

# A Brief Exposition of the IS-MP Curves: A Replacement for the Traditional IS-LM Curves

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## **INTRODUCTION**

The world economy is today in shambles. Equally, but perhaps less consequentially, the short-run macro models used today are in crisis. This note focuses on an updated approach to the central tool of short-run macro, the IS-LM analysis and IS-LM curves. This applies primarily to the closed economy, but is easily extended to the open economy. This note describes an updated version, the “IS-MP” analysis.

The problem that this relates to is the structure of monetary policy. The LM curve assumes that the central bank sets to quantity of money ( $M$ ) as its policy. When the IS-LM was developed (in the 1930s!), the world was in transition from the gold standard. The gold standard can be reasonably represented as a “M based” system, that is, one in which monetary policy sets the quantity of money (such as the value of high powered money).

Today, this approach is irrelevant. Rather, for countries with flexible exchange rates, monetary policy *normally* consists in setting a short-run risk-free nominal interest rate (the federal funds rate in the U.S.). The setting of this policy rate is based on policy objectives, such as inflation and real conditions. In developing our models, we need to move to this new reality about monetary policy. (In the liquidity trap, the IS-LM model is even worse, but that is another subject.)

For reference purposes, we can look at the treatment of the IS-LM analysis in Mankiw, *Macroeconomics*, but the treatment is similar in most if most macroeconomics textbooks up to today. It is gradually disappearing, but not fast enough. The traditional IS-LM analysis is not wrong; rather, it does not reflect the current realities of monetary policy in the U.S., E.U., Britain, or Japan. For a useful reference discussing the present approach, David Romer’s 2000 *Journal of Economic Perspectives* article describes the basics.

## **MODELING BASICS**

The basics of the IS curve are unchanged from standard textbook analyses. These show expenditures as a function of real interest rates and exogenous spending. For the IS

curve, output depends upon the real interest rate (faced by businesses and households), as well as exogenous spending items such as G, taxes, exports, and similar items.

$$(IS) \quad Y = IS(r; G, \dots)$$

Here,  $Y$  = real output,  $r$  = real interest rate and  $G$  is government purchases, the “...” represent other exogenous shocks such as exports.

We should pause a moment to consider the interest rates that are under discussion. We use the term “ $r$ ” to reflect the general level of real interest rates. If we were to look more carefully, we would want to consider a real rate on equity investments, “ $r_e$ ,” to be the real cost of capital faced by investors and consumers. Conceptually, we can think of  $r_e$  as the central bank rate, such as the federal funds rate (“ $iff$ ”), plus inflation (“ $\pi$ ”), plus spread reflecting a risk, term, and tax premium, “spread.” For most of the analysis, we assume that the spread is constant, so that  $r_e = iff + \pi + \text{spread}$ .

Now consider monetary policy. The old LM curve is inappropriate because central banks do not hold  $M$  constant; most sensible central banks do not even pay attention to  $M$ . A better approximation is the “Taylor rule,” TR, which states that the Fed sets the real interest rate as a function of (core) inflation and the deviation of output from potential:

$$(TR) \quad r = TR(\pi, Y) = r^* + b\pi + cY = TR(\pi, Y)$$

Where  $r^*$  is the target real interest rate,  $\pi$  is the rate of inflation, and  $b$  and  $c$  are parameters. In each case, we interpret the variable as deviation from a target. So for example,  $\pi$  is the difference between core inflation and a target of 2 percent per year. Similarly,  $Y$  is the difference between log output and the log of potential output. Note that while the monetary authority sets the nominal interest rate, this approach involves the real interest rate; this assumes that the central bank adjusts its targets for inflation.

Finally, we add an inflation equation, which is a standard inertial Phillips curve:

$$(PC) \quad \pi = PC(\pi_{-1}, Y) = \pi_{-1} + dY + e$$

Inflation is an inertial process, and is a function of lagged inflation,  $\pi_{-1}$ , with upward pressure determined by excess output demand ( $Y$ ), while  $e$  is random shocks (such as due to oil prices).

## **TWO APPROACHES TO INFLATION**

*Fixed prices.* We can do a first case where prices and therefore inflation are given in the short run, so the TR equation is just a function of  $Y$ . Assuming that the central bank has an output objective ( $c > 0$ ), this then leads to Figure 1. This shows the IS-TR curve. The

equilibrium is very similar to the old IS-LM model, but the monetary policy curve reflects the objectives of the Taylor rule rather than a fixed M rule.

Flexible (but not perfectly flexible) prices. A second and more important case is where we allow for inflation. For this, we substitute the PC into the TR, to get an integrated monetary policy (MP) rule:

$$r = r^* + b[\pi_{-1} + dY + e] + cY = a + b\pi_{-1} + (bd+c)Y + e$$

$$(MP) \quad r = r^* + b\pi_{-1} + (bd+c)Y + e = MP(Y; \pi_{-1}, e)$$

This is shown in Figure 2. The important point is that the MP equation looks very similar to the TR rule as well as to the LM curve. In the MP equation, the coefficient on output ( $Y$ ) is  $(bd+c)$  instead of  $c$ . In other words, output affects monetary policy directly through  $c$  and indirectly through  $bd$ . The output effect (as in the last case) says that as output declines below potential, as in a recession, the monetary authority lowers interest rates. However, in the other direction, high output leads to higher inflation in the realistic case of flexible prices. Also, note that there are explicit inflationary shocks ( $e$ ) in the MP equation.

### **SPECIAL CASES**

We can consider two special cases.

Inflation targeting. In this case, we set  $c = 0$ . This does not change the structure, but it does make the MP curve *flatter*. In other words, real interest rates respond less to IS shocks that reduce output. This is similar to the difference in reaction of the Fed and the ECB to the output shocks of 2007-2008.

Output targeting. Output targeting simply has a vertical TR or MP curve at the output target. This case applies to few central banks today but is an interesting case. Note that it looks much like the monetarist case of IS-LM analysis. This would also be the limiting case where the central bank was infinitely inflation-averse (where  $b$  is very large).

### **IMPACT OF SHOCKS**

We can consider four shocks that reflect common issues that face policy.

Case 1. Fiscal shock. Suppose that there is a fiscal shock, perhaps because of an unexpected increase in spending (say because of reunification of Germany, or a war in Iraq). This would lead to a shift in the IS curve. The reaction is a movement along the MP curve, a tightening of monetary policy as shown in Figure 3. Output and real interest rates rise.

Case 2. Financial shocks. A financial crisis raises risk spreads. Suppose that a financial crisis, such as that of 2007-08, leads to an increase in spreads between market interest rates and the monetary policy interest rate. For this, we need to rewrite the IS curve as  $IS(r_{ff}) = IS(r_e - \text{spread})$ , where  $r_{ff}$  = policy interest rate,  $r_e$  = cost of capital to firms,  $\text{spread} = r_e - r_{ff}$ . The shock then leads to a downward shift of the  $IS(r_{ff})$  curve, as shown in Figure 4. This is contractionary. Unconfused policymakers (such as the Fed) respond by monetary expansion. Real interest rates and output fall, but output falls less than they would for confused policymakers (as the ECB).

Case 3. An inflationary shock. Suppose that there is an inflationary shock, such as an oil price increase that gets into higher wage increases. This is slightly more complicated because it involves the inflationary background to the MP equation. A shock to inflation leads to a higher target real interest rate, and therefore an upward shift in the MP curve. The result is shown in Figure 5. The outcome is “stagflation,” higher real interest rates, lower output, and higher inflation.

Case 4. A change in monetary targets. A final case involves a change in monetary policy. This might occur when the central bank decides to lower its inflation target. This might be what happened to Fed policy after 1979, when the Fed decided to wring inflation out of the U.S. economy. This would have the same structure as Figure 5. A lower target would involve the Fed tightening policy by shifting the MP curve upward and to the left. This would raise real interest rates and lower output in the short run, lowering inflation. The longer run impacts will be seen shortly.

## **DYNAMICS**

We will postpone dynamics because that is well covered in the Mankiw chapter. So once we get over the LM hurdle with Mankiw, everything is fine.

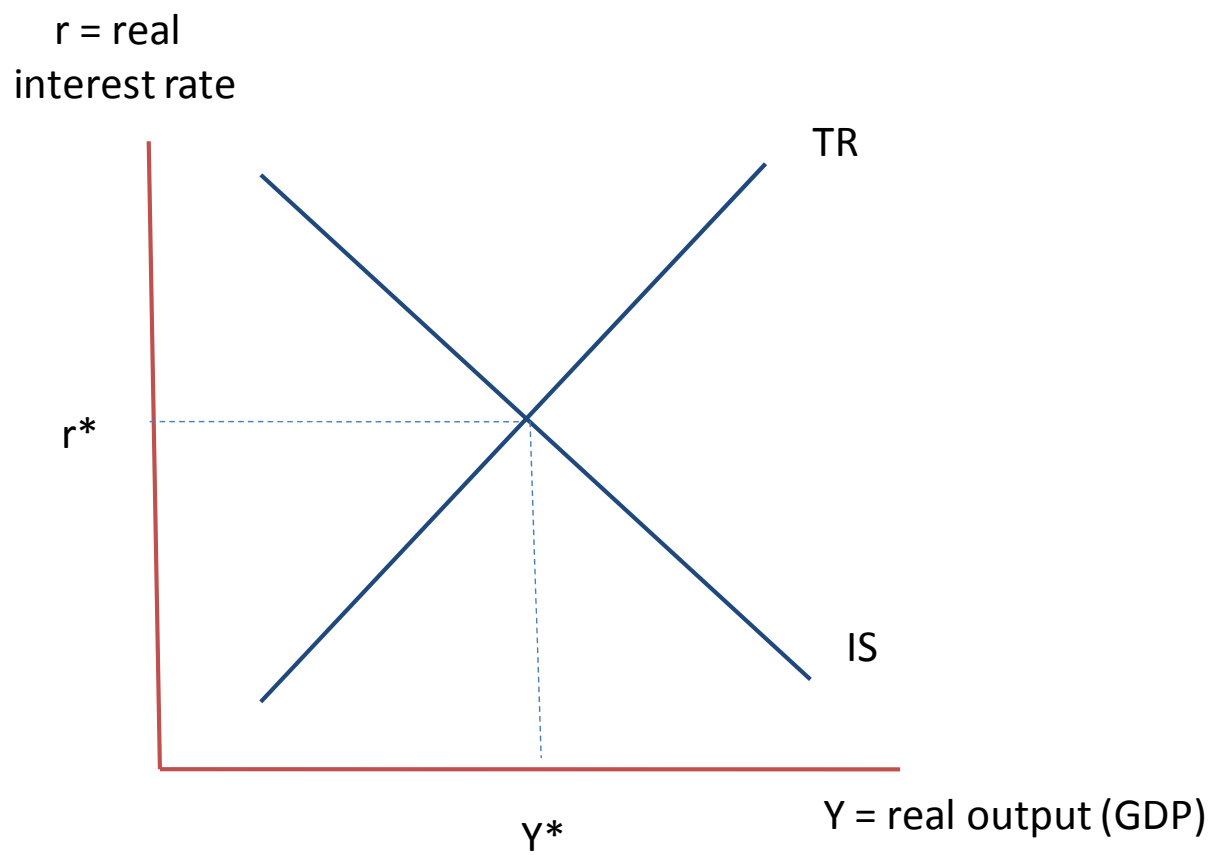


Figure 1. Simple IS-TR graph.

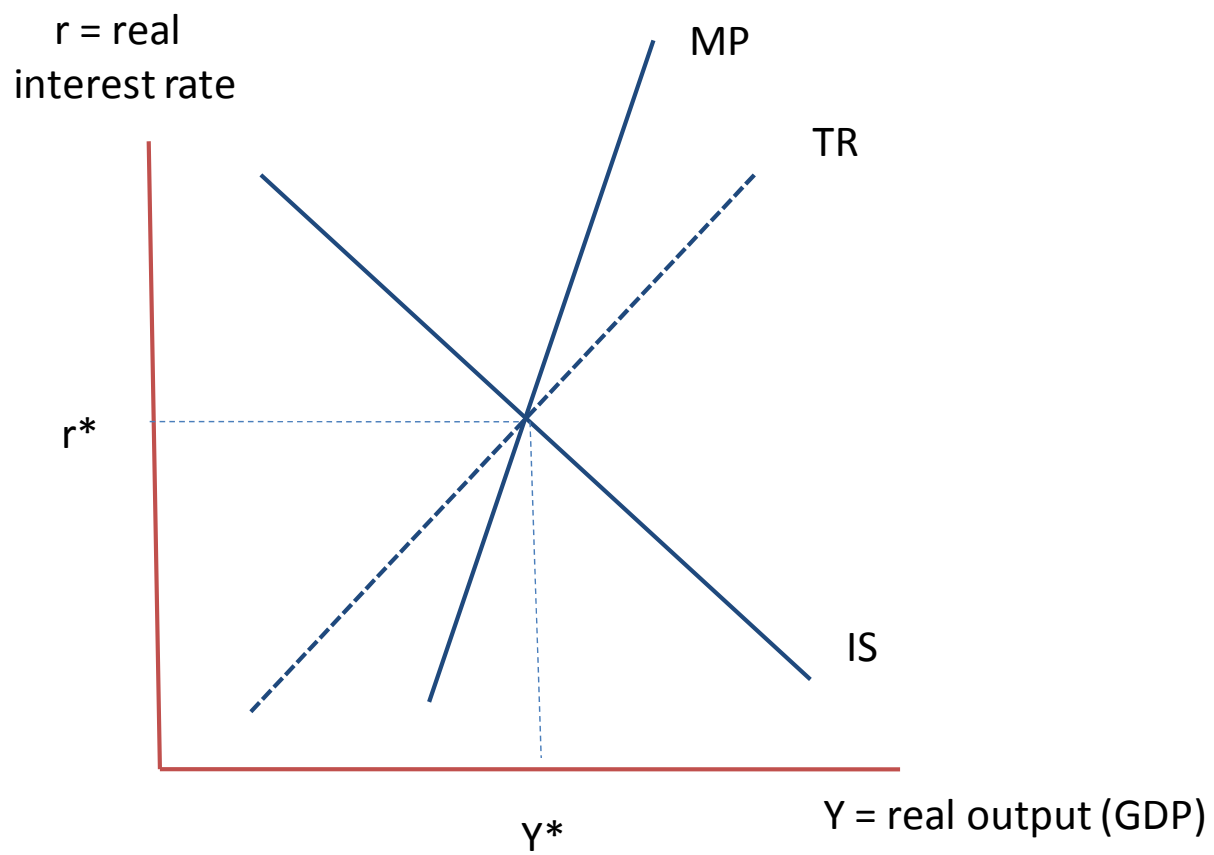


Figure 2. Complete IS-MP graph.

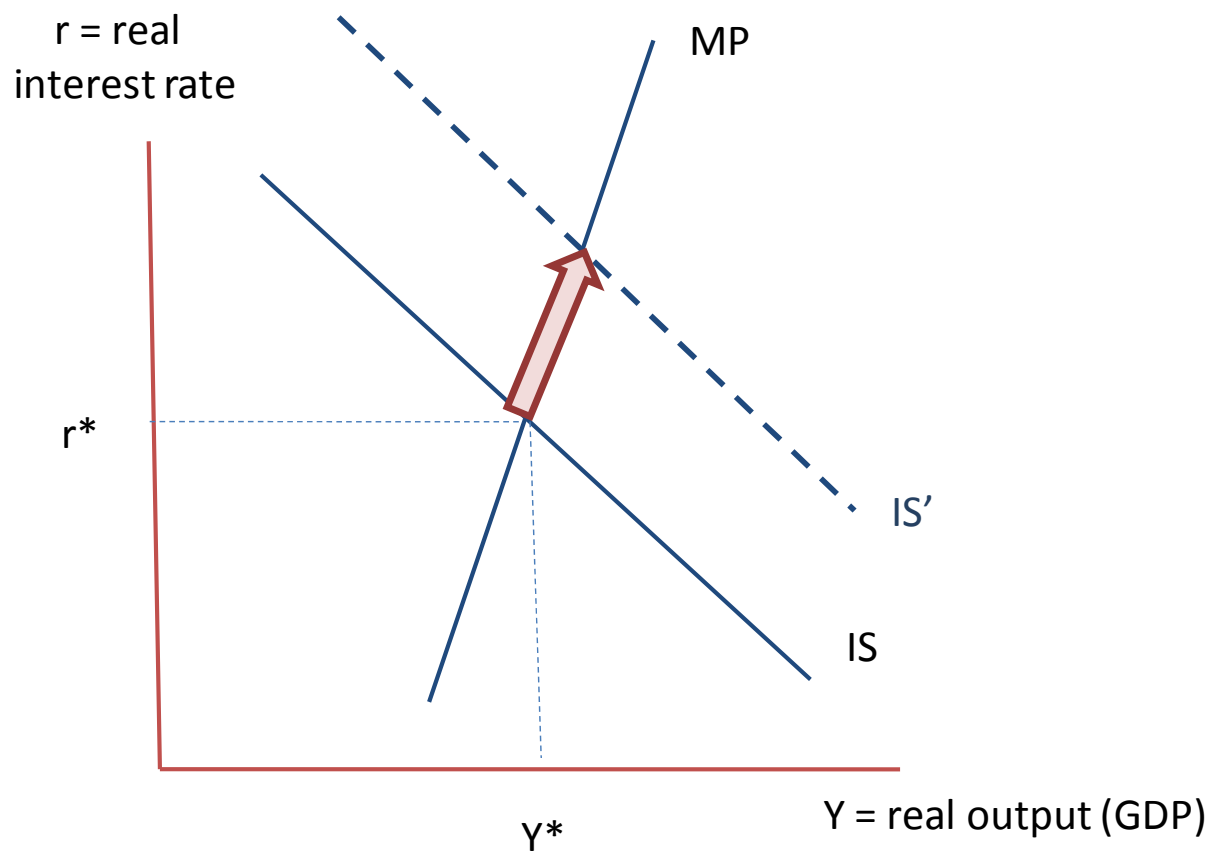


Figure 3. Impact of IS shock (say increase in G)

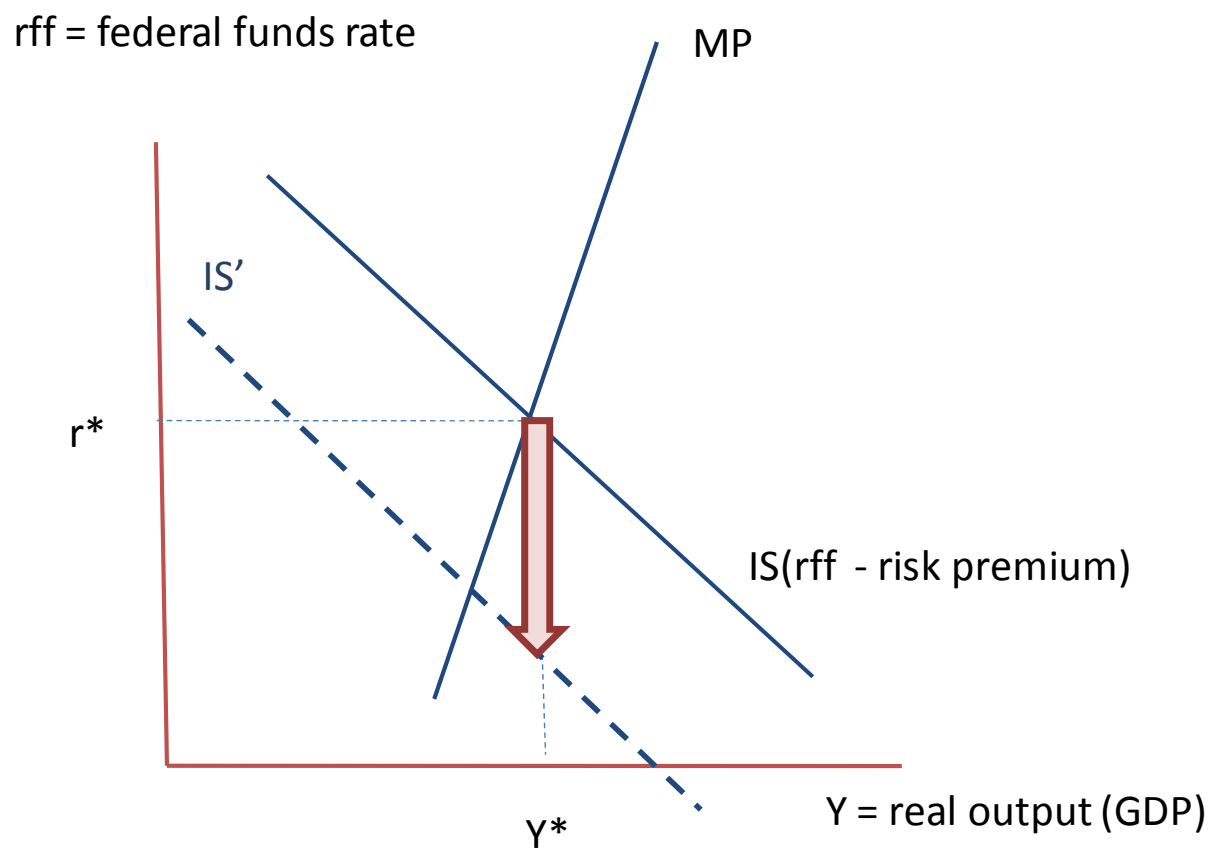


Figure 4. Impact of financial crisis that increases cost of capital to business relative to policy interest rate



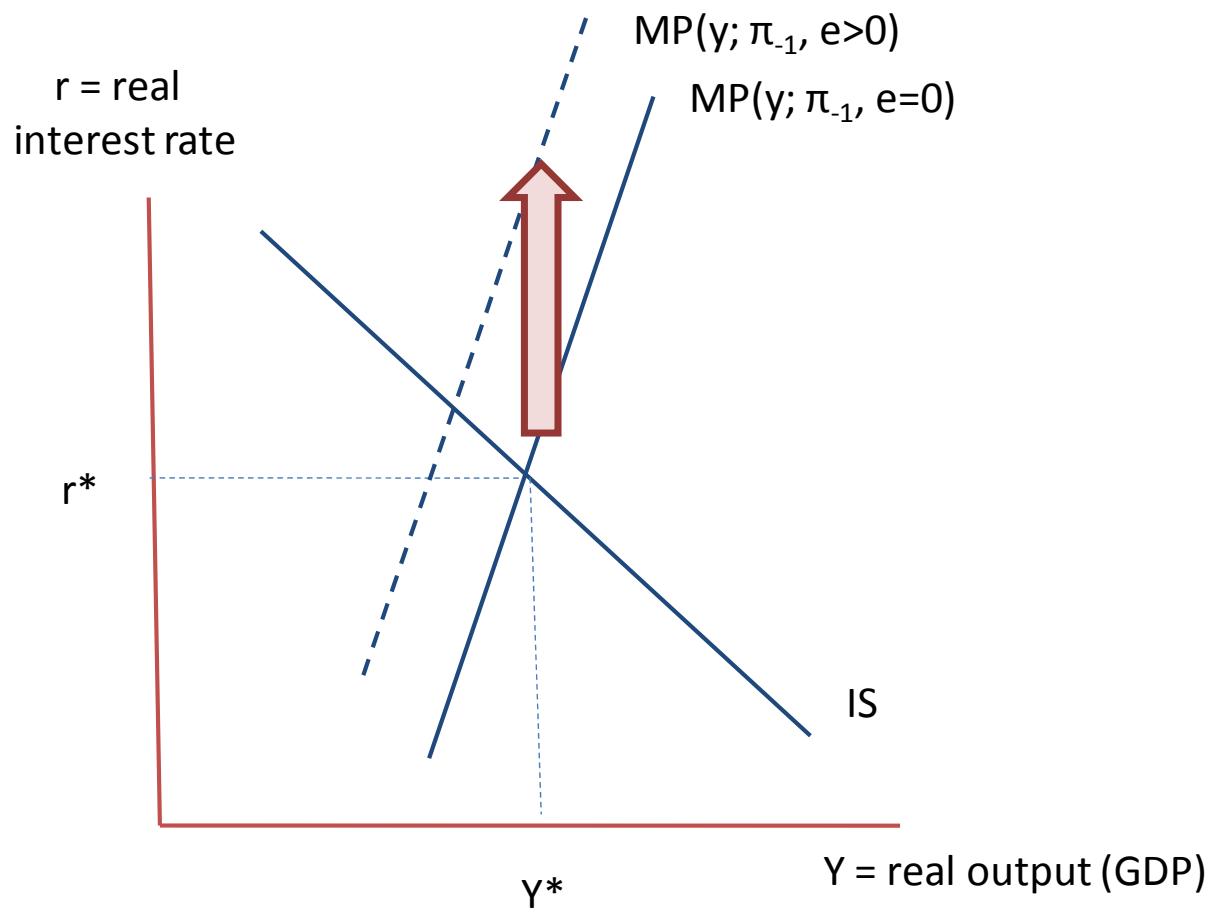


Figure 5. Impact of an inflationary shock