

Lecture 21: Fiscal Policy

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Fiscal policy – motivation & overview

- So far: study how monetary policy can stabilize short-run fluctuations
- Challenge in the Great Recession: interest rates at the zero lower bound
 - Contraction was demand-driven: financial crisis leads to household and firm deleveraging, collapsing demand. In our model: $\hat{\theta}_t \ll 0$
 - Optimal policy response is to cut interest rates significantly, but can't cut below zero. What to do?
- This lecture notes: fiscal policy – tools & their effects
 1. Government purchases: investment in infrastructure, defense spending, ...
Revisit RBC model, then study gov't spending in NK model.
 2. Stimulus checks: send lump-sum transfers to households
Most popular tool nowadays. Introduce “Ricardian Equivalence,” study stimulus checks in NK model, and apply to recent inflation spike.

Outline

1. Government Purchases

RBC Model

NK Model

2. Stimulus Checks

Ricardian Equivalence

Hand-to-Mouth Consumption

Modeling government purchases

- Suppose that the government now also purchases some amount of the final good, denoted g_t , financed by higher taxes

Examples in practice: infrastructure, science funding, military spending, ...

- We will study the effects of this in our usual labor-only economies, so the aggregate resource constraint now becomes

$$y_t = c_t + g_t$$

- Furthermore assume that gov't spending is not valued by households, so their per-period utility function is still $u(c_t)$

Essentially same results if valued in additively separable way, i.e., $u(c_t) + v(g_t)$.

- We will now see what gov't spending does in our two models:
 1. **RBC model**
 2. **NK model**

As usual the predictions of the NK model will be the relevant ones for the short run.

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Government spending in the RBC model

- Model equations [Detailed derivation on the board.]

- The resource constraint is

$$c_t + g_t = y_t \quad (1)$$

- The production function is

I am assuming constant returns to scale and fixed productivity, for simplicity.

$$y_t = \ell_t \quad (2)$$

and so real wages will be $w_t = 1 =$ marginal product of labor

- Household optimal labor supply is

$$w_t c_t^{-\gamma} = \ell_t^{\frac{1}{\phi}} \quad (3)$$

g_t is financed with *lump-sum* taxes. Enters the budget constraint and makes households poorer, but no direct effect on labor supply equation (3).

- The household Euler equation [= savings condition] is

$$c_t^{-\gamma} = \beta(1 + r_{t+1})\mathbb{E}_t [c_{t+1}^{-\gamma}] \quad (4)$$

- Experiment: a one-off change in gov't spending, g_t

Model solution

- Combining market-clearing (1) and labor supply (3) with the production function (2), we get

$$y_t^{-\frac{1}{\gamma\varphi}} + g_t = y_t$$

- Using the implicit function theorem:

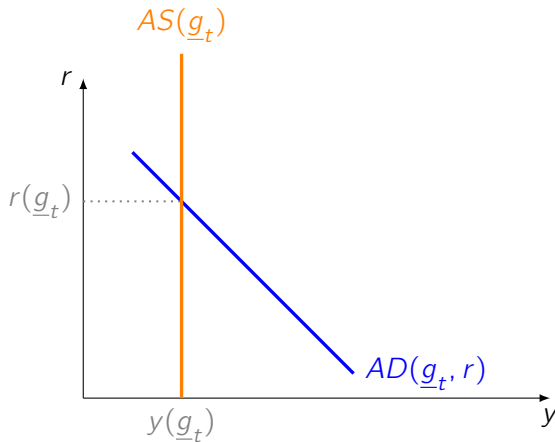
$$\frac{\partial y_t}{\partial g_t} = \frac{1}{1 + \frac{1}{\gamma\varphi} y_t^{-\frac{1+\gamma\varphi}{\gamma\varphi}}} \in (0, 1)$$

- Government spending increases output, but less than 1-1, so consumption drops. Gov't spending *crowds-out* consumption.
- Output rises only *because* consumption drops, which incentivizes more work
In the background: gov't spending financed with higher taxes, hh's get poorer.
- Since c_t drops but c_{t+1} is unchanged [since consider 1-period change in g_t], real interest rates need to increase, by the Euler equation (4)

A visual representation

policy experiment: increase g_t from $\underline{g}_t$ to $\bar{g}_t$

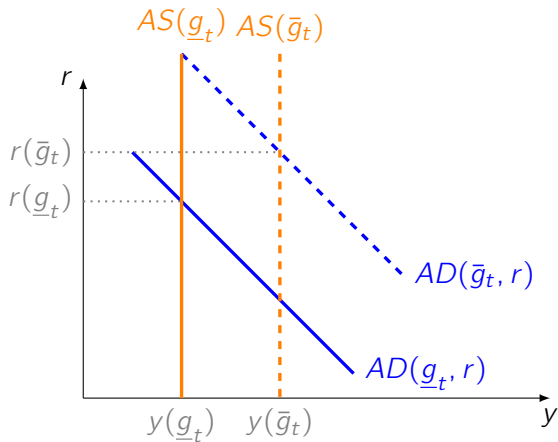
GE effect is because $g \uparrow$ shifts supply. Demand shift irrelevant.



A visual representation

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NK model with government spending

- Now let us study what happens when gov't spending is instead added to the NK model
Expectation: now gov't spending also operates via demand, not just via supply.

- The consumer Euler equation is unchanged, as seen before. In linearized form:

$$-\gamma c_t = r_t^n - \pi_t \quad (5)$$

I am again considering the augmented Euler equation featuring today's inflation, as in the problem set.

- The NKPC is different, reflecting the supply-side effects of gov't spending:

$$\pi_t = \kappa(y_t - \chi g_t) \quad (6)$$

where $\chi \in (0, 1)$, by the preceding RBC discussion

The precise value of χ is not important for our purposes. Key is that it is $\in (0, 1)$.

- Monetary policy is still conducted according to a Taylor rule:

$$r_t^n = \phi_\pi \pi_t \quad (7)$$

NK model with government spending

- The market-clearing condition now is

$$y_t = c_t + g_t \quad (8)$$

Combining this with the Euler equation, we get

$$-\gamma(y_t - g_t) = r_t^n - \pi_t \quad (9)$$

Finally the government itself just sets g_t , completing the model.

So we treat g_t as exogenous. It's just another "shock."

- Thus our new system in (y_t, π_t, r_t^n) is (9), (6), and (7). We see that gov't spending shows up as *both* a demand and supply shock.
- As usual: in the short-run κ is likely small (i.e., the economy is demand-determined), so we expect the demand effect to be dominant

Model solution

- Combining demand, supply, and policy, we for output obtain

$$y_t = \frac{\gamma + (\phi_\pi - 1)\kappa\chi}{\gamma + (\phi_\pi - 1)\kappa} \cdot g_t$$

Interest rates and inflation then follow residually.

- Some interesting special cases:

- If prices are very flexible [$\kappa \rightarrow \infty$], then

$$y_t = \chi g_t < g_t$$

Thus some consumption crowding-out, $c_t < 0$.

- As expected, we recover the RBC outcome. Only supply effect.
- Graphical representation is the same as before: vertical supply that is shifted by g_t , demand effect just matters for real interest rates

Model solution

- Combining demand, supply, and policy, we for output obtain

$$y_t = \frac{\gamma + (\phi_\pi - 1)\kappa\chi}{\gamma + (\phi_\pi - 1)\kappa} \cdot g_t$$

Interest rates and inflation then follow residually.

- Some interesting special cases:

- If prices are very sticky [$\kappa = 0$] or $\phi_\pi = 1$, then

$$y_t = g_t$$

Thus consumption does not change at all, $c_t = 0$. Key is fixed real rates.

- A unit output multiplier. The demand increase is accommodated 1-1, with no crowding-out or crowding-in of consumption.
- Graphical representation: supply is horizontal [fixed real rates], so only demand effect matters. g_t increases demand and thus output 1-1.

Model solution

- Combining demand, supply, and policy, we for output obtain

$$y_t = \frac{\gamma + (\phi_\pi - 1)\kappa\chi}{\gamma + (\phi_\pi - 1)\kappa} \cdot g_t$$

Interest rates and inflation then follow residually.

- Some interesting special cases:

- If nominal rates are fixed [$\phi_\pi = 0$] and prices are not too sticky [$\kappa < \gamma$], then

$$y_t = \frac{\gamma - \kappa\chi}{\gamma - \kappa} \cdot g_t > g_t$$

Thus consumption actually increases, $c_t > 0$. Key is that real rates *drop*.

- Output multiplier above 1, so gov't spending crowds-in consumption. Mechanism: demand $\uparrow$
 $\rightarrow$ inflation $\uparrow \rightarrow$ real rates $\downarrow \rightarrow$ consumption $\uparrow$
With hand-to-mouth consumers: $y_t \uparrow \rightarrow$ consumption $\uparrow$. Amplifies further.
- Graphical representation: upward-sloping demand curve!

Discussion

- Gov't spending in NK model: acts (mostly) like a demand booster
 - With sticky prices supply effects are secondary. Instead g_t acts like (and thus can offset) the demand shock $\hat{\theta}_t$
 - In normal times likely to crowd-out consumption [or keep it flat], but in recessions [at the ZLB] can have very large fiscal multipliers $\gg 1$
 - Thus: appealing to substitute for monetary policy when the central bank is constrained, because rates can't go lower
 - This explains the resurgence in policy interest in gov't stimulus in the years during and following the Great Recession
- But: works via gov't consumption/spending. what if no good projects available? could we get same stimulus by inducing households to spend?

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Demand neutrality – prices adjust

- Recently “stimulus checks” have become the fiscal policy tool of choice
 - Idea: send lump-sum transfers (“stimulus checks”) to people, postpone taxation to the (indefinite) future
 - Examples:
 1. Economic Growth and Tax Relief Reconciliation Act of 2001
 2. Economic Stimulus Act of 2008
 3. CARES Act of March 2020, Consolidated Appropriations Act of 2021, American Rescue Plan Act of 2021
- Our plan:
 - Stimulus checks with PIH households. “Ricardian equivalence.”
 - What happens with hand-to-mouth households?

Then ask: what's the likely contribution to inflation? and how will the checks be financed in eq'm?

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Stimulus checks with PIH households

- Recall our two-period permanent-income consumption-savings problem

- Preferences are

$$u(c_0) + \frac{1}{1+\rho} u(c_1)$$

- The budget constraints are

$$\begin{aligned}c_0 + a_1 &= y_0 \\ c_1 &= (1+r)a_1 + y_1\end{aligned}$$

- Suppose for simplicity that $r = \rho = 0$. The solution is

$$c_0 = c_1 = \frac{y_0 + y_1}{2}, \quad \text{and so } a_1 = y_0 - c_0 = \frac{y_0 - y_1}{2}$$

- Now suppose the government sends out stimulus checks τ at date 0, financed with taxes at date 1, so the budget constraints become

$$\begin{aligned}c_0 + a_1 &= y_0 + \tau \\ c_1 &= (1+r)a_1 + y_1 - (1+r)\tau\end{aligned}$$

What happens?

Ricardian equivalence

- Answer: nothing happens to consumption!
 - Households still consume their permanent income, which is unchanged:

$$c_0 = c_1 = \frac{y_0 + \tau + y_1 - \tau}{2} = \frac{y_0 + y_1}{2}$$

- Instead households just save the date-0 stimulus checks to pay off the higher taxes that they expect at date 1:

$$a_1 = y_0 + \tau - c_0 = \frac{y_0 - y_1}{2} + \tau$$

- This is known as “**Ricardian equivalence**”
 - Goes back to Ricardo (1820). Formal modern treatment in Barro (1974).
 - Of course inconsistent with empirical evidence, as we've seen. We've also seen how to fix it: add spenders = hand-to-mouth households.

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Stimulus checks for hand-to-mouth consumers

- Now consider instead a household that is **hand-to-mouth**, i.e., $c = \text{income}$. Then it is immediate that, in our two-period example, we have

$$c_0 = y_0 + \tau, \quad c_1 = y_1 - \tau$$

- Stimulus checks lead to a spending increase when they are paid out, and a demand bust when taxes are hiked [which may be in the far future]
 - In practice will have both **hand-to-mouth** and **permanent-income** households. No effect on the latter, demand boom-bust via the former.
- **Natural questions:**
 1. So far this was partial equilibrium, just looking at consumer demand. What happens in general equilibrium, using the NK model framework?
Aside: in RBC model nothing would happen, since fully supply-determined. Real rates $\uparrow$.
 2. How big does the future tax hike need to be? Can the short-run boom raise enough tax revenue today to obviate the need for future tax hikes?
The “Keynesian dream”: stimulus checks that “finance themselves.”

Stimulus checks in the NK model

- **Fiscal policy**

- The fiscal authority pays out stimulus checks today [date- t], and hikes taxes [as needed, we'll get back to this] in the future.
- Will assume that changes in output also endogenously affect tax revenue: for every \$ of output, $\$ \tau_y$ go into the government's pockets
Baseline tax code. Without Congress doing anything, if income goes up, tax revenue goes up.

- Consumers: now two types, both receive the transfers

1. **Permanent-income**: share $1 - \mu$, indexed by R
2. **Hand-to-mouth**: share μ , indexed by H

- Next slide: extended NK model with fiscal policy and two household types

I will still look at a “static” model. That treatment is still formally correct, in spite of the future taxes.
Can chat more if interested.

Stimulus checks in the NK model

- PIH households still consume according to their Euler equation:

$$-\gamma c_t^R = r_t^n - \pi_t \quad (10)$$

HtM households instead consume income less taxes plus stimulus checks:

$$c_t^H = (1 - \tau_y)y_t + \tau_t \quad (11)$$

- Supply is still summarized by an NKPC:

$$\pi_t = \kappa y_t \quad (12)$$

- The monetary authority as usual follows a Taylor rule:

$$r_t^n = \phi_\pi \pi_t \quad (13)$$

- Finally aggregate output equals consumption of the two types:

$$(1 - \mu)c_t^R + \mu c_t^H = y_t \quad (14)$$

Model solution

- Let us solve an instructive special case of this model with fixed real interest rates – either $\kappa = 0$ or $\phi_\pi = 1$, as covered before
 - Straightforward algebra [on the board] that combines (13) and (10), and then plugs this together with (11) into (14), gives

$$y_t = \frac{\mu}{1 - (1 - \tau_y)\mu} \tau_t \quad (15)$$

- Inflation thus accordingly is

$$\pi_t = \kappa \frac{\mu}{1 - (1 - \tau_y)\mu} \tau_t \quad (16)$$

- We see that stimulus checks act like a demand shock, increasing output and inflation. They can thus be used to substitute for monetary policy!

Some additional observations

- **Partial equilibrium** vs. **general equilibrium** decomposition
 - Stimulus checks increase demand by $\$ \mu$. This is the **direct**, or partial equilibrium, effect of the policy.
 - For every $\$$ of income, $\$(1 - \tau_y)\mu$ go to HtM hh's, and so get spent again, and so on. This is the **indirect**, general equilibrium, Keynesian multiplier. See the denominator of (15).
- The overall stimulative effects of the policy are increasing in μ :
 - If $\mu = 0$ [no HtM], then nothing happens, as we expected.
 - The bigger μ , the bigger both the direct **PE** effect and the indirect **GE** amplification. How strong can this get? Can the stimulus checks “finance themselves”?
Idea: boom raises tax revenue. Is that enough to finance the initial stimulus checks?

Self-financing?

- How much tax revenue does this boom raise?

- Simple arithmetic gives

$$\tau_y y_t = \tau_y \frac{\mu}{1 - (1 - \tau_y)\mu} \tau_t \leq \tau_t$$

- This is 0 if $\mu = 0$, increasing in μ , and $= \tau_t$ = full self-financing if $\mu = 1$!

→ If $\mu = 1$ the boom is big enough so that the stimulus check finances itself.

→ If $\mu = \frac{3}{4}$ and $\tau_y = \frac{1}{3}$ then still finance $\frac{1}{2}$.

- How plausible is this?

- Only relevant if NK model is applicable = demand-constrained economy, no sharp interest rate increase by the central bank. [remember: $\phi_\pi = 1$]

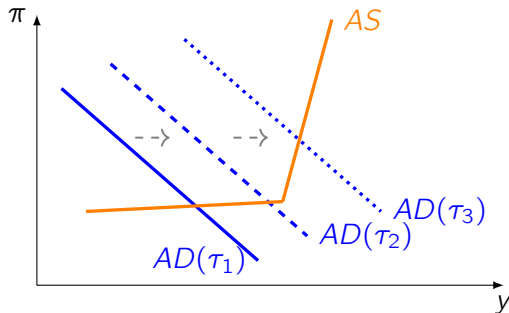
- Practical μ can be big because, in a proper dynamic model, it is not the MPC over a quarter, but over a couple of years. $\mu = \frac{3}{4}$ plausible.

- But is this desirable? it does bring with it inflation ...

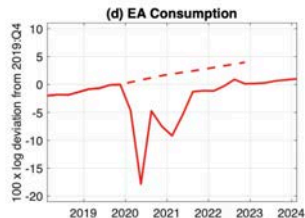
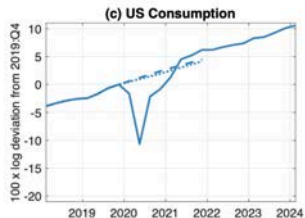
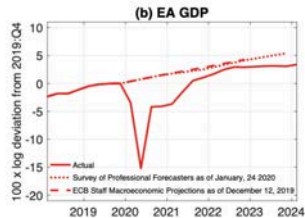
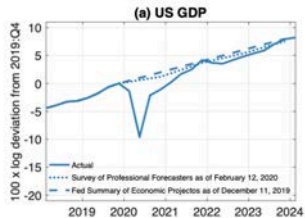
Implications for inflation

- Note that output increases, and this brings with it higher inflation:
 - No problem if the economy is very demand-constrained, so $\kappa \approx 0$. Horizontal AS curve. In figure go from $\tau_1 = 0$ to $\tau_2 > 0$.
 - Much more problematic if the economy is close to capacity, so κ is large. Very steep AS curve. In figure go from $\tau_1 = 0$ to $\tau_3 \gg 0$.

This is in part what happened in recent years. Economy already “at capacity.”

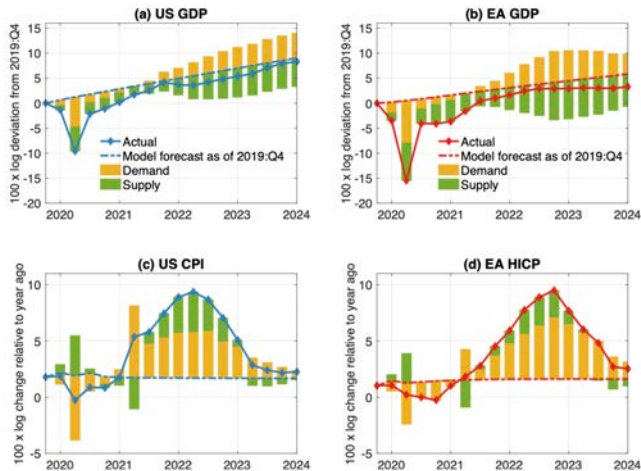


Spending in US. vs. Europe



Source: Giannone & Primiceri (2024). See much larger spending in US.

Inflation decomposition



Source: Giannone & Primiceri (2024). Inflation in part demand-driven.

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