Fiscal policy in a world without frictions and rational forward looking agents

Francesco Giavazzi

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The Intertemporal Dimension of Fiscal Policy

- When discussing Fiscal Policy we must start by recognizing that countries (and governments) are in for the long term
- They don't need to balance their books year-by-year:
  - they can spend in excess of tax revenue today (running up debt)
  - provided they will be able to pay back their debt in the future thanks to tax revenues in excess of spending (otherwise households will not buy government bonds)
- That's why – in order to understand Fiscal Policy – we need to be able to value streams of income that will come at some time in the future
- The Present Value of a stream of income is the value today (time t_0) of a stream of income that will flow between t_0 and some future date, say $t_0 + T$

Valuing today goods that will be received tomorrow

- Assume the economy has a technology to transfer goods from today (period t) to tomorrow (period $t+1$). For instance one unit of corn used as seed and planted today yields $(1+r)$ units of corn tomorrow

$$y_{t+1} = (1+r)\, y_t$$

- Then the price of a unit of good at time $t+1$ relative to a unit of good at time t (*i.e.* the number of units of t good required to obtain 1 unit of $t+1$ good)

$$\frac{[\text{units of goods at time } t]}{[\text{units of goods at time } t+1]} = \frac{1}{(1+r)}$$

- Thus if one wants to add up the two goods at time t, the way to do it is

$$y_t + \frac{y_{t+1}}{(1+r)}$$

The Consumption Function

- To start thinking about Fiscal Policy it is useful to move a step beyond the textbook (Blanchard et al, *Macroeconomics*) consumption function and realize that consumption also depends on a household's wealth

$$C = C\left(Y^{disp}, Wealth\right)$$

$$Wealth = W^{financial} + W^{housing} + PDV(Y^{disp})$$

- The first term is financial wealth (stocks and bonds), the second is the value of the family's house (because they can use it as "collateral" to borrow from a bank), the third is human wealth, the value of expected income (net of taxes) over a lifetime: if you attend an MBA you can go to the bank and ask for a loan anticipating you will land a job on Wall Street (we shall see in a minute what are the consequences if the bank refuses to lend you the money)

Consumption and Wealth

- $$C = C\left(Y^{disp}, Wealth\right)$$
  $$Wealth = W^{financial} + W^{housing} + PDV(Y^{disp})$$

- Assuming $r_t = r = constant$ for all t

$$PDV(Y^{disp}) = \sum_{i=0}^{T} \frac{Y_{t+i} - T_{t+i}}{(1+r)^i} = \sum_{i=0}^{T} \frac{Y_{t+i}^{disp}}{(1+r)^i}$$

How can Fiscal Policy Affect Consumption ?

- The fact that consumption depends on wealth is useful to understand how Fiscal Policy affects consumption

- To see why this is the case, we begin by considering *intertemporal budget constraints*

Does it matter how a government finances G ?

- Assume there are only two periods. The government's *intertemporal budget constraint*, i.e. its budget constraint over the two periods is

$$T_1 + \frac{T_2}{(1+r)} = G_1 + \frac{G_2}{(1+r)}$$

- The households' *intertemporal budget constraint*—assume for the moment that financial and housing wealth are zero, so that the only form of wealth is $PDV(Y^{disp}, Y \ \textit{for simplicity})$—is

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

The irrelevance of the government's decision whether to tax today or tomorrow

Assume that households realize that the government is subject to an intertemporal budget constraint and consider two cases

The government budget is balanced in each period

$$T_1 = G_1, \quad T_2 = G_2$$

then

$$\begin{aligned} C_1 + \frac{C_2}{(1+r)} &= (Y_1 - T_1) + \frac{(Y_2 - T_2)}{(1+r)} \\ &= (Y_1 - G_1) + \frac{(Y_2 - G_2)}{(1+r)} \end{aligned}$$

Taxes only in period 2

$$T_1 = 0, \quad G_1 = B, \quad T_2 = G_2 + B(1+r)$$

substituting we still get

$$C_1 + \frac{C_2}{\quad} = (Y_1 - G_1) + \frac{(Y_2 - G_2)}{\quad}$$

Ricardian Equivalence

- From 1. and 2. we see that they way the government finances a given level of spending makes no difference. All that matters is $PDV(G) = G_1 + \frac{G_2}{(1+r)}$ Whether
  - $T_1 = G_1, \quad T_2 = G_2$
  - or $\quad T_1 = 0, \quad G_1 = B, \quad T_2 = G_2 + B(1+r)$
- makes no difference

Ricardian Equivalence

- This result is known as *Ricardian Equivalence* from David Ricardo the British economist who first noted this
- in his *Essay on the Funding System* (1820) Ricardo studied whether it makes a difference to finance a war that costs £20 with £20 million in current taxes, or to issue government bonds with infinite maturity (consols) and annual interest payment of £1 million in all following years financed by future taxes
- at the assumed interest rate of 5%, Ricardo concluded that there is no difference between the three modes: 20 millions £ in one payment made in year 1, 1 million £ per annum forever starting in year 1, or £1,2 million for 45 years are all precisely of the same value
- if the horizon is infinite, $\sum_{1}^{\infty} \frac{1}{(1+r)}^{i} = \frac{1}{(1+r)} + \frac{1}{(1+r)^2} + \frac{1}{(1+r)^3} + \ldots = \frac{1}{r}$ so that if $\frac{1}{r} = 20$, then $r = \frac{1}{20} = 5\%$
- if the horizon is not infinite, for instance only T years, then compute x so that $\frac{x}{(1+r)} + \frac{x}{(1+r)^2} + \frac{x}{(1+r)^3} + \ \ldots \ + \frac{x}{(1+r)^T} = \ 20$ for $T = 45$, $x = 1.2$

Private Consumption and Government Spending

- Assume G_1 increases to $G_1^{'} > G_1$, while G_2 does not change. Assume also that G yields no utility to consumers.
  - $\left(Y_1 - G_1^{'}\right) + \frac{(Y_2 - G_2)}{(1+r)} = \left(C_1 + \frac{C_2}{(1+r)}\right)_{|G_1^{'}} < \left(C_1 + \frac{C_2}{(1+r)}\right)_{|G_1} = (Y_1 - G_1) + \frac{(Y_2 - G_2)}{(1+r)}$
  - $\frac{d\left(C_1 + \frac{C_2}{(1+r)}\right)}{dG_1} < 0$. This is what is sometimes referred to as an "expansionary fiscal contraction".
  - the *opposite sign* compared with what you have learned so far in your *Macro* textbook !

Expansionary fiscal contractions: Denmark, 1983-86

(numbers are average yearly growth rates over the period indicated)

avg change over the period	$1979-82$	$1983-86$
$\%\Delta$ **G**	**+ 4.0**	**0.0**
$\%\Delta$ **T**	- 0.03	+ 1.3
$\Delta(G-T)/Y$	+ 1.8	- 1.8
$\Delta\ (debt/Y)$	+10.2	0.0
$\%\Delta\ Y^{disposable}$	+ 2.6	- 0.3
$\%\Delta$ **C**	**- 0.8**	**+ 3.7**
$\%\Delta\ I$	- 2.9	+12.7
$\%\Delta\ real\ GDP$	+ 1.3	+ 3.2

Source: Giavazzi, F. and M. Pagano 1990 "Can Severe Fiscal Contractions Be Expansionary?"

- This means that a cut in G can be expansionary: if consumption increases enough to more than compensate the reduction in G
- Cuts in G can be good news for the economy

Expansionary contractions: How can this be possible ?

- if Ricardian Equivalence holds
- $\frac{d\left(C_1+\frac{C_2}{(1+r)}\right)}{dG_1} < 0$
- since $Y = C + G$ (forgetting I)
- $\frac{dY_1}{dG_1}$?
- but you could make the argument also for I: $\frac{dI}{dG} < 0$
- $I = PDV(NetProfits) - cost\ of\ capital$
  - $G \downarrow \ PDV(NetProfits)\ |_{cost\ of\ capital} \uparrow \quad I \uparrow$
- then $\frac{dY_1}{dG_1}$ ¡ 0 is even more likely

The limits to the Ricardian Equivalence

- We will now show that the result that the government's financial policy is irrelevant (or Ricardian Equivalence) depends on a few strong assumptions
- Ricardo himself had doubts. In the same essay he writes: *"But the people who paid the taxes never so estimate them, and therefore do not manage their private affairs accordingly. We are too apt to think that the war is burdensome only in proportion to what we are at the moment called to pay for it in taxes, without reflecting on the probable duration of such taxes. Moreover it would be difficult to convince a man who possessed £20,000 that a perpetual payment of £50 per annum was equally burdensome as a single tax of £1000"*
- In other words, only if people are rational, and expect to live as long as the government, they would be indifferent as to when they pay taxes

The limits of Ricardian Equivalence (cont.)

- Two assumptions are needed for Ricardian Equivalence to hold
- The horizon of households corresponds to that of the government. In other words, people think they will pay all the taxes the government will eventually have to levy, *i.e.* they will not leave debts (future taxes to pay) to their children to pay
- People can freely borrow against the *PDV* of their future income

The limits of Ricardian Equivalence (cont.)

- We now consider what happens if these conditions fail, namely if
  - Households' horizon is shorter than that of the government
  - Households cannot freely borrow against their expected future income

1. Households' horizon is shorter than that of the government

- if people plan to be around in period 2
  - $\left\{ \begin{array}{c} T_1 = 0 \\ G_1 = B \\ G_2 = 0 \end{array}, \; T_2 = B(1+r) \right\}$
  - $C_1 + \frac{C_2}{(1+r)} = (Y_1 - G_1) + \frac{(Y_2 - G_2)}{(1+r)}$
- if people anticipate that the government will wait period 3 to balance its books ($T_2 = 0, \; T_3 = B(1+r)^2$) and think they will not be around in period 3, then
  - $C_1 + \frac{C_2}{(1+r)} = Y_1 + \frac{Y_2}{(1+r)}$
- In this case

$$\frac{d\left(C_1 + \frac{C_2}{(1+r)}\right)}{dG_1} = 0 \quad \text{not} \quad < 0 \quad !$$

- the debt, B , is transferred to the next generation who will bear its burden: if did not, nobody would buy B in period 1

2. Liquidity constraints (people cannot borrow on the expectation of higher future income)

- to keep the algebra simple let $\left\{ \begin{array}{cc} G_1 = G_2 = G & C_1 = C_2 = C \\ r = 0 & Y_1 = Y_2 = Y \end{array} \right\}$
- note that we introduce the assumption that consumers not only satisfy their budget constraint but also wish to keep their consumption path flat
- then the max achievable level of consumption is

$$C_1 + \frac{C_2}{(1+r)} = 2C = 2Y - 2G$$

- and the optimal path of consumption is

$$C_1 = C_2 = C = Y - G$$

Liquidity Constraints (cont.)

- Assume all taxes are levied in $t = 1$ $\left\{ \begin{array}{c} T_2 = 0 \\ T_1 = 2G \end{array} \right\}$
  - along the optimal path $C_1 = C_2 = C = Y - G$
    - thus in $t = 1$ $\quad Y_1^{disp} = Y - 2G$ and $C = Y - G$ so that $\mathbf{C} > \mathbf{Y}_1^{disp}$
    - and in $t = 2$ $\quad Y_2^{disp} = Y =$ and $C = Y - G$ so that $\mathbf{C} < \mathbf{Y}_2^{Disp}$
- but if households cannot borrow in $t = 1$ the optimal path of consumption cannot be achieved

Discussion (remember the "Medium Run" in your macro text book)

- So far we have assumed Y_1 and Y_2 to be exogenous
  - in particular we have assumed that the level of output does not respond to G: this is a BIG assumption
- In other words, we have studied the effects of G in the *medium run* (remember the distinction between *short - medium and long run* in the macro textbook) where y_n (the *medium run* level of output) is fixed, in particular it is independent of M, G, and T
  - go back to the definition of the *Medium Run* in your macro text book

How do these results compare with what you learned in your macro text book?

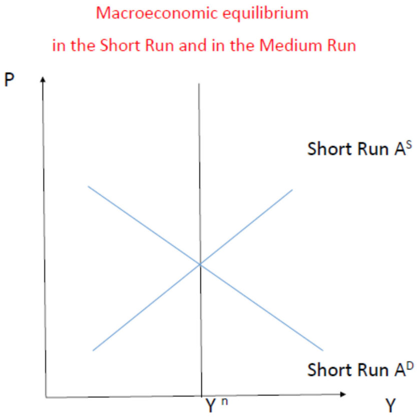
- If $y = y_n$ it is obvious that private sector demand $(C + I)$ must fall as G rises

- But the channel through which this happens is different in this model, compared to the $AS - AD$ model
  - in the $AS - AD$ model, as G rises, P rises, M/P falls, i rises and *investment* falls to make room for G
  - here C falls, but the fall in C has nothing to do with i (there is no money market in the model we have studied): it depends on the expectation of higher T in the future

- In the $AS - AD$ model crowding out happens mostly via *interest rates*. G affects Y so long as prices are fixed and the effect vanishes as prices adjust

- Here instead crowding out happens through the anticipation of future taxes

How do these results compare with what you learned in your macro text book?



Discussion (cont)

- Could an increase in G raise y_n (the medium run level of output) ? Remember what determines y_n
  - the level of mark-ups and the generosity of unemployment benefits
    - nothing G can do about mark-ups
    - but higher G could mean more generous unemployment benefits: these lower the response of wages to unemployment (Remember that y_n depends on the parameter describing generosity of u benefits)
  - y_n also depends on the production function: $Y = AN$. If G is spent, for instance, on *public infrastructure*, it could improve the efficiency of private sector firms and thus raise Y for any level of labor input N. In this case higher G would raise y_n

Discussion (cont)

- Key difference between partial and general equilibrium
  - In partial equilibrium, focus on one change/parameter holding all other parameters constant;
  - In general equilibrium, allow all variables and parameters to adjust.
- The Ricardian equivalence in partial vs general equilibrium:
  - Partial: r is held constant
  - General: r is the instrument through which the government incentivizes the consumers' borrowing.
- Bottom line: in a more complete (a general equilibrium) model the effects of changes in G happen through many channels: here we have studied one special channel (crowding out via expected future taxes), a channel you had not seen before.