 and expects to have net returns of £40,000 next year, £52,000 the year after and £56,000 the third year and then close down with equipment valued at zero? What if the firm expects to sell the equipment in period 3 for £20,000?

- Net present value of an investment: without resale.

  $V = \frac{F(K)_2}{(1+r)} + \frac{F(K)_3}{(1+r)^2} + \frac{F(K)_4}{(1+r)^3} - K$

4. IBC of a firm

If the real interest rate is 5%, what's the value of a firm that invests £100,000 and expects to have net returns of £40,000 next year, £52,000 the year after and £56,000 the third year and then close down with equipment valued at zero? What if the firm expects to sell the equipment in period 3 for £20,000?

- Net present value of an investment: without resale.

  $$V = \frac{F(K)_2}{(1+r)} + \frac{F(K)_3}{(1+r)^2} + \frac{F(K)_4}{(1+r)^3} - K$$

  $$\frac{40{,}000}{1.05} + \frac{52{,}000}{1.05^2} + \frac{56{,}000}{1.05^3} - 100,000 = 33,635.68$$

- Including resale value

  $$V = \frac{F(K)_2}{(1+r)} + \frac{F(K)_3}{(1+r)^2} + \frac{F(K)_4}{(1+r)^3} + \frac{K_3}{(1+r)^3} - K$$

  $$= \frac{40000}{1.05} + \frac{52{,}000}{1.05^2} + \frac{56{,}000}{1.05^3} + \frac{20{,}000}{1.05^3} - 100,000 = 50,912.43$$