Lecture 8
Policy in the New Keynesian Model

Macroeconomics EC2B1

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London School of Economics, Winter 2024

Plan

1. Monetary policy
    - already part of model, can use as is
2. Fiscal policy
    - not in model yet, will have to extend it
3. Pecking order of monetary and fiscal policy?

Key observation: sticky prices break first welfare theorem

- sticky prices = “friction”
- $\Rightarrow$ rationalizes some sort of policy intervention

Monetary Policy in the New Keynesian Model

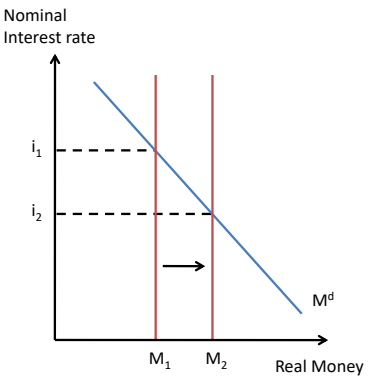
What is central bank's policy instrument? Money supply or interest rate?

- Recall: assume that central bank has two policy instruments
  1. i_1: nominal interest rate between periods 1 and 2
  2. M_2: money supply in period 2
- Usual description of monetary policy in media etc: interest rates
  - why is monetary policy not only setting i_1? Or (i_1, i_2)?
- Answer:
  - in general, setting i and M are equivalent – see next slide
  - in practice central banks announce i, adjust M accordingly
  - but technical issue in our 2-period model: there is only one interest rate, i.e. no $i_2 \Rightarrow$ need M_2 in addition to i_1
  - note: not an issue in standard NK model because infinite horizon
- Related question: why not only (M_1, M_2) instead of (i_1, M_2)?
  - this is equivalent, see next problem set
- Next slides: **focus on i_1 as central bank's policy instrument**

Equivalence of setting *i* and *M* (from EC1B1)

Money Supply

- Modern economy: Central bank can vary the money supply at will
- In particular: Central Bank can set money supply at each point in time to achieve any interest rate it desires



Monetary policy affects consumption, investment, GDP

- Recall expressions for consumption, investment and GDP

$$C_1 = \left(\frac{1}{\beta A_2}\right)^{\sigma} A_2 \frac{M_2}{(1+i_1)P_1}$$

$$I_1 = \frac{M_2}{(1+i_1)P_1}$$

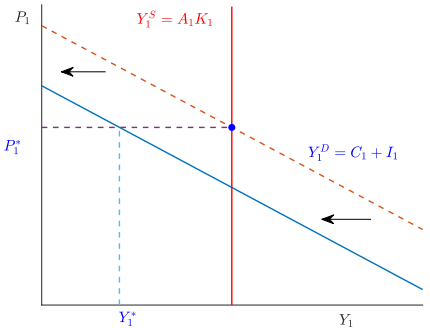
$$Y_1 = C_1 + I_1 = \left[1 + \left(\frac{1}{\beta A_2}\right)^{\sigma} A_2\right] \frac{M_2}{(1+i_1)P_1}$$

- Clearly when central bank cuts interest rate $i_1 \downarrow$, all of $C_1, I_1, Y_1 \uparrow$

- Explain intuition in a few slides

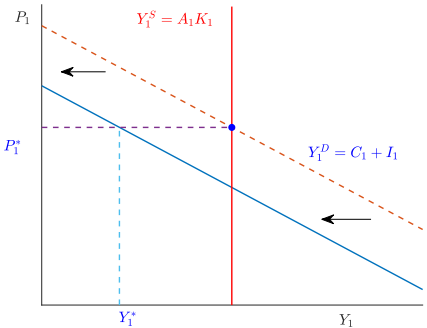
Monetary policy can stabilize recession caused by demand shock

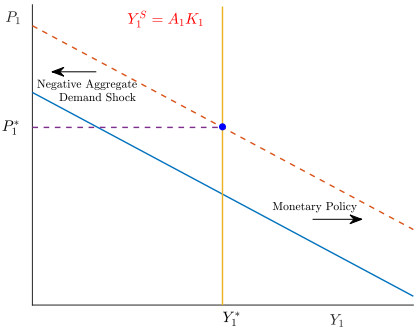
$$Y_1 = \left[1 + \left(\frac{1}{\beta A_2}\right)^{\sigma} A_2\right] \frac{M_2}{(1+i_1)P_1} \quad \downarrow \quad \text{because } A_2 \downarrow \text{ or } \beta \uparrow$$



Monetary policy can stabilize recession caused by demand shock

$$Y_1 = \left[1 + \left(\frac{1}{\beta A_2}\right)^{\sigma} A_2\right] \frac{M_2}{(1+i_1)P_1} \quad \uparrow \quad \text{because } i_1 \downarrow$$





The monetary transmission mechanism: intuition

Looking at equations: central bank cutting nominal interest rate

$$i_1 \downarrow \quad \Rightarrow \quad C_1,\ I_1,\ Y_1,\ C_2,\ Y_2 \quad \text{all} \uparrow, \quad P_2 \downarrow$$

What's going on under the hood, i.e. what's transmission mechanism?

- $i_1 \downarrow \Rightarrow$ real interest rate $1 + r_1 = (1 + i_1)P_1/P_2 \downarrow$
- $r_1 \downarrow \Rightarrow$ household consumption $C_1 \uparrow$ from Euler eqn $C_1 = C_2[\beta(1 + r_1)]^{-\sigma}$ (intertemporal substitution)
- $r_1 \downarrow \Rightarrow$ firm investment $I_1 = K_2 \uparrow$ from firm investment demand curve
- $C_1 \uparrow$ and $I_1 \uparrow \Rightarrow$ aggregate demand $Y_1^D = C_1 + I_1 \uparrow$
- $Y_1^D \uparrow \Rightarrow$ output $Y_1 \uparrow \Rightarrow$ household income $\Omega = P_1 Y_1 \uparrow \Rightarrow C_1, C_2 \uparrow$ (income effect) $\Rightarrow$ aggregate demand $Y_1^D \uparrow \Rightarrow$ ... (Keynesian cross logic)
- $K_2 \uparrow \Rightarrow$ future output $Y_2 = A_2 K_2 \uparrow$ consistent with $C_2 \uparrow$ (so that $C_2 = Y_2$)
- $C_2 \uparrow \Rightarrow$ price level $P_2 \downarrow$ from quantity equation $P_2 C_2 = M_2$ (one intuition: $K_2 \uparrow \Rightarrow$ aggregate supply $Y_2^S \uparrow \Rightarrow$ price level $P_2 \downarrow$)
- $P_2 \downarrow \Rightarrow$ real interest rate $1 + r_1 = (1 + i_1)P_1/P_2 \uparrow$ until $1 + r_1 = A_2$ so that capital market is in equilibrium (recall infinitely elastic capital demand)

Another way of looking at it: IS and MP curves

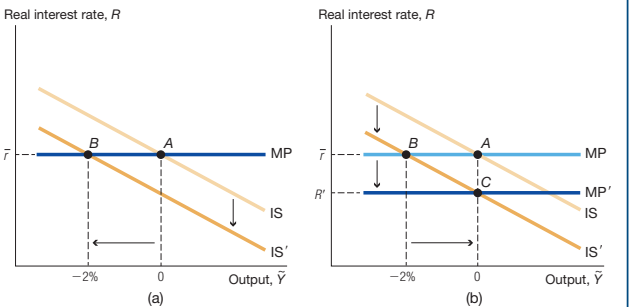
Recall IS and MP curves from EC1B1 and standard textbooks (e.g. Jones)

The negative shock leads to a recession as the economy moves from point *A* to point *B*.

The Fed responds by stimulating the economy with lower interest rates, moving output back to potential as the economy moves to point *C*.

FIGURE 12.5

Stabilizing the Economy after a Housing Bubble



Source: Jones, Macroeconomics

Here: IS and MP curves = just another way of plotting our equations

Another way of looking at it: IS and MP curves

- Recall expressions for consumption, investment and GDP

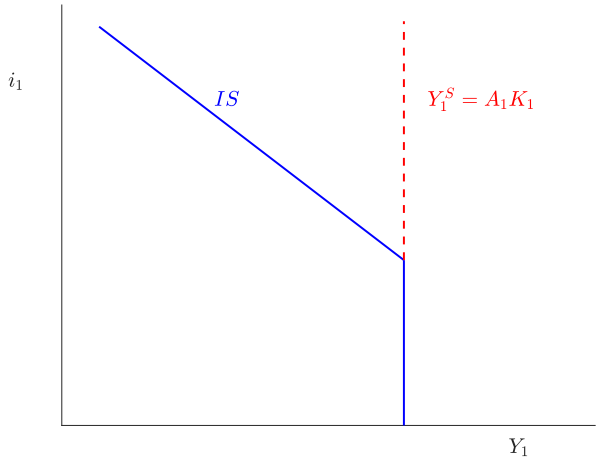
$$C_1 = \left(\frac{1}{\beta A_2}\right)^{\sigma} A_2 \frac{M_2}{(1+i_1)P_1}$$

$$I_1 = \frac{M_2}{(1+i_1)P_1}$$

$$Y_1 = C_1 + I_1 = \left[1 + \left(\frac{1}{\beta A_2}\right)^{\sigma} A_2\right] \frac{M_2}{(1+i_1)P_1}$$

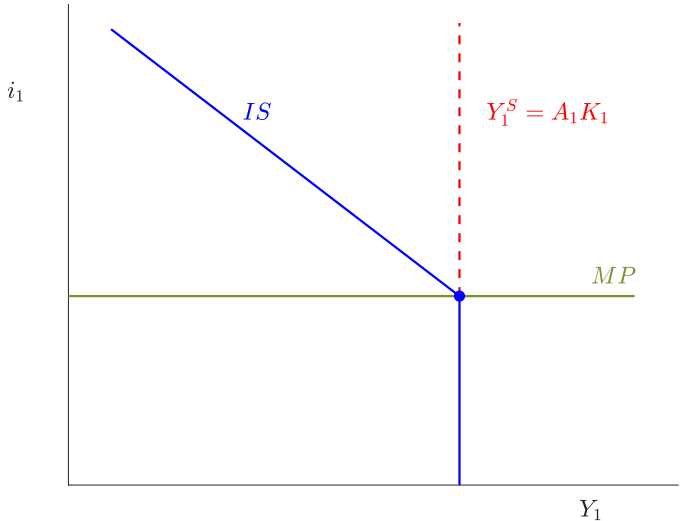
- Before: plotted Y_1 as function of P_1, called it "aggregate demand"
- Now: plot Y_1 as function of i_1, call it "IS curve"

IS curve = Y_1 plotted as function of i_1

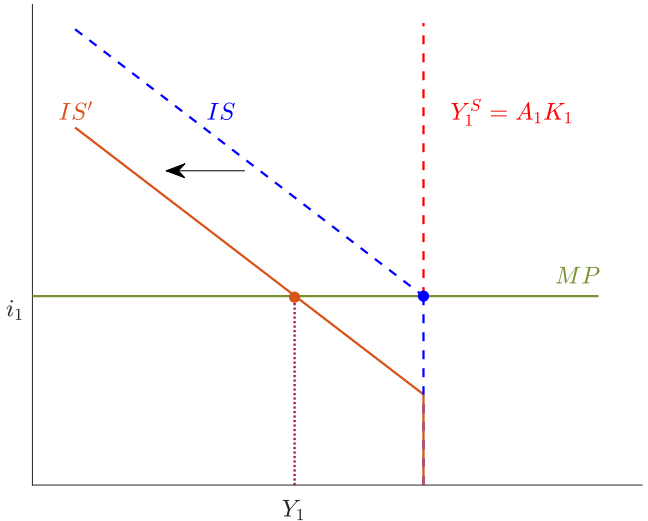


- Question for you: why the kink?
- Comment: usually IS(r) not i – would need extension with i_1 affecting r_1

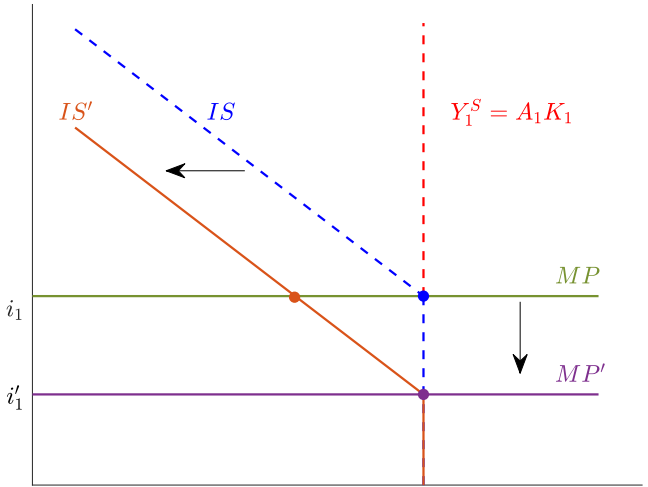
IS and MP curves



A negative demand shock causes a recession

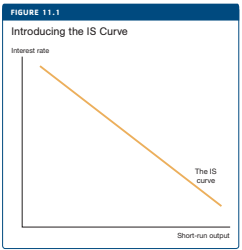


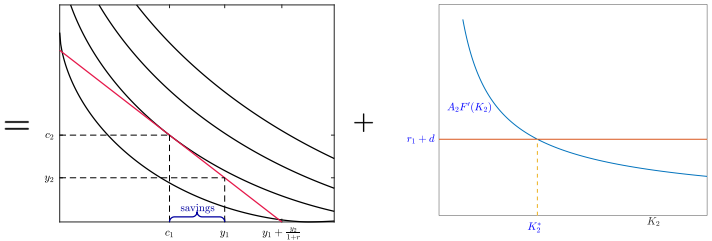
Monetary policy can stabilize recession caused by demand shock



IS curve = Euler equation + investment demand curve

- Will sometimes hear “New Keynesian IS curve”
- Just another name for “Euler equation” and/or “investment demand curve”

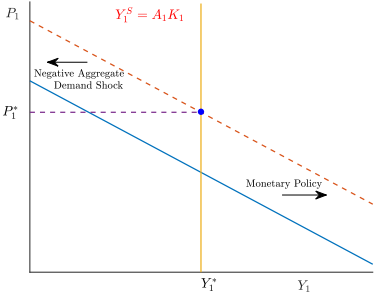




- From Jones’ book: “The IS curve captures the fact that high interest rates reduce output in the short run. This occurs because high interest rates make borrowing expensive for firms and households, reducing their demand for new investment. The reduction in demand leads to a decline in output in the economy as a whole.”
- Jones is clearly talking about Euler equation and investment demand curve

Optimal monetary policy and “divine coincidence”

- Question: what is the optimal monetary policy?
- Answer: the policy that
  - undoes all distortions due to price stickiness
  - equates allocation with sticky prices to that with flexible prices (first best because welfare theorems hold)



Optimal monetary policy and "divine coincidence"

- Specifically optimal monetary policy chooses i_1 (or M_2) to equate

$$Y_1^{\text{sticky}} = \left[1 + \left(\frac{1}{\beta A_2}\right)^{\sigma} A_2\right] \frac{M_2}{(1+i_1)P_1} \quad \text{and} \quad Y_1^{\text{flex}} = A_1 K_1$$

- $\Rightarrow$ optimal policy sets

$$\frac{M_2}{(1+i_1)P_1} = \frac{1}{1 + \left(\frac{1}{\beta A_2}\right)^{\sigma} A_2} A_1 K_1$$

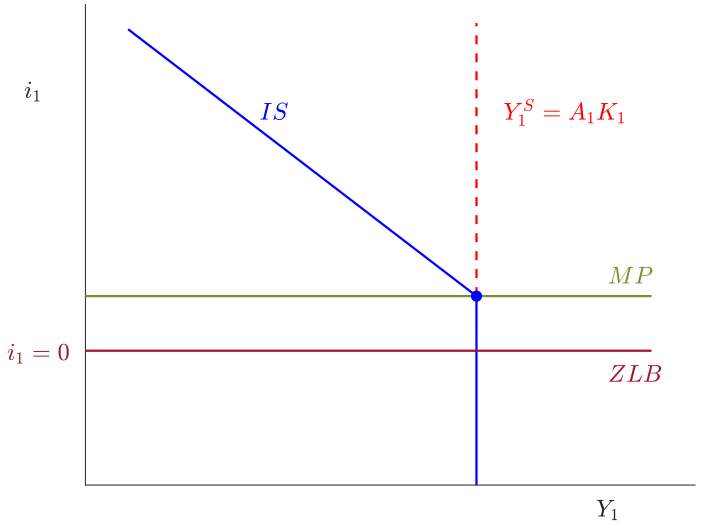
- Striking result: for any type and size of demand shock, there's always a monetary policy that can restore first-best allocation
  - when responding to demand shocks, in this model, monetary policy faces no tradeoff of any kind
  - result is called "divine coincidence" (Blanchard and Gali, 2007)

    https://en.wikipedia.org/wiki/Divine_coincidence

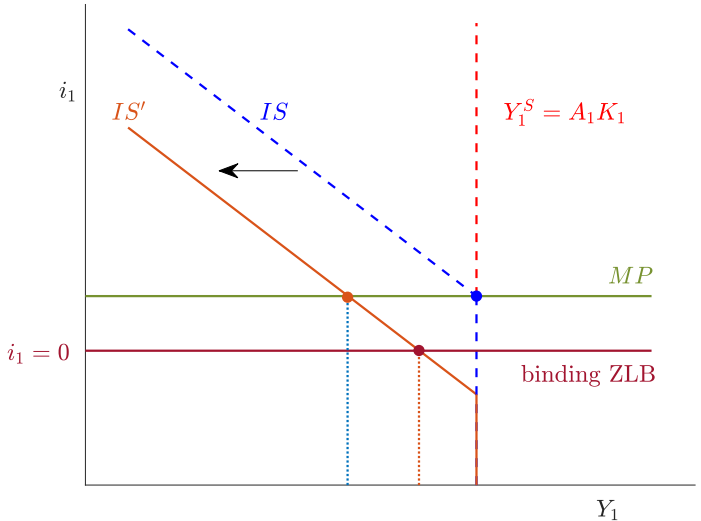
Limits to monetary policy: zero lower bound (ZLB)

- Question: Is the optimal policy always feasible? Answer: no
- **Definition:** The zero lower bound (ZLB) is the requirement that nominal interest rates cannot be negative, $i_1 \geq 0$
- Rationale:
  - households and firms borrow and lend at rate i_1
  - but there's an alternative to lending, namely holding money
  - money always pays an interest rate of zero
  - If $i_1 < 0$, you're better off putting your money under your mattress
- Alternative names for ZLB that mean same thing:
  - effective lower bound (ELB), reason: bound may not be exactly = 0
  - liquidity trap

Limits to monetary policy: zero lower bound (ZLB)



Monetary policy cannot stabilize recession because ZLB binds



Fiscal Policy in the New Keynesian Model

Two main types of fiscal policy: G and T

1. **Government spending** G
   - infrastructure projects,...
   - the traditional way of thinking about fiscal policy

2. **Transfers** or tax cuts to households T
   - tax cuts, stimulus checks, ...
   - used in all U.S. recessions, same in many other countries
   - in practice, probably the more important type of fiscal policy

Introducing fiscal policy into the model

- Follow MW's notation
  - G_1, G_2: government spending
  - T_1, T_2: lump-sum taxes, transfers = $T_t < 0$
- Key changes to model equations are as follows...
- Resource constraints

$$C_1 + I_1 + G_1 = Y_1, \quad C_2 + G_2 = Y_2$$

- Household budget constraint

$$P_1 C_1 + \frac{P_2 C_2}{1 + i_1} = P_1(\Pi_1 - T_1) + \frac{P_2(\Pi_2 - T_2)}{1 + i_1}$$

- Government budget constraint

$$P_1 G_1 + \frac{P_2 G_2}{1 + i_1} = P_1 T_1 + \frac{P_2 T_2}{1 + i_1}$$

- MW: G_1, G_2 enter utility fn, here: G_1, G_2 not valued ("digging ditches")

Equilibrium with sticky prices and fiscal policy

$$C_1 = \left(\frac{1}{\beta A_2}\right)^{\sigma} A_2 \frac{M_2}{(1+i_1)P_1}$$

$$C_2 = A_2 \frac{M_2}{(1+i_1)P_1}$$

$$I_1 = \frac{1}{1-g_2} \frac{M_2}{(1+i_1)P_1}$$

$$Y_1 = \frac{1 + \left(\frac{1}{\beta A_2}\right)^{\sigma} A_2(1-g_2)}{1-g_2} \frac{M_2}{(1+i_1)P_1} + G_1$$

$$Y_2 = A_2 \frac{1}{1-g_2} \frac{M_2}{(1+i_1)P_1}$$

$$P_2 = \frac{1+i_1}{A_2} P_1$$

where $g_2 = G_2/(A_2K_2)$ = share of G_2 in potential output A_2K_2

Note: equations are identical to MW's equations (31)-(36)

Fiscal policy via government spending G_1

- Focus on effect of G_1 on variables at $t = 1$

$$C_1 = \left(\frac{1}{\beta A_2}\right)^{\sigma} A_2 \frac{M_2}{(1+i_1)P_1}$$

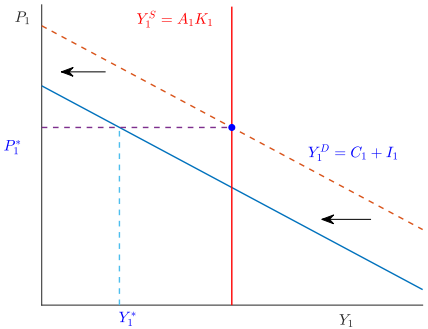
$$I_1 = \frac{1}{1-g_2}\frac{M_2}{(1+i_1)P_1}$$

$$Y_1 = C_1 + I_1 + G_1 = \frac{1+\left(\frac{1}{\beta A_2}\right)^{\sigma} A_2(1-g_2)}{1-g_2}\frac{M_2}{(1+i_1)P_1} + G_1$$

- Clearly when $G_1 \uparrow$, GDP Y_1 increases one-for-one

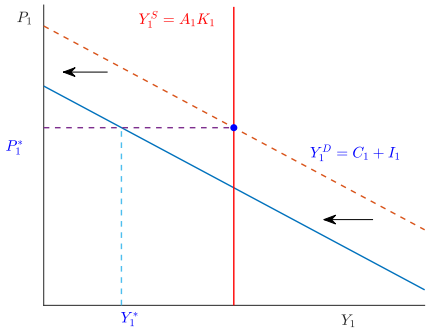
Government spending can stabilize recession caused by demand shock

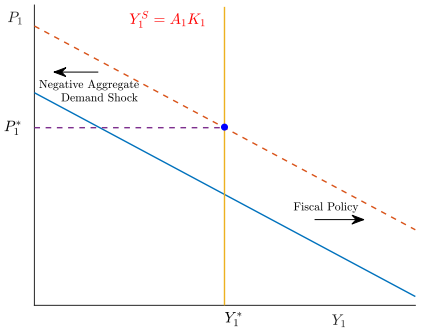
$$Y_1 = \frac{1 + \left(\frac{1}{\beta A_2}\right)^{\sigma} A_2(1 - g_2)}{1 - g_2} \frac{M_2}{(1 + i_1)P_1} + G_1 \quad \downarrow \quad \text{because } A_2 \downarrow \text{ or } \beta \uparrow$$



Government spending can stabilize recession caused by demand shock

$$Y_1 = \frac{1 + \left(\frac{1}{\beta A_2}\right)^{\sigma} A_2(1 - g_2)}{1 - g_2} \frac{M_2}{(1 + i_1)P_1} + G_1 \quad \uparrow \quad \text{because } G_1 \uparrow$$





In this model fiscal multiplier is exactly 1

- Fiscal multiplier, more precisely government spending multiplier

$$\text{multiplier} = \frac{\Delta Y_1}{\Delta G_1} = \text{£ increase in GDP per £ of government spending}$$

- All of $C_1, I_1, C_2, \ldots$ do not depend on G_1 and

$$Y_1 = C_1 + I_1 + G_1$$

- Therefore clearly

$$\text{multiplier} = \frac{\Delta Y_1}{\Delta G_1} = 1$$

- Intuition in Mankiw-Weinzierl's words:

  "The government-spending multiplier here is precisely one. An increase in government spending puts idle resources to work and raises income. Consumers, meanwhile, see their income rise but recognize that their taxes will rise by the same amount to finance that new, higher level of government spending. As a result, consumption and investment are unchanged & the increase in income precisely equals increase in government spending."

In this model fiscal multiplier is exactly 1

$$\text{multiplier} = \frac{\Delta Y_1}{\Delta G_1} = 1$$

stands in contrast with other common hypotheses

- Crowding out of investment and private consumption

$$Y = C + I + G \text{ with } C, I \downarrow \quad \Rightarrow \quad \text{multiplier} = \frac{\Delta Y}{\Delta G} < 1$$

- Typical old Keynesian multiplier stories

$$Y = C + I + G \text{ with } C, I \uparrow \quad \Rightarrow \quad \text{multiplier} = \frac{\Delta Y}{\Delta G} > 1$$

- In a sense, multiplier = 1 is most natural and intuitive benchmark
  - GDP increases by £1 for every £1 government spends
- Should not expect multipliers either far < 1 or far > 1, e.g. $1/2$ or 2

Stabilization via G is only second-best

- Welfare effect of stabilization via G?
- Fiscal policy restores only first-best level of GDP Y_1 but not C_1 and I_1
  - C_1 and I_1 do not change when $G_1 \uparrow$
  - shortfall in private consumption $C_1 + I_1 < A_1 K_1$ is made up by public consumption $G_1 \uparrow$ such that $C_1 + I_1 + G_1 = A_1 K_1$
- But households value G_1 differently than C_1
  - in fact recall assumption: G_1, G_2 not valued at all ("digging ditches")
  - MW: more generally $G_1 \uparrow$ distorts optimal mix of C_1 and G_1:
    "This fiscal policy is second-best, however, because it fails to produce the same allocation of resources achieved under flexible prices. Public consumption will be higher in both periods, but private consumption will be lower. As a result, households will end up with a lower level of welfare."

Fiscal policy via transfers / tax cuts T_1 ("stimulus checks")

- Consider deficit-financed tax cut T_1
  - $T_1 \downarrow$
  - G_1, G_2 unaffected
  - require $T_2 \uparrow$ for government budget constraint to hold
- **Question 1:** from expressions for equil'm variables, what is effect of $T_1 \downarrow$?

$$C_1 = \left(\frac{1}{\beta A_2}\right)^{\sigma} A_2 \frac{M_2}{(1+i_1)P_1}, \qquad Y_1 = \frac{1 + \left(\frac{1}{\beta A_2}\right)^{\sigma} A_2(1-g_2)}{1-g_2} \frac{M_2}{(1+i_1)P_1} + G_1, \ldots.$$

- **Question 2:** what is the intuition?
  - hint: "Ricardian equivalence"
  - hint: present value $P_1 T_1 + \frac{P_2 T_2}{1+i_1}$ in household budget constraint
- **Question 3:** what is wrong with this result?
  - hint: recall empirical evidence on consumption from Lecture 4

Adding high MPC households: TANK model

Simplest way: "spender-saver model" of Campbell and Mankiw (1989)

- Fraction λ of households are "spenders" that consume their entire income, i.e. MPC=1
- Remaining fraction $1-\lambda$ are "savers" that behave as before, i.e. maximize $U(C_1^{sa}) + \beta U(C_2^{sa})$ subject to PV budget constraint
- Aggregate consumption is

$$C_t = \lambda C_t^{sp} + (1-\lambda) C_t^{sa}$$

Add this "spender-saver" structure to our New Keynesian model

- see supplement "Lecture 8: Hand-to-Mouth Households (TANK Model)"
- makes model more consistent with empirical evidence (high MPCs)

This type of model: "TANK model" = Two Agent New Keynesian model

- a simplified version of the more complicated HANK models

Fiscal policy via transfers ("stimulus checks") in TANK model

- Presence of spenders $\lambda > 0$ breaks Ricardian equivalence
- Stimulus checks can now stabilize recession caused by demand shock
- Result: transfer multiplier for transfers to spenders is (γ^{sp} = income share)

$$\frac{\partial Y_1}{\partial(-T_1^{sp})} = \frac{\lambda}{1-\lambda\gamma^{sp}} > 0$$

- Result: when there are high-MPC households ($\lambda > 0$), stimulus checks can restore the flexible-price (first best) level of aggregate consumption C_1
  - not just GDP (as in case $\lambda = 0$)
  - (though distribution C_1^{sp} vs C_1^{sa} differs from first-best)
  - conjecture: combined with investment policies, can restore first-best aggregate allocation completely (see Wolf paper in a few slides)
- Also interesting: government spending multiplier becomes $\frac{1}{1-\lambda\gamma^{sp}} > 1$

Pecking Order of Monetary and Fiscal Policy?

Pecking order of monetary and fiscal policy?

- When there is a recession, what type of stabilization policy should governments use?
- New Keynesian model implies clear pecking order: monetary policy preferable, only use fiscal policy on rare occasions
  - this is also the conclusion of Mankiw-Weinzierl
- More recent work (TANK and HANK models): it's less clear

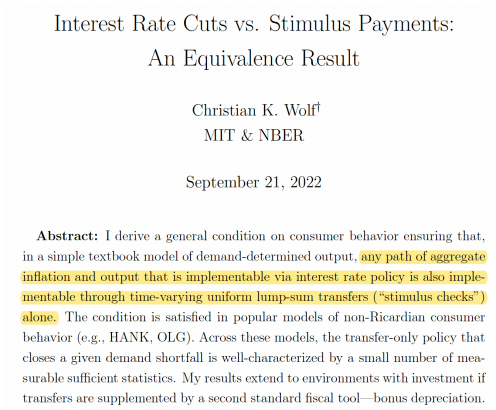
New Keynesian model: clear pecking order of monetary and fiscal policy

- Monetary policy alone can restore first-best flexible-price allocation
  - "divine coincidence"
- Only exception: if monetary policy is constrained by ZLB
- Fiscal policy is either second-best (*G*) or ineffective (*T*)
- Therefore
  - monetary policy preferable
  - only use fiscal policy on rare occasions (e.g. binding ZLB)

More recent work: no clear pecking order

- When households have high MPCs and Ricardian equivalence breaks, there is no longer such a clear pecking order
- Under some conditions, monetary and fiscal policy are exactly equivalent as far as aggregate demand management is concerned
    - Anything government can do with monetary policy can also be done with fiscal policy and vice versa

Congratulations, you've just caught up to the research frontier



Interest Rate Cuts vs. Stimulus Payments:
An Equivalence Result

Christian K. Wolf†
MIT & NBER

September 21, 2022

Abstract: I derive a general condition on consumer behavior ensuring that, in a simple textbook model of demand-determined output, any path of aggregate inflation and output that is implementable via interest rate policy is also implementable through time-varying uniform lump-sum transfers ("stimulus checks") alone. The condition is satisfied in popular models of non-Ricardian consumer behavior (e.g., HANK, OLG). Across these models, the transfer-only policy that closes a given demand shortfall is well-characterized by a small number of measurable sufficient statistics. My results extend to environments with investment if transfers are supplemented by a second standard fiscal tool—bonus depreciation.

1 Introduction

The prescription of standard New Keynesian theory is to conduct stabilization policy through changes in short-term interest rates. In recent years, much policy and academic interest has centered on the question of whether—and if so, how—alternative policy tools could be used to replicate monetary stimulus when nominal interest rates are constrained by a zero or effective lower bound (ELB).[1] Prior work has in particular identified tax policy, often labeled *unconventional* fiscal policy, as an attractive option (Correia et al., 2008, 2013): time-varying tax rates manipulate intertemporal prices just like monetary policy and thus can replicate any desired monetary allocation.

In this paper I ask whether *conventional* fiscal policy—that is, fiscal instruments that are already part of the standard stabilization policy toolkit—are similarly sufficient to replicate any given monetary policy. The setting for much of my analysis is a textbook business-cycle model with nominal rigidities and without capital, extended to allow for more general, non-Ricardian household consumption behavior. The conventional fiscal stabilization tool that I consider are uniform, deficit-financed transfers ("stimulus checks"), a policy instrument used in all recent U.S. recessions.‖ My first contribution is to identify a general sufficient condition

Source: https://economics.mit.edu/sites/default/files/2022-09/mp_equiv.pdf

Sticky prices: summary and policy implications

(Contrast with analogous slide for flexible prices from Lecture 7)

- Sticky prices break monetary neutrality and the classical dichotomy
- Corollary: monetary policy affects real variables
- 1st welfare theorem breaks: some policy intervention is desirable
- Stabilization policy? When there is a recession due to shortfall in aggregate demand
  - stabilization via fiscal policy is both possible and desirable
  - stabilization via monetary policy is both possible and desirable unless ZLB binds
  - no clear pecking order, use both depending on circumstances
- Role of central bank? control price level, stabilize recessions
  - see e.g. mandate of U.S. Fed ("dual mandate")