

# Fiscal Policy and Ricardian Equivalence

ECON 30020: Intermediate Macroeconomics

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# Readings

- ▶ GLS Ch. 12.1-12.2

# Fiscal Policy

- ▶ The term *fiscal policy* refers to government spending and tax collection
- ▶ We will study fiscal policy in a particularly simple environment – endowment economy with no production
- ▶ Basic conclusions will carry over to a model with production
- ▶ Key result: *Ricardian Equivalence*. Ricardian Equivalence states that the manner in which a government finances its spending (debt or taxes) is irrelevant for understanding the equilibrium effects of changes in spending
- ▶ We will also discuss the “government spending multiplier”

# Environment

- ▶ Time lasts for two periods,  $t$  and  $t + 1$
- ▶ Government does an exogenous amount of expenditure,  $G_t$  and  $G_{t+1}$ . We do not model the usefulness of this expenditure (i.e. public good provision)
- ▶ Like the household, the government faces two flow budget constraints:

$$G_t \leq T_t + B_t$$

$$G_{t+1} + r_t B_t \leq T_{t+1} + B_{t+1} - B_t$$

- ▶  $B_t$ : stock of debt government debt issued in  $t$  and carried into  $t + 1$
- ▶ Government can finance its period  $t$  spending by raising taxes ( $T_t$ ) or issuing debt ( $B_t$ , with initial level  $B_{t-1} = 0$ )
- ▶ Same in period  $t + 1$ , except government also has interest expense on debt,  $r_t B_t$

# Intertemporal Budget Constraint

- ▶ Note that  $B_t > 0$  means debt (opposite for household savings) and  $B_t < 0$  means government saving
- ▶ Terminal condition:  $B_{t+1} = 0$
- ▶ Intertemporal budget constraint is then:

$$G_t + \frac{G_{t+1}}{1 + r_t} = T_t + \frac{T_{t+1}}{1 + r_t}$$

- ▶ Conceptually the same as the household
- ▶ Government's budget must balance in an intertemporal present value sense, not period-by-period

# Household Preferences

- ▶ Representative household. Everyone the same
- ▶ Household problem the same as before. Lifetime utility:

$$U = u(C_t) + \beta u(C_{t+1}) + \underbrace{h(G_t) + \beta h(G_{t+1})}_{\text{Can Ignore}}$$

- ▶ Cheap way to model usefulness of government spending: household gets utility from it via  $h(\cdot)$
- ▶ As long as “additively separable” manner in which household receives utility is irrelevant for understanding equilibrium dynamics
- ▶ Hence we will ignore this

# Household Budget Constraints

- ▶ Faces two within period flow budget constraints:

$$C_t + S_t \leq Y_t - T_t$$
$$C_{t+1} + S_{t+1} - S_t \leq Y_{t+1} - T_{t+1} + r_t S_t$$

- ▶ Household takes  $T_t$  and  $T_{t+1}$  as given
- ▶ Imposing terminal condition that  $S_{t+1} = 0$  yields household's intertemporal budget constraint:

$$C_t + \frac{C_{t+1}}{1 + r_t} = Y_t - T_t + \frac{Y_{t+1} - T_{t+1}}{1 + r_t}$$

# Household Optimization

- ▶ Standard Euler equation:

$$u'(C_t) = \beta(1 + r_t)u'(C_{t+1})$$

- ▶ Can write household's IBC as:

$$C_t + \frac{C_{t+1}}{1 + r_t} = Y_t + \frac{Y_{t+1}}{1 + r_t} - \left[ T_t + \frac{T_{t+1}}{1 + r_t} \right]$$

- ▶ But since present value of stream of taxes must equal present value of stream of government spending, this is:

$$C_t + \frac{C_{t+1}}{1 + r_t} = Y_t + \frac{Y_{t+1}}{1 + r_t} - \left[ G_t + \frac{G_{t+1}}{1 + r_t} \right]$$



# Taxes Drop Out

- ▶ From the household's perspective, knowing that the government's IBC must hold, we can get:

$$C_t + \frac{C_{t+1}}{1 + r_t} = Y_t - G_t + \frac{Y_{t+1} - G_{t+1}}{1 + r_t}$$

- ▶ In other words,  $T_t$  and  $T_{t+1}$  drop out
- ▶ From household's perspective, it is as though  $T_t = G_t$  and  $T_{t+1} = G_{t+1}$
- ▶ This means that the consumption function (which can be derived qualitatively via indifference curves and budget lines) does not depend on  $T_t$  or  $T_{t+1}$ :

$$C_t = C^d(Y_t - G_t, Y_{t+1} - G_{t+1}, r_t)$$

# Intuition

- ▶ All the household cares about when making its consumption/saving decision is the present discounted value of the stream of income
- ▶ A cut in taxes, not met by a change in spending, means that future taxes must go up by an amount equal in present value
- ▶ Example:
  - ▶ Cut  $T_t$  by 1
  - ▶ Holding  $G_t$  and  $G_{t+1}$  fixed, the government's IBC holding requires that  $T_{t+1}$  go up by  $(1 + r_t)$
  - ▶ Present value of this is  $\frac{1+r_t}{1+r_t} = 1$ , the same as the present value of the period  $t$  cut in taxes – i.e. it's a wash from the household's perspective

# Ricardian Equivalence

- ▶ Ricardian Equivalence due to Barro (1979), named after David Ricardo
- ▶ Basic gist: the manner of government finance is irrelevant for how a change in government spending impacts the economy
- ▶ Increasing  $G_t$  by increasing  $T_t$  (“tax finance”) will have equivalent effects to increasing  $G_t$  by increasing  $B_t$  (“deficit finance”)
- ▶ Why? Current debt is equivalent to future taxes, and household is forward-looking
- ▶ Debt must equal present value of government’s “primary surplus” (taxes less spending, excluding interest payments):

$$B_t = \frac{1}{1 + r_t} [T_{t+1} - G_{t+1}]$$

- ▶ Issuing debt equivalent to raising future taxes

# Ricardian Equivalence in the Real World

- ▶ Ricardian Equivalence rests on several dubious assumptions:
  1. Taxes must be lump sum (i.e. additive)
  2. No borrowing constraints
  3. Households forward-looking
  4. No overlapping generations (i.e. government does not “outlive” households)
- ▶ Nevertheless, the basic intuition of Ricardian Equivalence is potentially powerful when thinking about the real world

# Fiscal Policy in an Endowment Equilibrium Model

- ▶ Market-clearing requires that  $B_t = S_t$  – government borrowing equals household saving
- ▶ Equivalently, “aggregate saving” equals zero:

$$S_t - B_t = 0$$

- ▶ But this is:

$$Y_t - T_t - C_t - (G_t - T_t) = 0$$

- ▶ Which implies:

$$Y_t = C_t + G_t$$

# Equilibrium Conditions

- ▶ Household optimization:

$$C_t = C^d(Y_t - G_t, Y_{t+1} - G_{t+1}, r_t)$$

- ▶ Market-clearing:

$$Y_t = C_t + G_t$$

- ▶ Exogenous variables:  $Y_t, Y_{t+1}, G_t, G_{t+1}$ .
- ▶ Taxes irrelevant for equilibrium!
- ▶ IS and  $Y^s$  curves are conceptually the same as before, but now  $G_t$  and  $G_{t+1}$  will shift the IS curve

# The Government Spending Multiplier

- ▶ Total desired expenditure is:

$$Y_t^d = C^d(Y_t - G_t, Y_{t+1} - G_{t+1}, r_t) + G_t$$

- ▶ Impose that income equals expenditure:

$$Y_t = C^d(Y_t - G_t, Y_{t+1} - G_{t+1}, r_t) + G_t$$

- ▶ Totally differentiate, holding  $r_t$ ,  $Y_{t+1}$ , and  $G_{t+1}$  fixed:

$$dY_t = \frac{\partial C^d}{\partial Y_t}(dY_t - dG_t) + dG_t$$

- ▶ Or:  $dY_t = dG_t$
- ▶ This tells you that, *holding  $r_t$  fixed*, output would change one-for-one with government spending – i.e. the “multiplier” would be 1. This gives horizontal shift of the IS curve to a change in  $G_t$

## The Multiplier without Ricardian Equivalence

- ▶ Suppose that the household is not forward-looking, so desired expenditure, equal to total income, is:

$$Y_t = C^d(Y_t - T_t, r_t) + G_t$$

- ▶ Suppose that there is a deficit-financed increase in expenditure, so that  $T_t$  does not change. Totally differentiating:

$$dY_t = \frac{\partial C^d}{\partial Y_t} dY_t + dG_t$$

- ▶ Simplifying one gets a “multiplier” of:

$$\frac{dY_t}{dG_t} = \frac{1}{1 - MPC} > 1$$

- ▶ Note: this assumes (i) no Ricardian Equivalence and (ii) fixed real interest rate



## “Rounds of Spending” Intuition

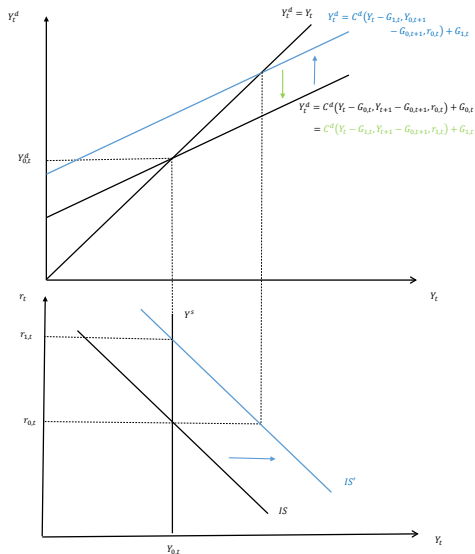
- ▶ One can think of several “rounds” of spending happening within a period
- ▶ In round 1, government spending goes up by 1
- ▶ With no Ricardian equivalence, this generates 1 of income, which generates  $MPC$  of extra consumption in round 2. This extra  $MPC$  of consumption in round 2 generates  $MPC$  extra income, which generates  $MPC^2$  of extra consumption in round 3, and so on:

$$\frac{dY_t}{dG_t} = 1 + MPC + MPC^2 + MPC^3 + \dots = \frac{1}{1 - MPC}$$

- ▶ With Ricardian Equivalence, process is similar, but initially only a  $1 - MPC$  infusion of spending (because household reacts to increase in  $G_t$  as though taxes have increased):

$$\frac{dY_t}{dG_t} = (1 - MPC) + MPC(1 - MPC) + MPC^2(1 - MPC) + \dots = \frac{1 - MPC}{1 - MPC} = 1$$

# Graphical Effects: Increase in $G_t$



## Crowding Out

- ▶ An increase in  $G_t$  has no effect on  $Y_t$  in equilibrium
- ▶ Hence, private consumption is completely “crowded out”:  
 $dC_t = -dG_t$
- ▶ To make this compatible with market-clearing,  $r_t$  must rise
- ▶ Increase in  $G_{t+1}$  has opposite effect:  $r_t$  falls to keep current  $C_t$  from declining
- ▶ Again,  $r_t$  adjusts so as to undo any desired smoothing behavior by household
- ▶ Multiplier is *zero* in equilibrium. *Not* a consequence of Ricardian Equivalence, but rather assumption of endowment economy where output cannot react

# Graphical Effects: Increase in $G_{t+1}$

