Lecture 2: Non-Neutrality of Money

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Advanced Monetary Economics 2020

Roadmap

Motivation

- Why study monetary economics at all?
- Can we think of money as just a regular commodity? Or is it special?
- Why is it special?

Motivation

- This lecture: basic concepts, classical theories of non-neutrality and then empirical evidence.
- By classical here, I mean old theories: Keynesianism and Monetarism.

Roadmap

Interest and Rate of Time Preference

- Opportunity cost of time.
- Funds today are worth more than funds tomorrow.
- Holding an asset offers a return.

Interest and Rate of Time Preference

- Invest £1 at time $t \Rightarrow$ yields £I_{t+1} at time $t+1$.
- I_{t+1} is the gross nominal rate of interest on the asset.
- How much is £1 at $t+1$ worth at time t?

Interest and Rate of Time Preference

- How much is £1 at $t+1$ worth at time t: find x [unknown] in the following:

$$1 \text{ at } t \Rightarrow I_{t+1} \text{ at } t+1$$
$$\text{x at } t \Rightarrow 1 \text{ at } t+1,$$

  which gives that $x = \frac{1}{I_{t+1}}$.

- Look familiar? We need to discount future cash flows to account for opportunity cost.

- We refer to x as the present value of a future cash flow of £1.

- Always discount nominal (real) cash flows with the nominal (real) opportunity cost.

Role of Money

- Three main roles that it serves:
  1. Medium of exchange,
  2. Unit of account,
  3. Store of value.

Role of Money: (1) Medium of Exchange

- How does one pay for their beer or dinner?
- Money facilitates transactions.
- Alternative is a barter economy.
- Harder to coordinate and agree to transactions in a barter economy. Lots of time wastage.

Role of Money: (2) Unit of Account

- Price measurement.
- Makes the terms of trade for goods and services precise.
- E.g. a beer costs £5 and dinner costs £10.
- This price difference in terms of money has some meaning.
- Much harder to conceptualise in a barter economy.
- E.g. a beer costs 10 apples and dinner costs 50 seashells.

Role of Money: (3) Store of Value

- We can save money.
- What if your salary was paid in apples?
- Much harder to store.

Money and Welfare

- Having money to fill these three roles makes the world a better place.
- Saves on transaction costs, allows for savings etc.
- These are all things that help us with our everyday lives.

Money as a Policy Tool

- Who controls the supply of money?
- The government (central bank).
- Thinking of money supply and nominal interest rates as a policy tool are one in the same.
- Can the government adjust the money supply to affect the behaviour of agents in the macroeconomy?

Real v.s. Nominal

- Economists are typically interested in real things like output, consumption, investment and hours worked.
- Unit of account role.
- £5 buys one beer.
- The price of beer is denoted in terms of money.

Real v.s. Nominal

- Nominal variables: denoted in terms of money.
- E.g. a bar sold £500 worth of beer in an evening.
- Money in itself is not something we care about though (fiat money). Just worthless pieces of paper.
- We care about the number of beers that the economy consumes/produces.
- Real variables: actual quantities.
- E.g. a bar sold 100 beers in an evening.

Fisher Equation

- Relates the real and nominal interest rates and inflation.
- Say that there is no randomness in the world.
- Consider an asset, in which you invest £1 at time t.
- Say it delivers a payoff of £Y_{t+1}^N at time $t+1$.

Fisher Equation

- We know that nominal and real payoffs at time $t+1$ are related by

$$Y_{t+1}^N = P_{t+1} Y_{t+1}^R \tag{1}$$

  where Y_{t+1}^R denotes a real payoff and P_{t+1} denotes the price level.

- Make sense? Y_{t+1}^N is in terms of £ and Y_{t+1}^R is in terms of output or goods.

Fisher Equation

- See then that the amount we put into the asset at time t is such that

$$1 = P_t Y_t^R \tag{2}$$

  where P_t is the price level at t and Y_t^R is the size of the real investment.

- Recall that the left-side is the size of the nominal investment.

Fisher Equation

- Follows that we can then use 1 and 2 to write

$$\frac{Y_{t+1}^N}{1} = \frac{P_{t+1}}{P_t}\frac{Y_{t+1}^R}{Y_t^R}$$
$$\Rightarrow I_{t+1} = \Pi_{t+1} R_{t+1} \tag{3}$$

  where the I_{t+1}, Π_{t+1} and R_{t+1} are the nominal return, inflation rate and real return respectively.

- Equation (3) is a version of the Fisher equation.

- Note that these are all written in gross terms.

Money Neutrality

- Money neutrality: when changes in the money supply have no impact on real variables.
- Obviously it comes with changes in the money market.
- E.g. a decrease in the supply of money changes the price level.
- Money is neutral if nothing other than the price changes though.
- E.g. double the money supply: then nominal price levels just double. Real quantities are unaffected.

Money Super-Neutrality

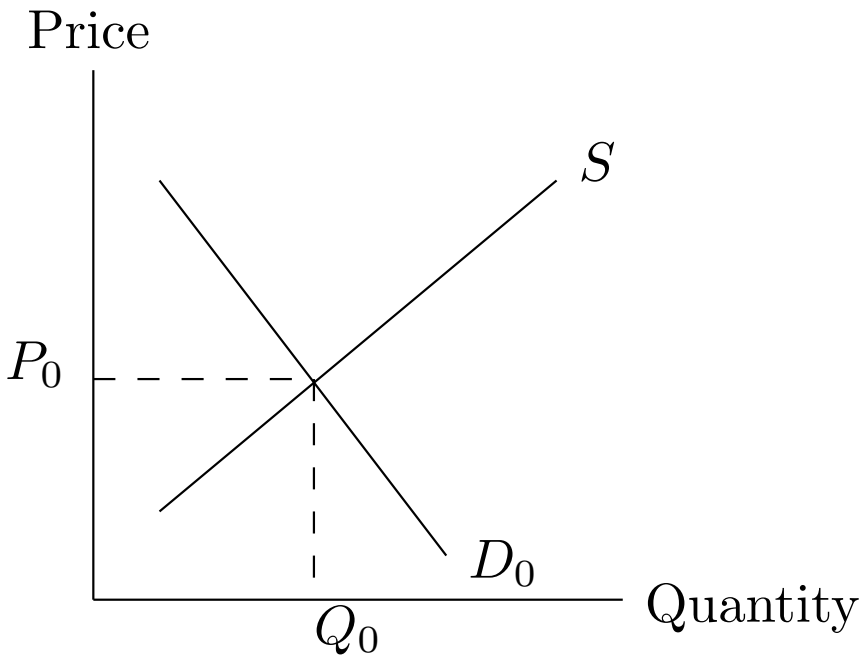
- Money super-neutrality: when changes in the growth rate of the money supply have no impact on the real economy.
- A stronger concept than neutrality.
- Changes in the growth rate will affect the rate of inflation.
- Starts to impact real returns.
- Can affect real returns to productive assets (e.g. capital or labour).
- Might lead to changes in real outcomes.

Roadmap

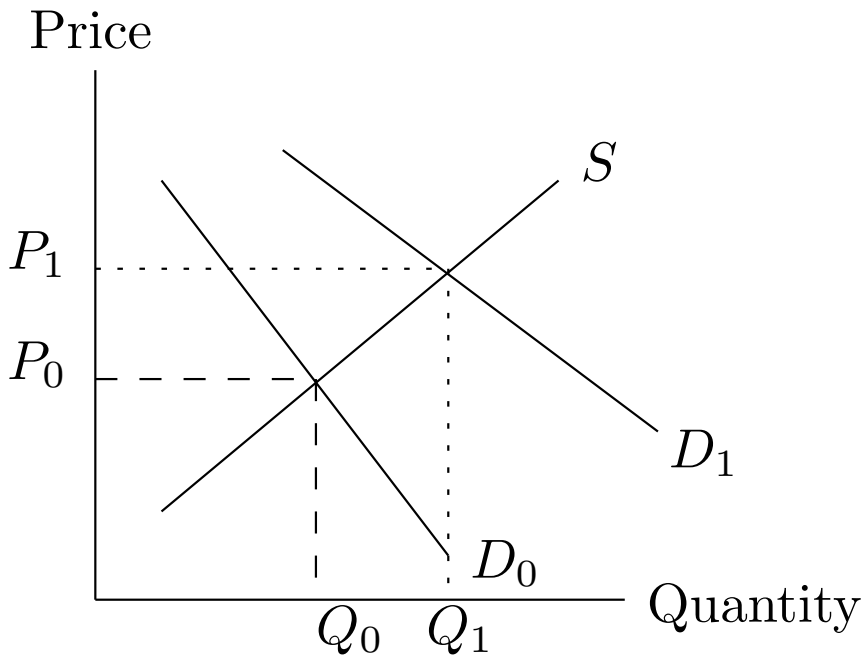
What Drives Real Effects of Monetary Policy?

- It's all about price rigidity/stickiness in the short-run.
- If prices don't respond quickly, we can see real effects of monetary policy changes.

What Drives Real Effects of Monetary Policy?



What Drives Real Effects of Monetary Policy?



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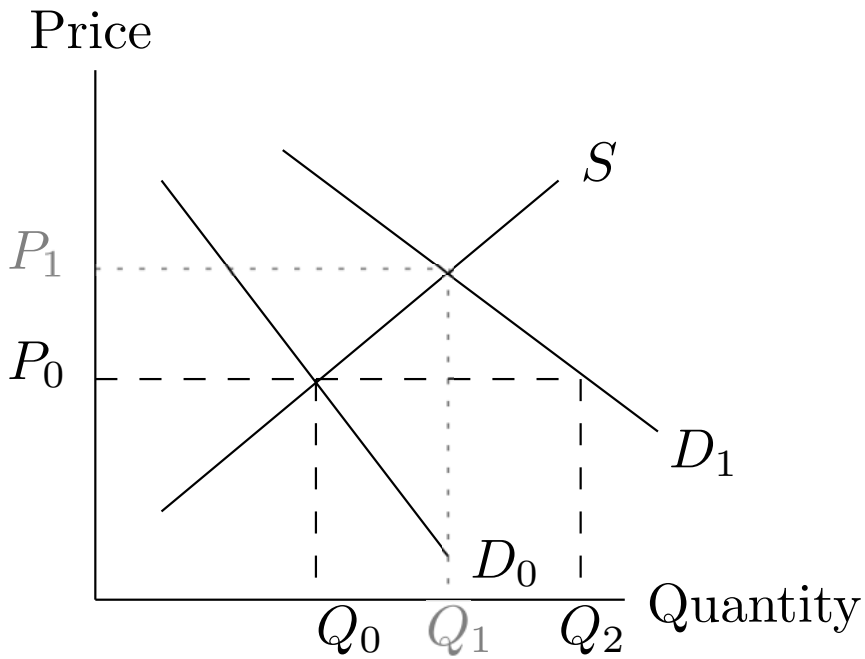


What Drives Real Effects of Monetary Policy?

- This is very much a short-run idea though: prices rigid over a short time horizon.
- In the long-run, we usually think of prices as perfectly flexible.

Roadmap

Review

- The remainder of this module is very mathy.
- We'll now review AD-AS and IS-LM as thinking about the math in this context helps build intuition.
- This school of thought was all about behavioural equations that held by assumption.
- Lacked proper microfoundations.

Consumer Behaviour: Consumption Spending

- Assume a consumption function of the form

$$C = \mathcal{C}(Y, R)$$

where Y is income and R is the real interest rate.

- Assume that

$$1 > \frac{\partial \mathcal{C}}{\partial Y} > 0$$
$$\frac{\partial \mathcal{C}}{\partial R} < 0$$

meaning consumption is increasing in income (but less than one for one) and in the real interest rate.

- See that $\frac{\partial \mathcal{C}}{\partial Y}$ is the marginal propensity to consume.

Consumer Behaviour: Savings

- Assume a savings function of the form

$$\begin{aligned} S &= \mathcal{S}(Y, R) \\ &= Y - C \end{aligned}$$

where

$$1 > \frac{\partial S}{\partial Y} > 0$$

but the derivative for the real rate is ambiguous.

Firm Behaviour: Investment

- Assume an investment function

$$IN = \mathcal{I}(R)$$

where IN stands for investment and

$$\frac{\partial IN}{\partial R} < 0$$

meaning that as the real rate (the cost of funds for the firm) rises, investment falls.

IS Curve

- IS: investment-savings.
- How does output relate to the real rate of interest?

$$\mathcal{Y}(R) = \mathcal{C}(Y, R) + \mathcal{I}(R)$$

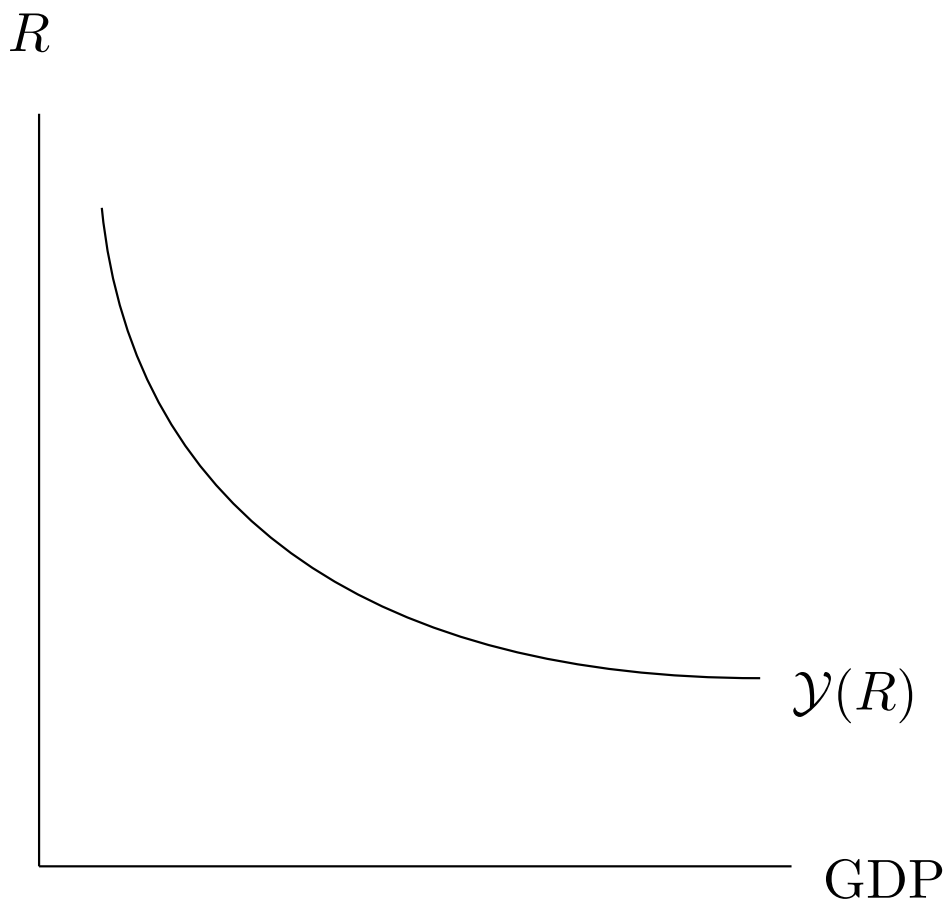
where $\mathcal{Y}(R)$ denotes GDP.

- See that it's downward sloping as

$$\frac{\partial \mathcal{Y}(R)}{\partial R} = \frac{\partial \mathcal{C}(Y, R)}{\partial R} + \frac{\partial \mathcal{I}(R)}{\partial R}$$

where both terms on the right-side were negative by assumption.

IS Curve



Money Market Equilibrium

- Assume an exogenous demand for money

$$L = \mathcal{L}(Y, I)$$

where L denotes holdings of real balances and I denotes the nominal rate of interest.

- Assume that

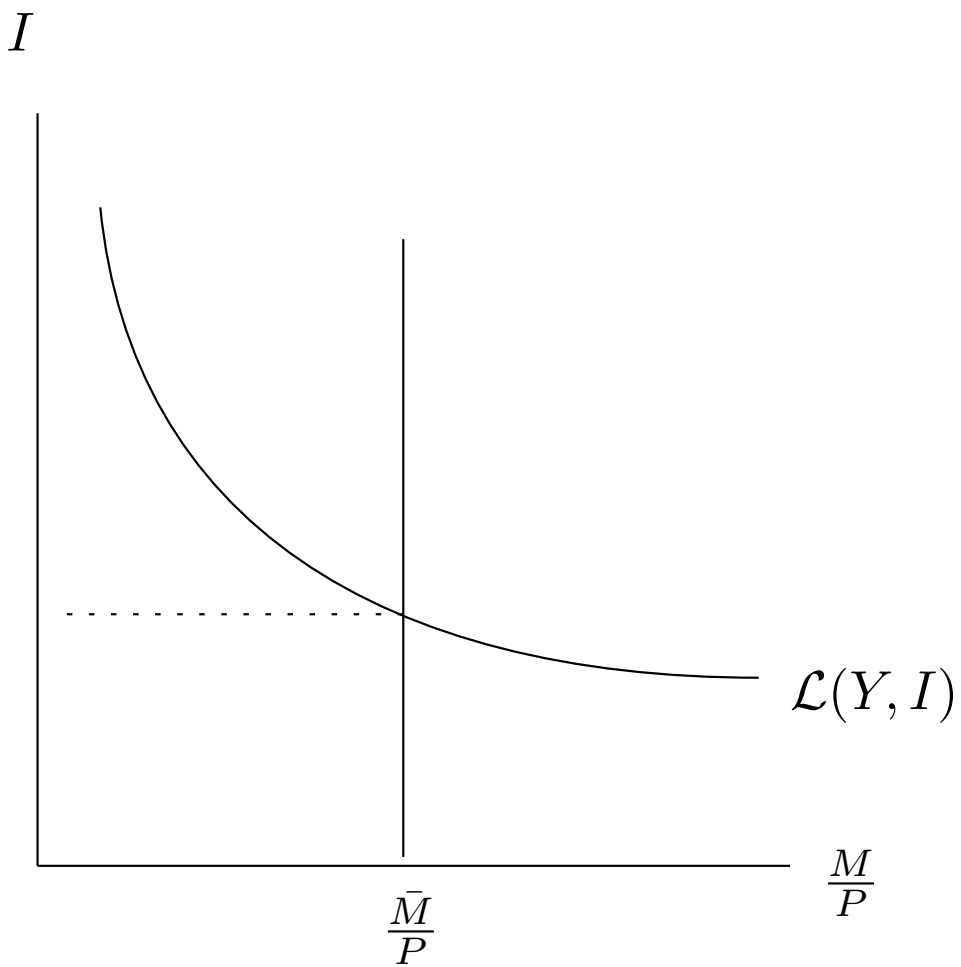
$$\frac{\partial L}{\partial Y} > 0$$
$$\frac{\partial L}{\partial I} < 0$$

- Since I is the opportunity cost of holding cash: higher I decreases cash holdings. Higher income means more cash holdings.

Money Market Equilibrium

- Assume an exogenous supply of money given by $\bar{M}$.
- Supply of real balances given by $\frac{\bar{M}}{P}$.
- In the short-run, assume that prices are rigid, meaning P fixed.
- Intersection of demand and supply gives equilibrium I and R since prices are fixed.

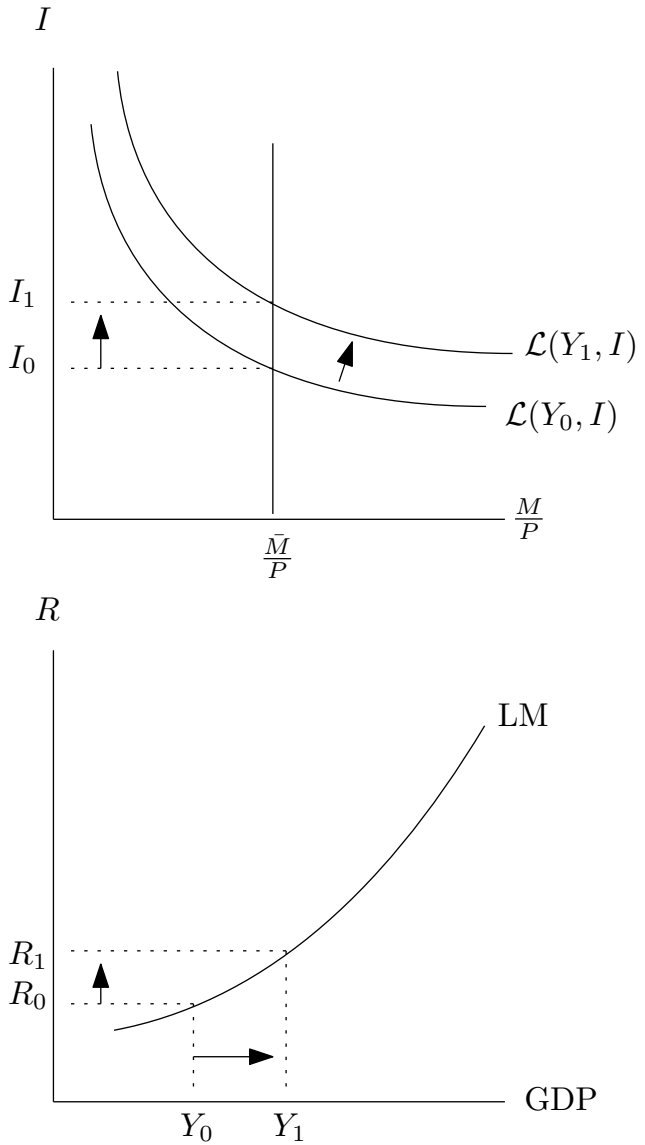
Money Market Equilibrium



LM Curve

- Liquidity-money curve.
- The locus of points in R v.s. Y space where the money market equilibrium holds.
- LM curve has positive slope since when Y rises, there is an increase in money demand.
- Causes R to rise when P is fixed in the short-run.

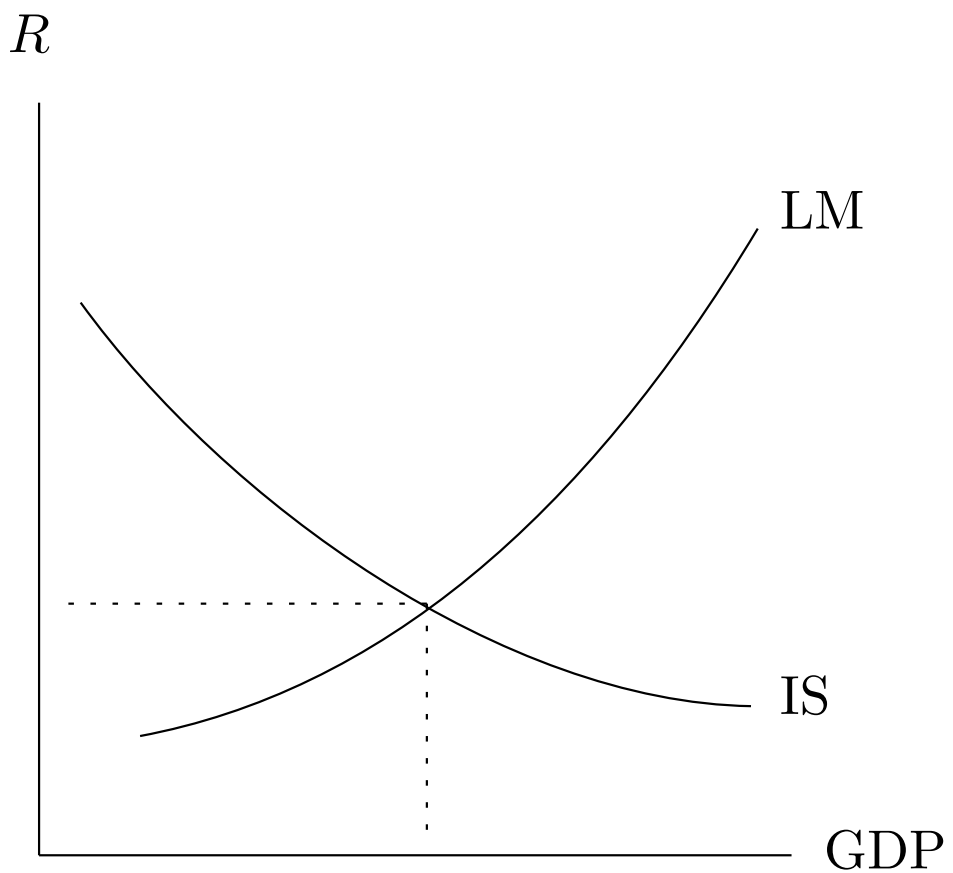
LM Curve


I
I_1
I_0
$\mathcal{L}(Y_1, I)$
$\mathcal{L}(Y_0, I)$
$\frac{M}{P}$
$\frac{\bar{M}}{P}$
R
LM
R_1
R_0
GDP
Y_0
Y_1

IS-LM

- Intersection of IS-LM gives equilibrium Y and R for fixed price P.

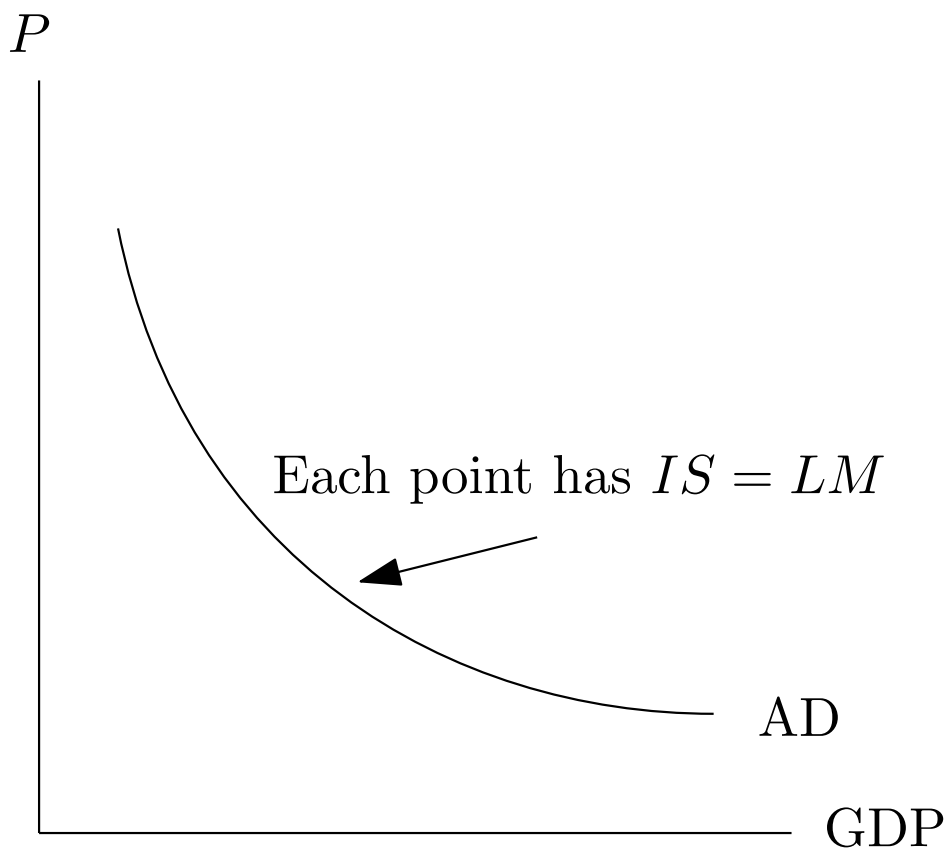
IS-LM



AD

- Aggregate demand and supply are plotted in price (P) v.s. output (Y) space.
- Each point along the AD curve corresponds to an intersection of the IS-LM curves.

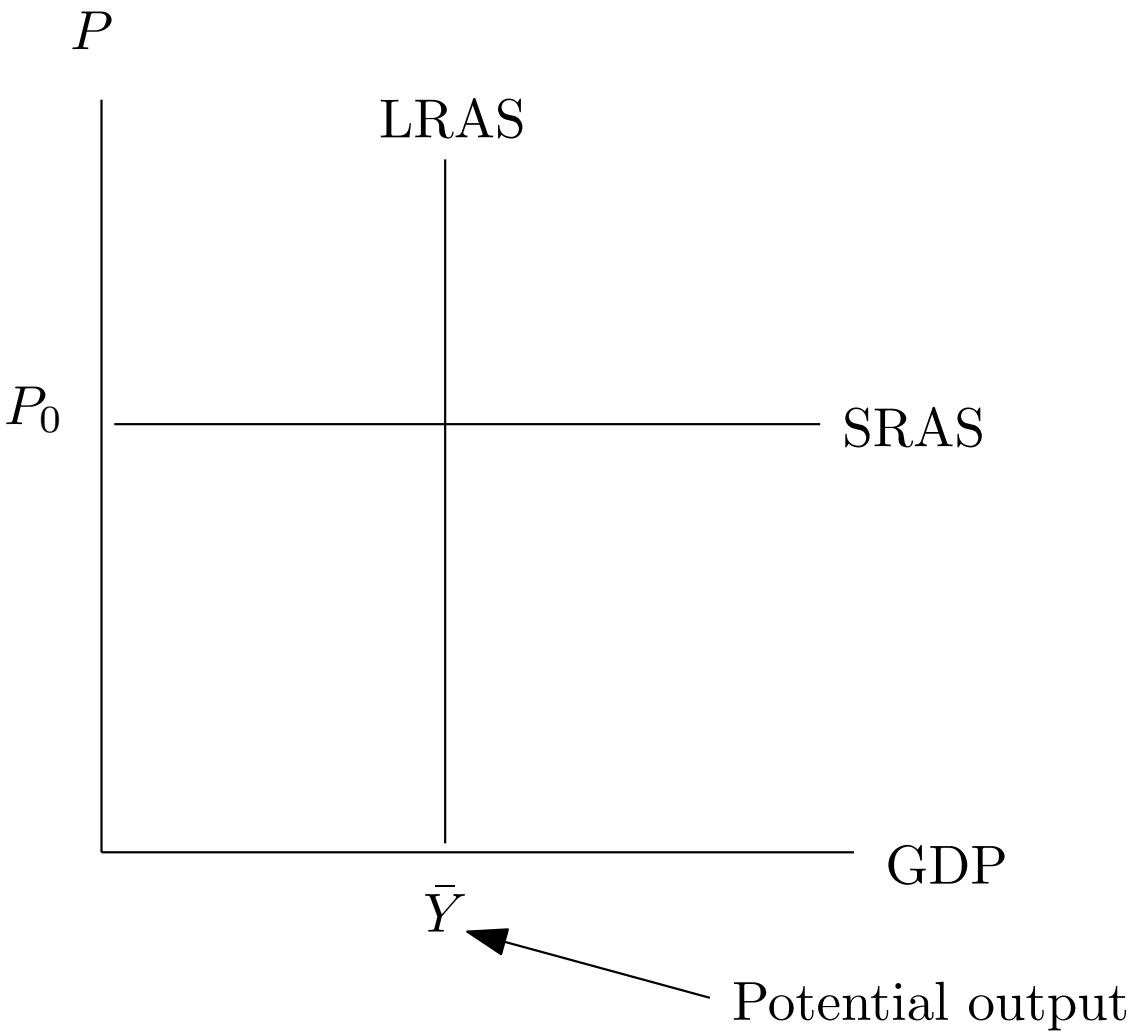
AD



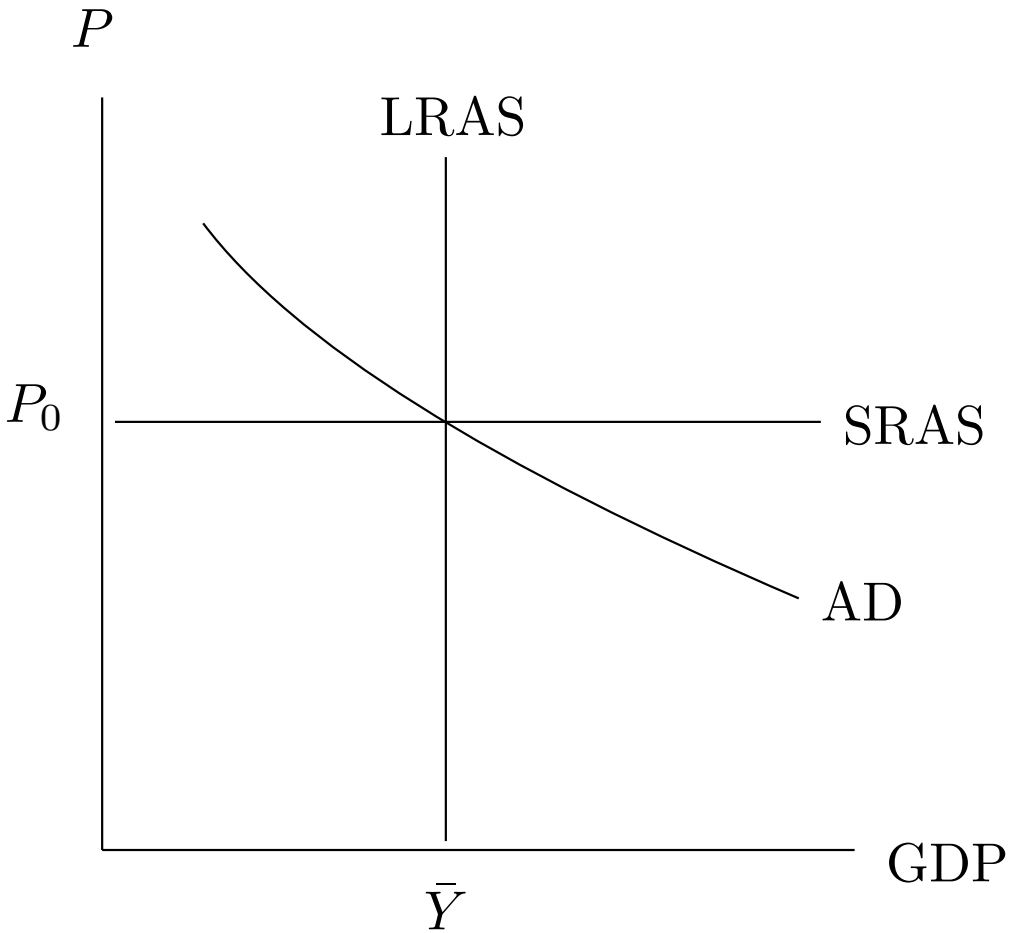
AS

- Two types of aggregate supply: short-run and long-run.
- In the short-run: horizontal at the fixed price P.
- In the long-run: vertical at potential output.

AS



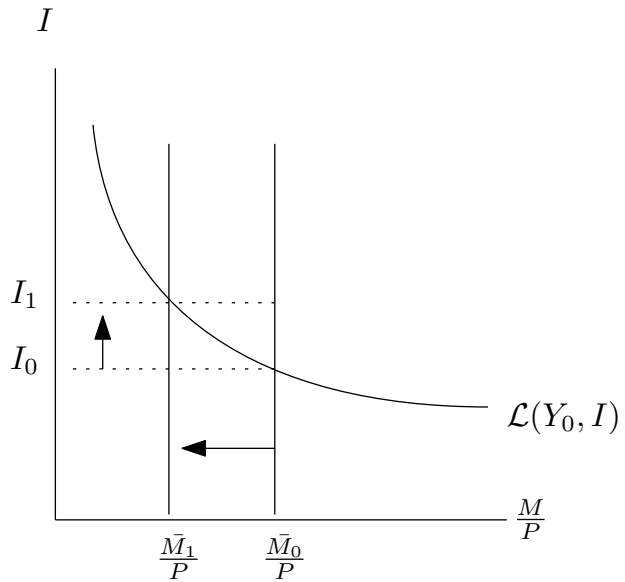
Equilibrium

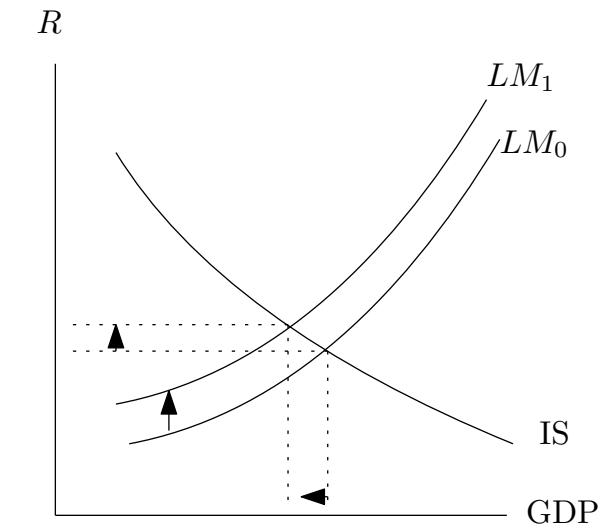


Monetary Policy

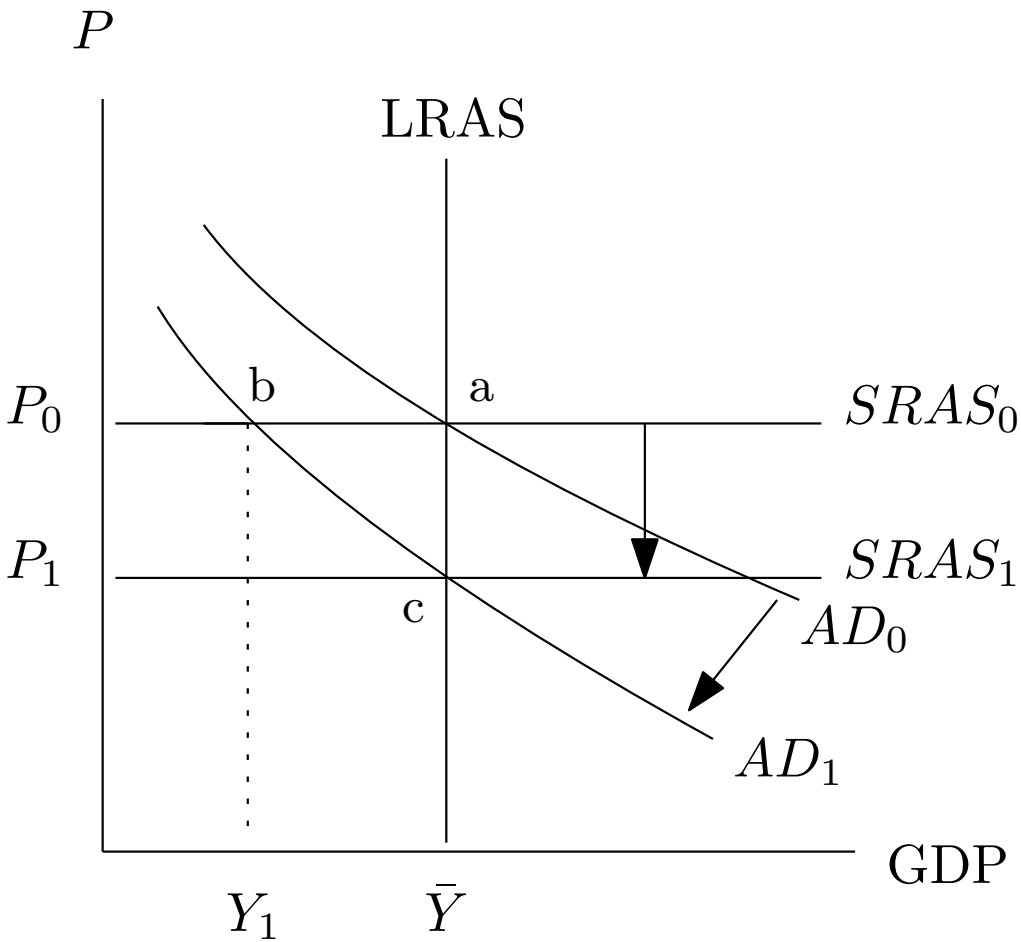
- What happens when there is a monetary contraction?
- Can think of as a decrease in the money supply $\bar{M}$ (from M_0 to M_1) or as an increase in I (from I_0 to I_1).

Monetary Policy





Monetary Policy



Monetary Policy

- Monetary contraction has a temporary dampening effect on output.
- Leads to permanently lower prices though.

Roadmap

Review

- Monetarists also believe that rigidities can lead to real effects of monetary policy in the short run.
- Point of departure from Keynesians though is that Monetarists believe more strongly in the efficacy of monetary policy.
- Keynesians advocate more for fiscal interventions than monetary.

Quantity Theory of Money

- An identity (meaning must hold by definition) of the form

$$MV = PQ$$

where

  - M is money supply,
  - V is velocity of money circulation,
  - P is price level and
  - Q is volume of transactions.

Monetarist Policy Recommendations

- Monetarists believe that V is relatively constant.
- *Inflation is always and everywhere a monetary phenomenon* (Friedman).
- An increase in the money supply leads to a rise in P since Q (in the long run) is independent of money supply.
- You'll just keep working your way up the LRAS curve in the long-run.

Monetarist Policy Recommendations

- Remove central bank discretion; keep the money supply predictable.
- Keep government interventions generally to a minimum: the private sector gets the job done just fine.

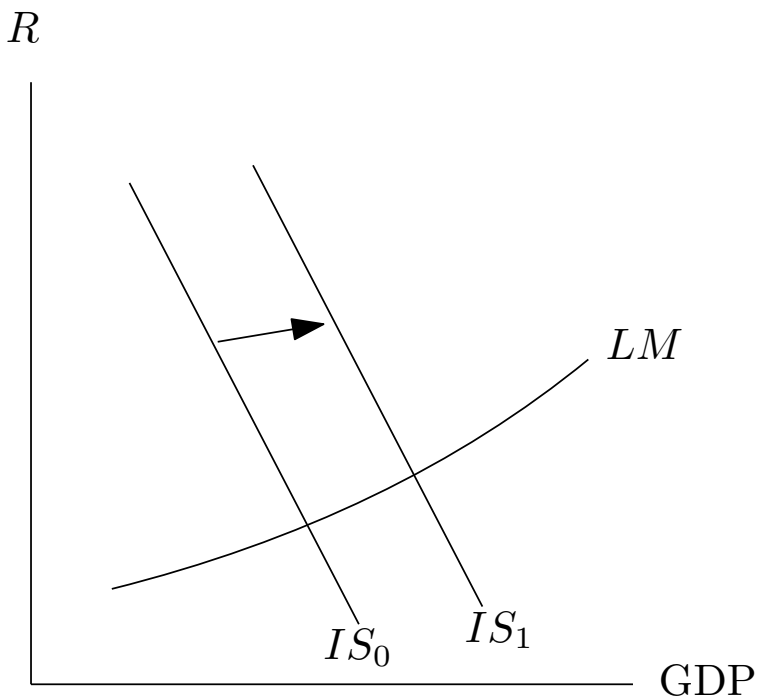
Keynesian Policy Recommendations

- Keynesians think V moves around with the money supply.
- Not clear that changes in the money supply will be perfectly passed-on through higher prices.
- Focus on fiscal policy interventions instead.

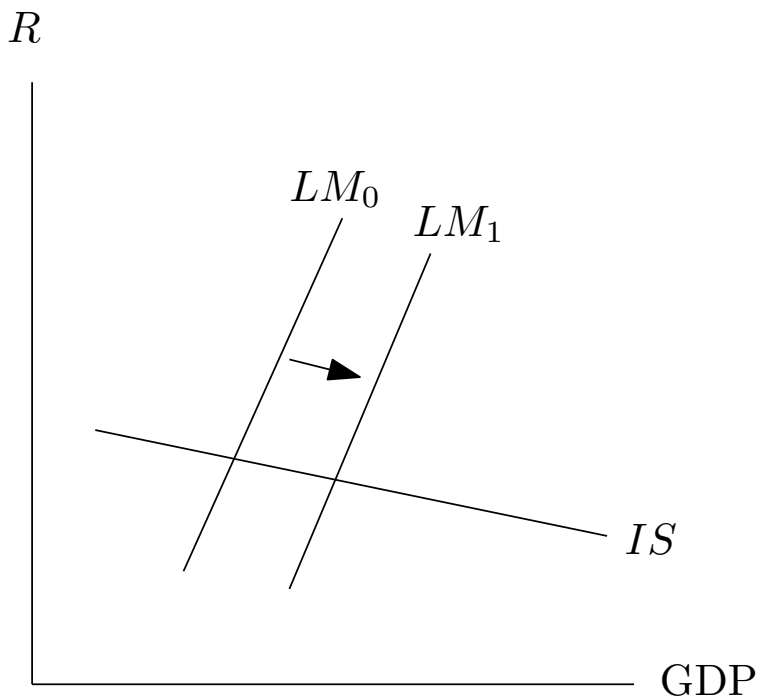
Demand Management

- Keynesians: fiscal.
- Monetarists: monetary.
- Differ in beliefs of the relative slopes of the IS and LM curves.
- Which curve should you try to shift to induce a response in AD?

Demand Management



Keynesian view



Monetarist view

Monetary Policy

- Although the literal senses of monetarist ideas are outdated, getting governments to take monetary policy more seriously is their lasting legacy.

Roadmap

Empirical Challenges

- Challenge for empiricists is identifying exogenous movements in the interest rate.
- Correlations between monetary and macro aggregates don't give evidence of non-neutrality.
- Reverse causality: is it the monetary variable that moves first or vice-versa.

Empirical Challenges

- Monetary policy rules.
- Taylor rule (more on this later) followed by central bank:

$$I_t = \underbrace{\Lambda + \phi_\Pi \Pi_t + \phi_Y Y_t}_{\text{Endogenous part}} + \underbrace{\epsilon_t}_{\text{Exogenous part}}$$

says that central bank changes the nominal rate endogenously in response to higher inflation or over-heating output.

Empirical Challenges

- Can then estimate exogenous changes as the residual of the observed rate from the policy rule.
- I.e. once you have an estimate for the endogenous component, you can estimate exogenous movements in the policy rate using the residual

$$\epsilon_t = I_t - (\Lambda + \phi_\Pi \Pi_t + \phi_Y Y_t)$$

- You can then find the response of the economy to an exogenous monetary shock using an estimated set of equations.

Evidence

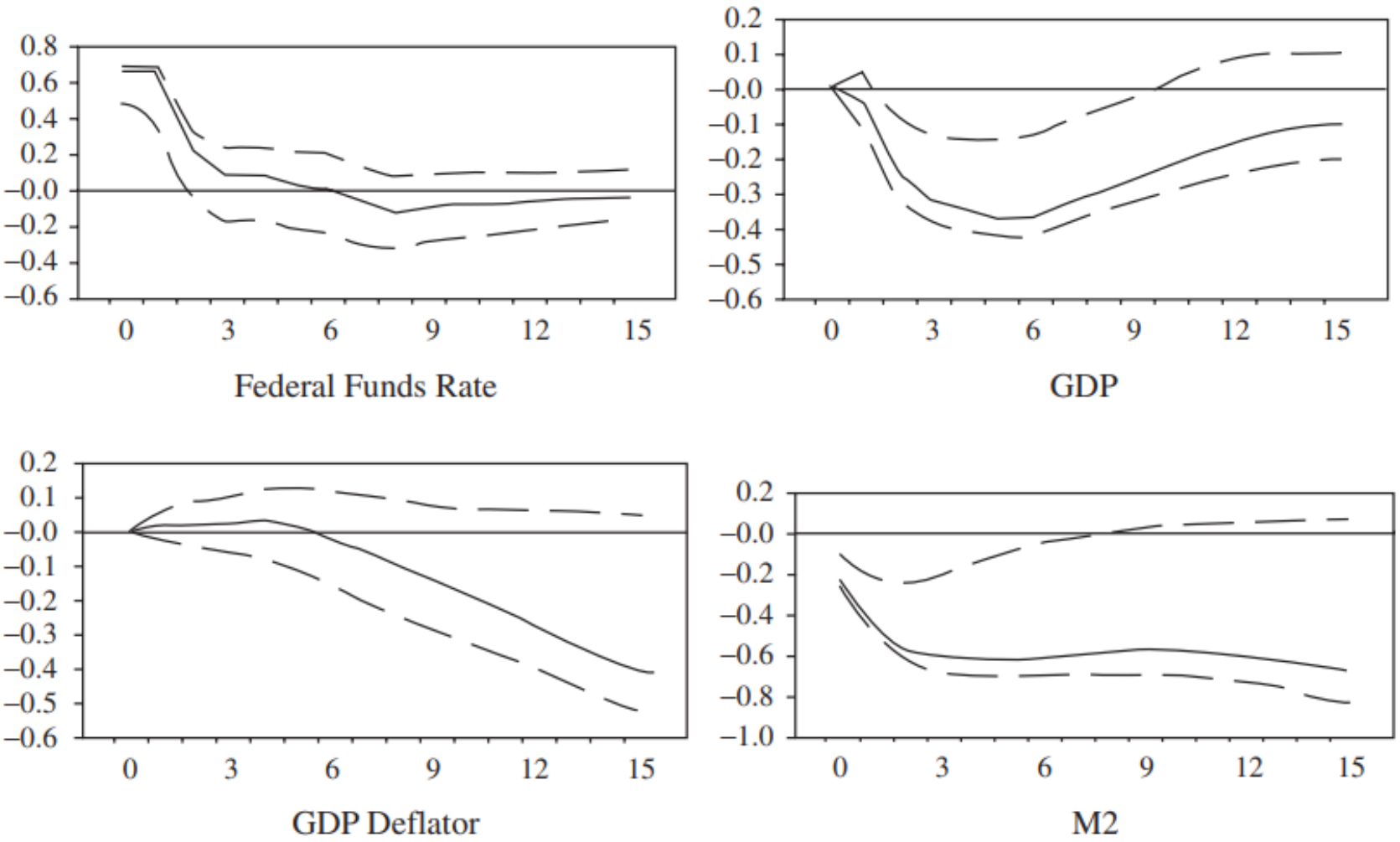


Figure 1.1 Estimated Dynamic Response to a Monetary Policy Shock

Source: Christiano, Eichenbaum, and Evans (1999).

Evidence

- Slow response of GDP deflator (price level): evidence of nominal rigidities.
- Higher Fed Funds rate drives decrease in GDP: non-neutrality.

Roadmap

Summary

- Non-neutralities come through nominal rigidities (sticky wages, prices).
- Old theories: you can use monetary policy to stimulate demand.
- Empirical evidence: seems to be an impact of exogenous monetary shocks on the macroeconomy.
- What does this mean for the remainder of our course...?

Summary

- If money is non-neutral, what are the channels through which it affects the economy?
- What is the optimal monetary policy for the central bank to follow?
- Formal models of monetary policy are needed to answer questions like these (both qualitatively and quantitatively).
- Next step: the real business cycle (RBC) model.
- The first building block to thinking rigorously about monetary policy.