

Money Growth and Inflation, Nominal and Real Interest Rates The ISLM Model

The *IS* relation is:

$$Y = C(Y - T) + I(Y, r) + G$$

Firms consider the real interest rate when making investment decisions.

The *LM* relation is given by:

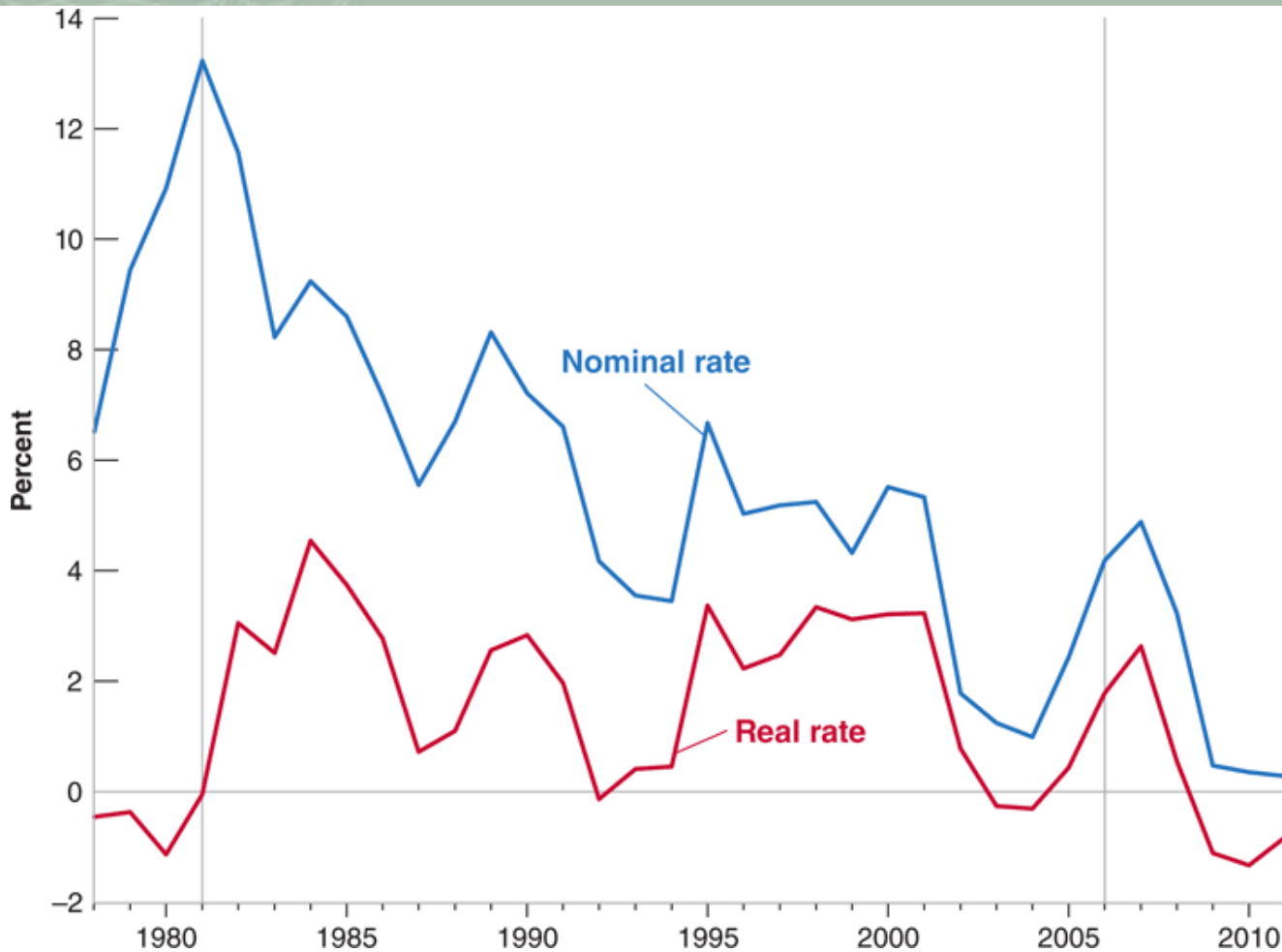
$$\frac{M}{P} = YL(i)$$

The interest rate directly affected by monetary policy (the interest rate that enters the *LM* equation) is the nominal interest rate.

$$r_t \approx i_t - \pi_{t+1}^e$$

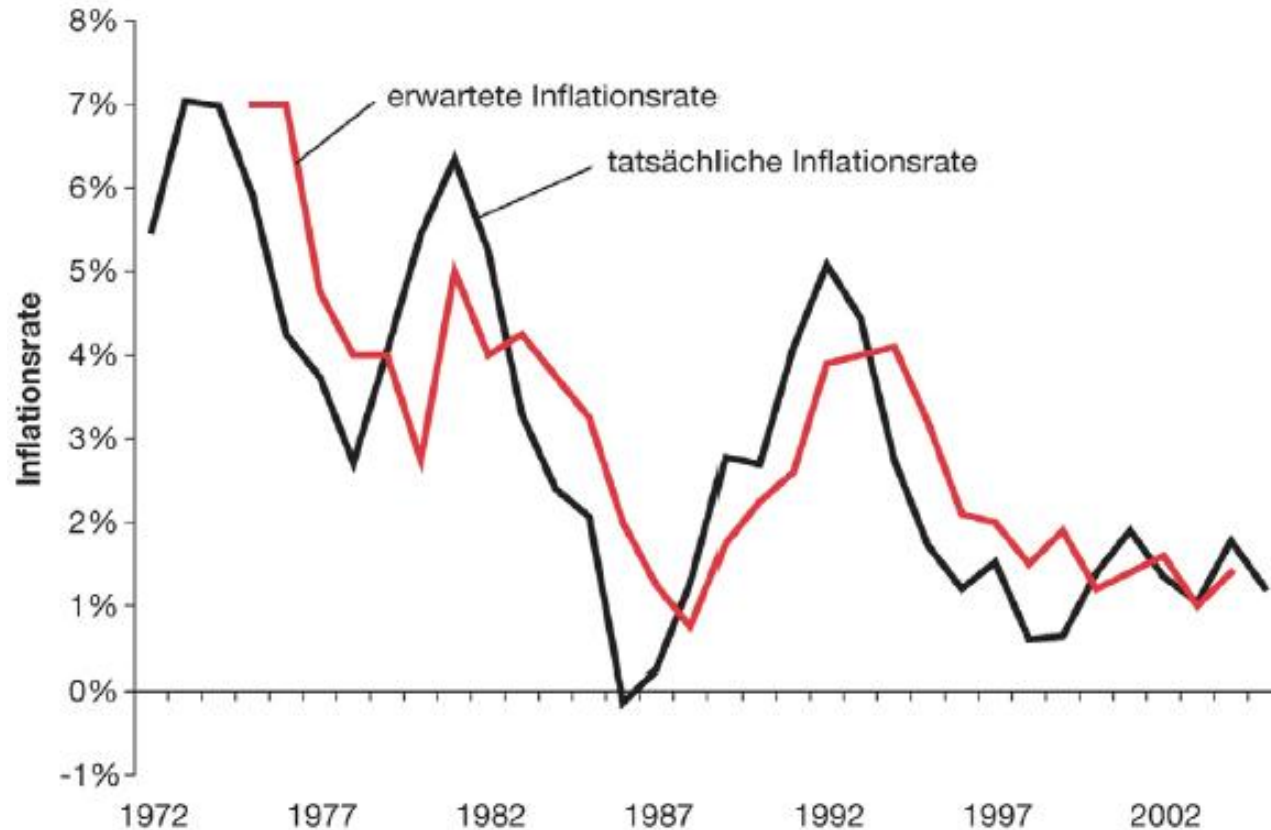
The effects of monetary policy on output therefore depend on how movements in the nominal interest rate translate into movements in the real interest rate.

Figure: Nominal and Real One-Year T-Bill Rates in the United States since 1978



Source: Nominal interest rate is the 1-year Treasury bill in December of the previous year: Series TB1YR, Federal Reserve Economic Data (FRED) <http://research.stlouisfed.org/fred2/> (Series TB6MS in December 2001, 2002, 2003, and 2004.) Expected inflation is the 12-month forecast of inflation from the December OECD Economic Outlook from the previous year.

Figure: Expected and actual inflation rates for Germany, 1972 -2005





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- Higher money growth leads to lower nominal interest rates in the short run but to higher nominal interest rates in the medium run.
- Higher money growth leads to lower real interest rates in the short run but has no effect on real interest rates in the medium run.

Figure: Equilibrium Output and Interest Rates

The ISLM Model

The equilibrium level of output and the equilibrium nominal interest rate are given by the intersection of the *IS* curve and the *LM* curve.

The real interest rate equals the nominal interest rate minus expected inflation.

$$r = i - \pi^e \Rightarrow \Delta r = \Delta i - \Delta \pi^e$$

$$\Delta \pi^e = 0 \Rightarrow \Delta r = \Delta i$$

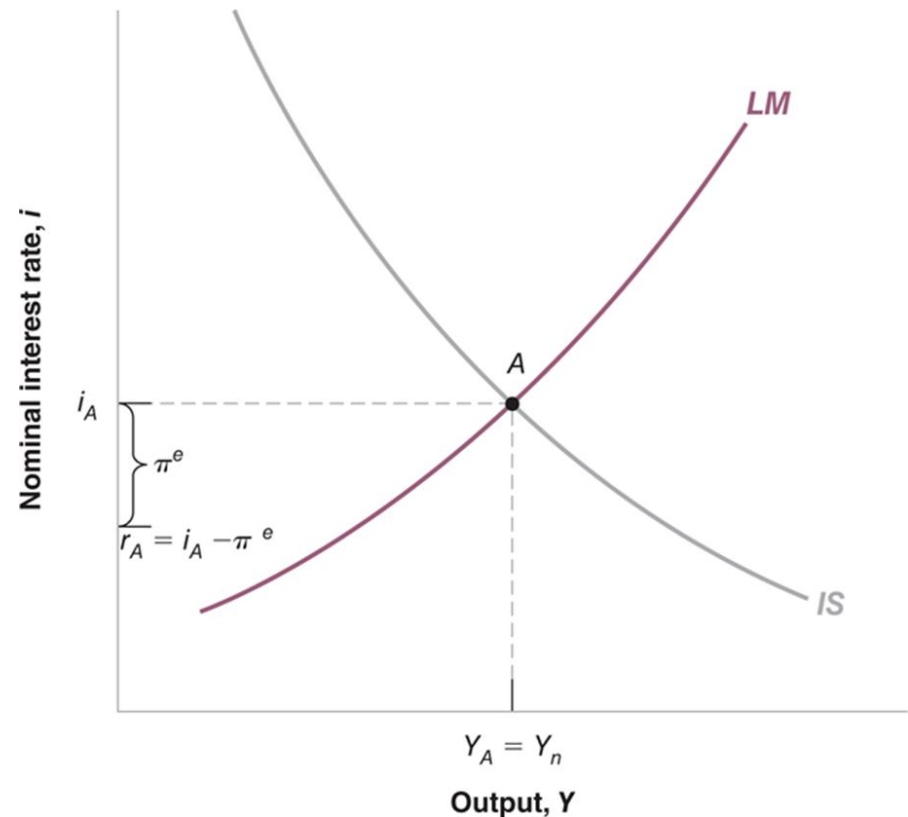
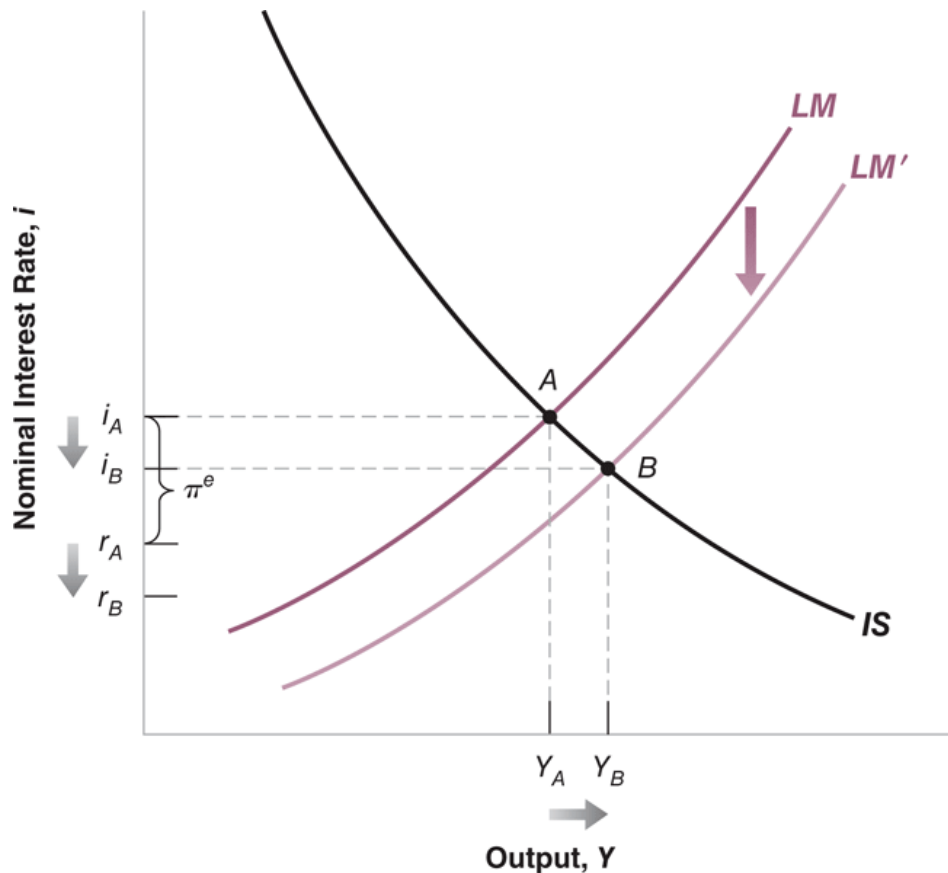


Figure: The Short-Run Effects of an Increase in Money Growth The ISLM Model

An increase in money growth increases the real money stock (M/P) in the short run. This increase in real money leads to decreases in both the nominal and real interest rates, and an increase in output and



Nominal and Real Interest rates in the Medium Run The ISLM Model

In the medium run, output returns to the natural level of output: $Y = Y_n$

$$Y_n = C(Y_n - T) + I(Y_n, r) + G$$

The real interest rate returns to the natural interest rate, r_n . It is independent of the rate of money growth.

$$\dot{i} = r_n + \pi$$

The rate of inflation, π , is equal to the rate of nominal money growth, g_m (neutrality of money).

$$\dot{i} = r_n + g_m$$

Nominal and Real Interest rates in the Medium Run The ISLM Model

$$\dot{i} = r_n + \pi$$

$$\dot{i} = r_n + g_m$$

This result – that, in the medium run, the nominal interest rate increases one-for-one with inflation – is known as the ***Fisher effect***, or the ***Fisher hypothesis***, after Irving Fisher.

From Short Run to the Medium Run

The ISLM Model

What happens between the short run and the medium run?

In the short run:

$$r < r_n \Rightarrow Y > Y_n \Rightarrow u < u_n \Rightarrow \pi \uparrow$$

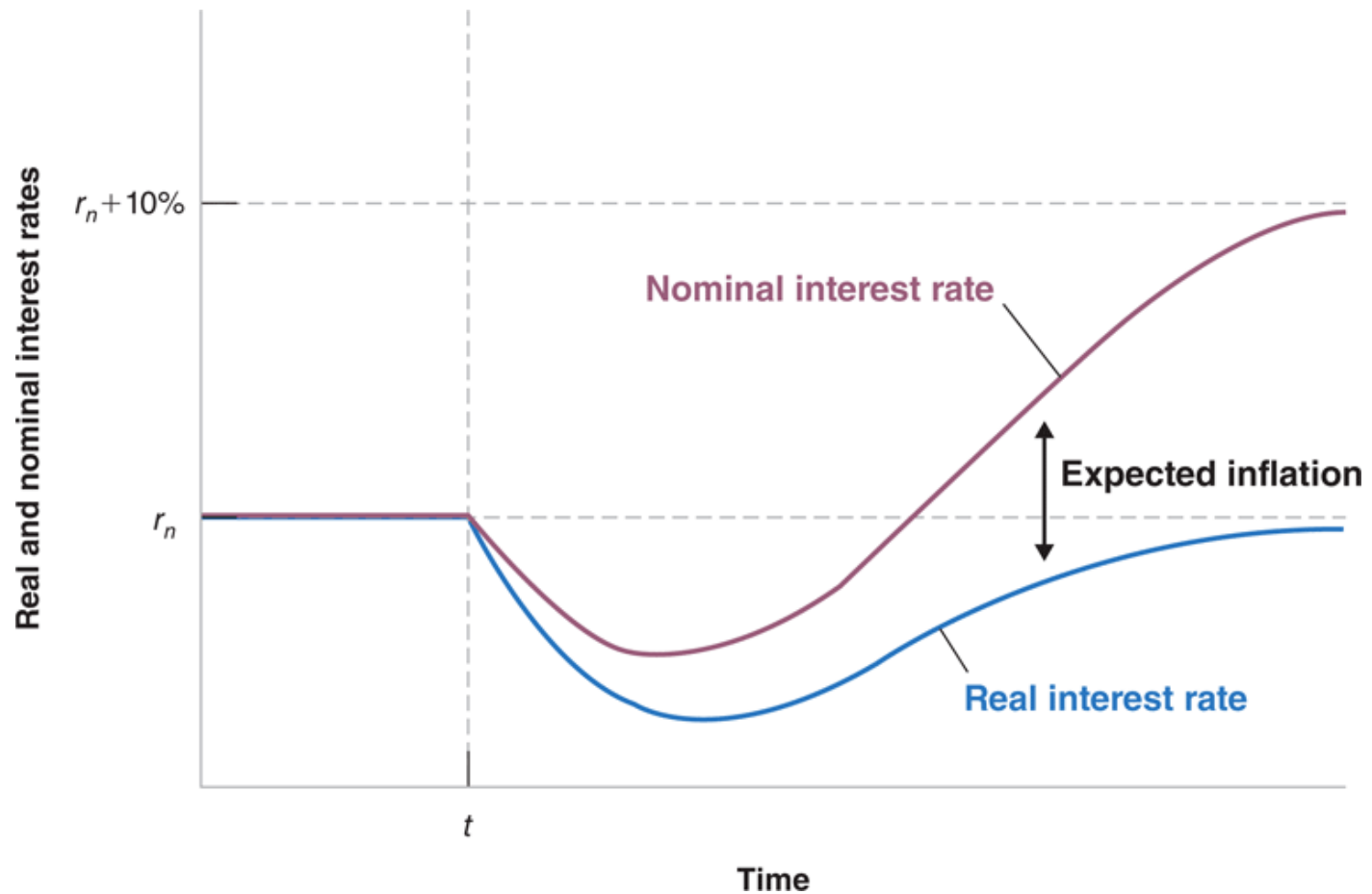
Over time:

$$\pi \uparrow \Rightarrow \pi > g'_m \Rightarrow (g'_m - \pi) < 0 \Rightarrow i \uparrow$$

In the medium run:

$$r = r_n, Y = Y_n, u = u_n, \pi = g_m, i = r_n + g_m$$

Figure: The Adjustment of the Real and the Nominal Interest Rates to an Increase in Money Growth





Evidence for the Fisher Hypothesis

Cross country analysis: the relation between nominal interest rates and inflation across countries. The data from the early 90s supports the Fisher hypothesis.

Inflation cycles: the relation between the nominal interest rate and inflation over time in a given country. Again

Figure: Nominal Interest Rates and Inflation across Latin America in the Early 1990s

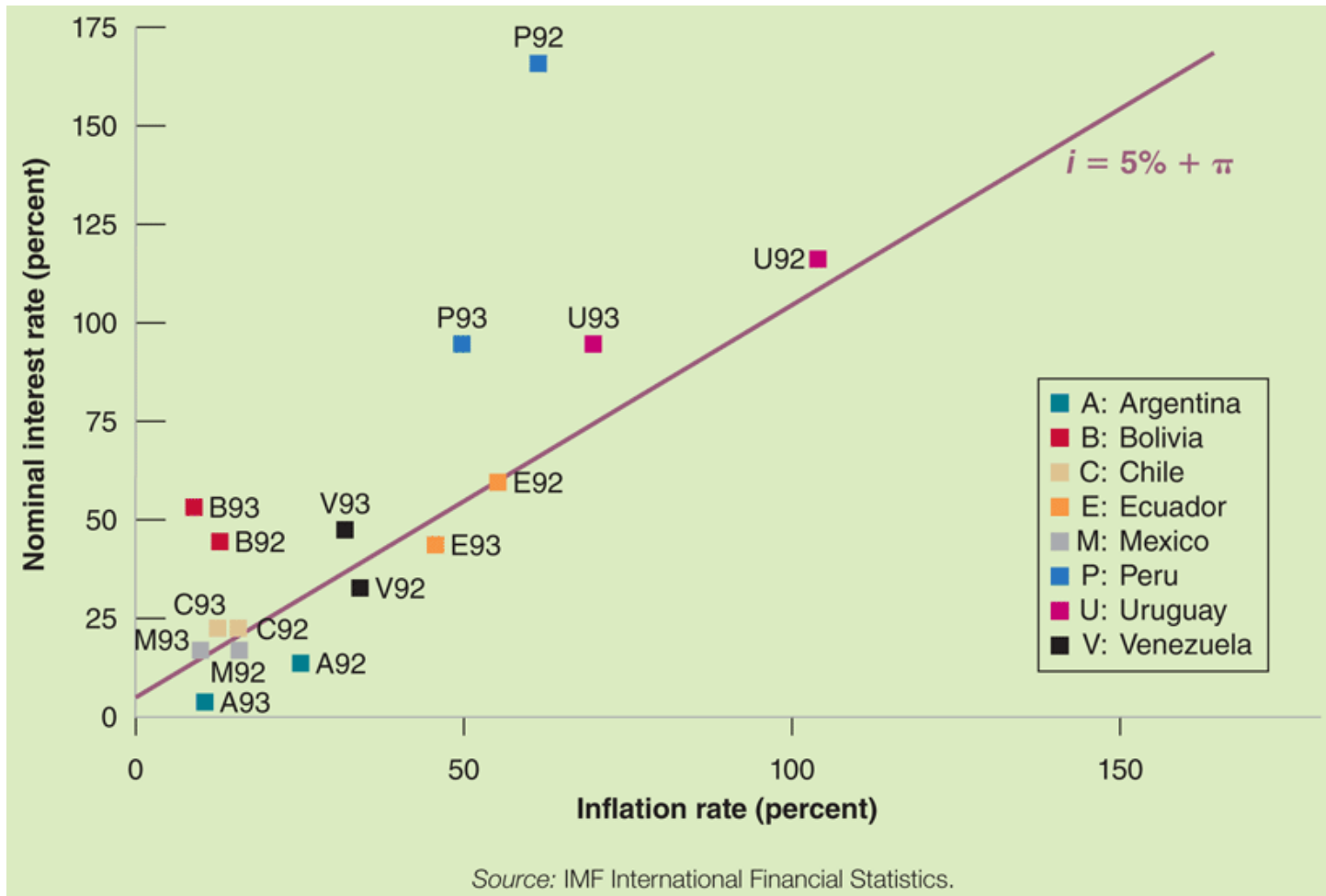
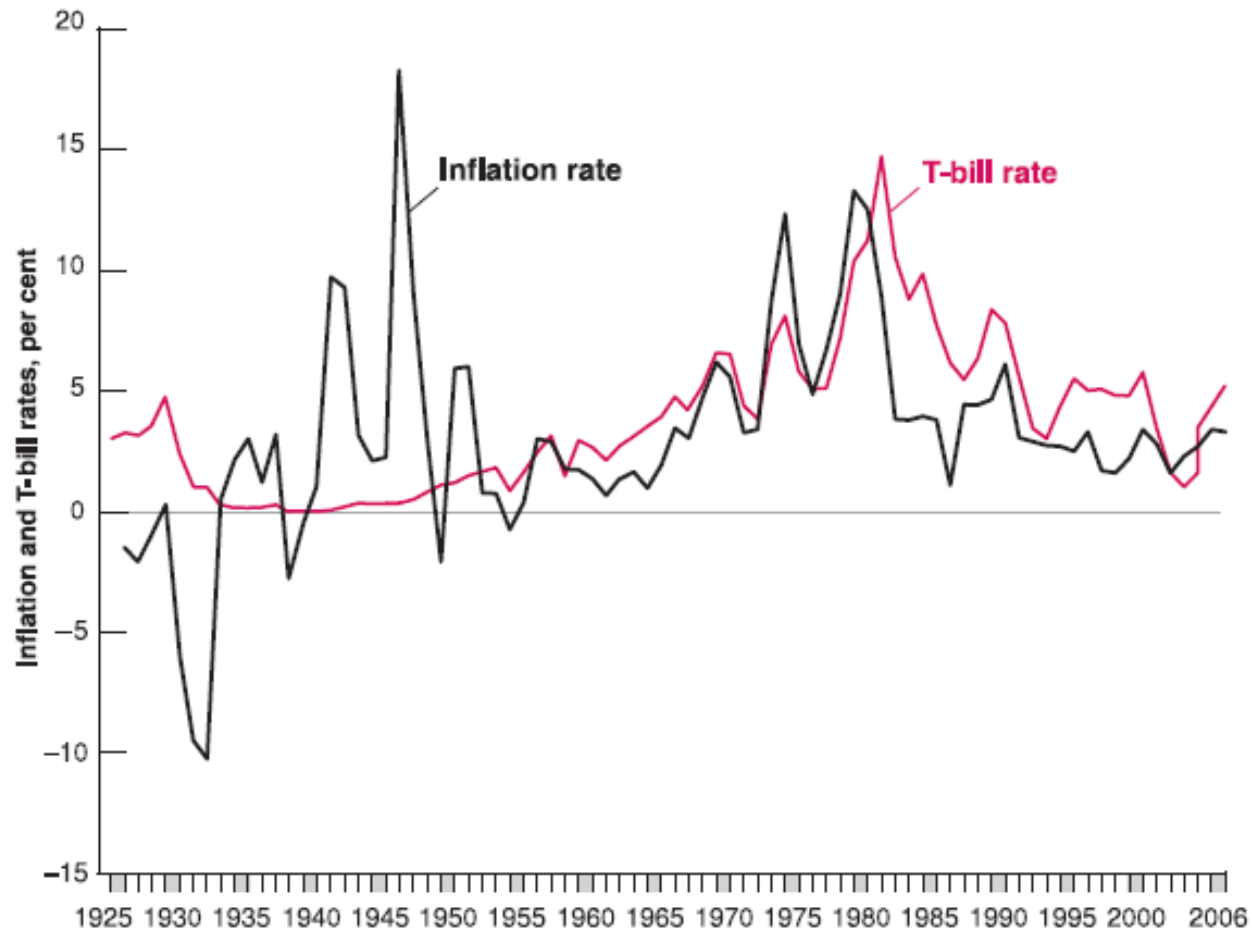
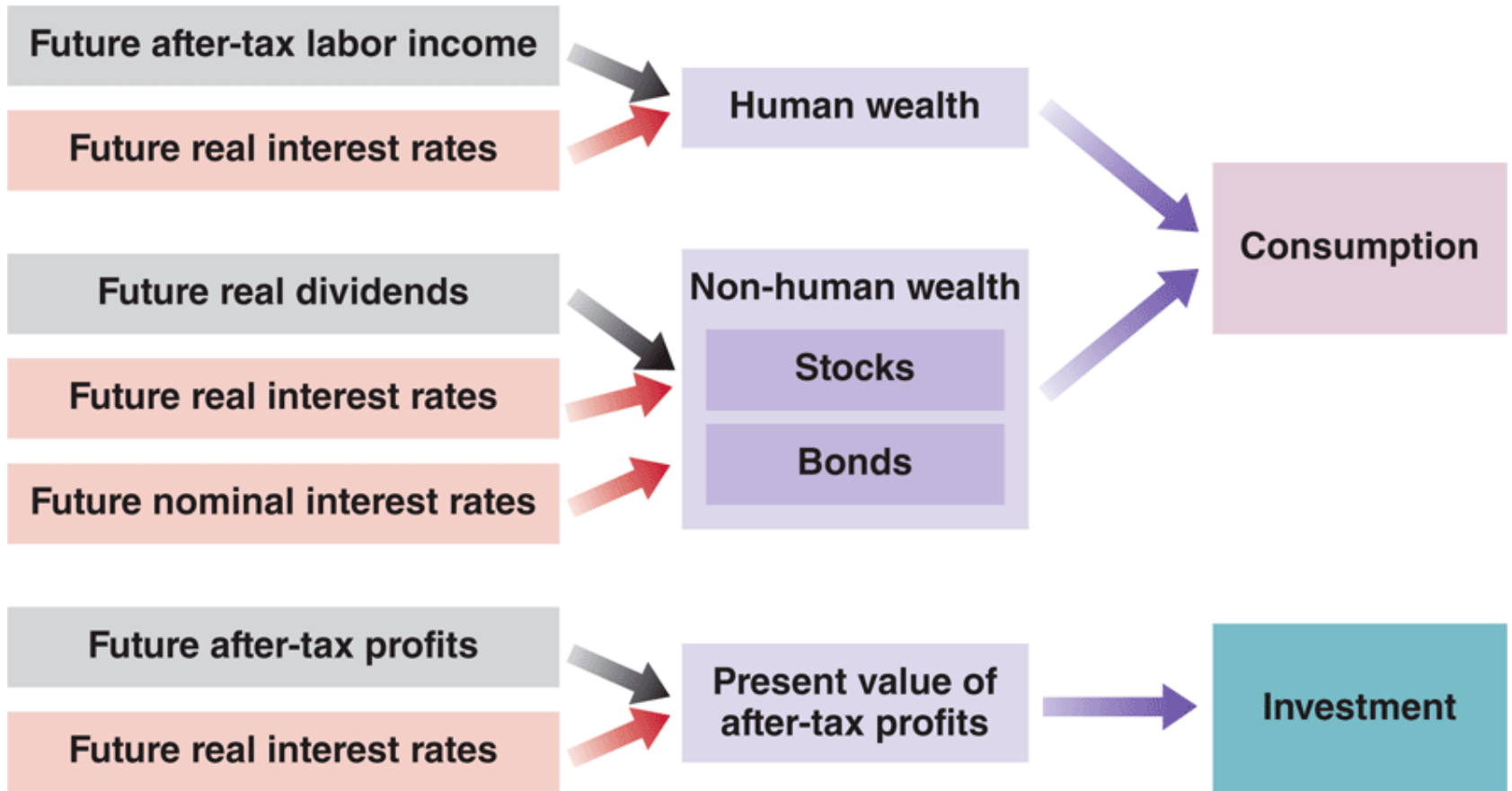


Figure: The three-month treasury bill rate and inflation since 1927



Expectations and Spending: The Channels



Expectations and the IS relation

The ISLM Model

$$Y = C(Y - T) + I(Y, r) + G$$

Expectations affect both consumption and investment.
Let's modify the IS relationship to take this into account!

First, define aggregate private spending as the sum of consumption and investment spending:

$$A(Y, T, r) \equiv C(Y - T) + I(Y, r)$$

We can rewrite the IS relation using this notation:

$$Y = A(Y, T, r) + G$$

(+, -, -)

The New IS Curve with Expectations

The ISLM Model

The natural extension is to allow spending to depend also on their expected values in the future period:

$$Y = A(Y, T, r, Y^{e}, T^{e}, r^{e}) + G$$

(+, -, -, +, -, -)

(Primes denote future values and the superscript e denotes an expectation)

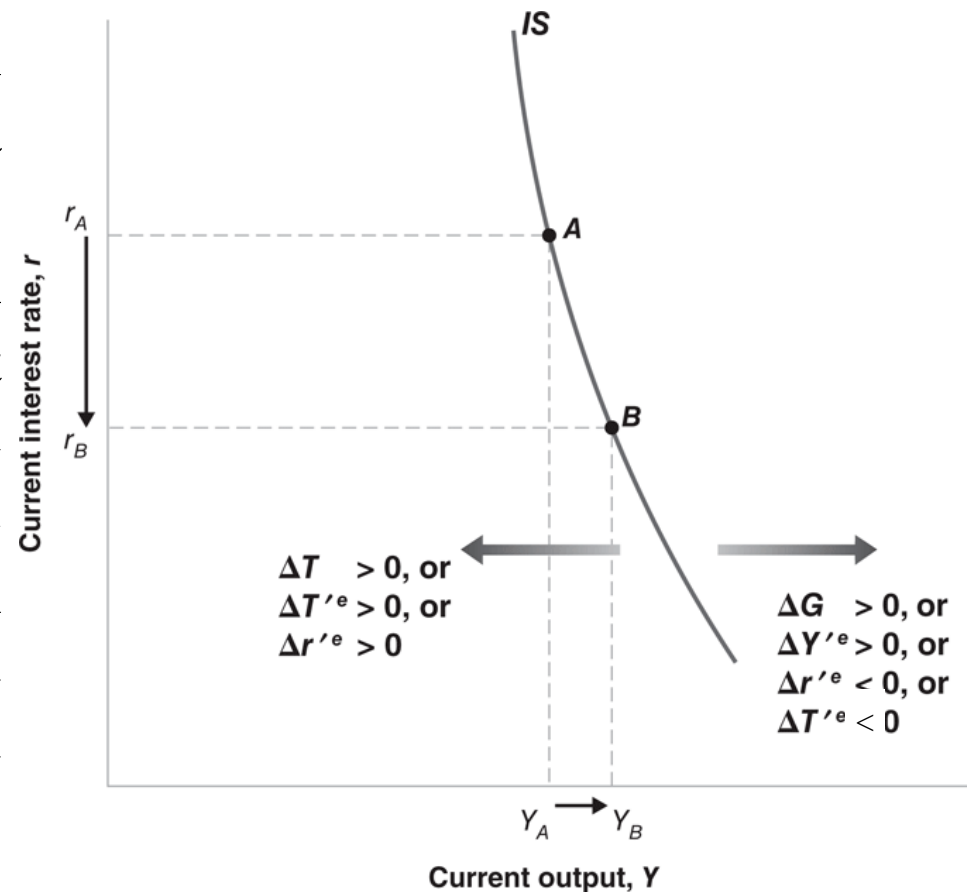
Y' or Y'^e increases $\Rightarrow A$ increases

T' or T'^e increases $\Rightarrow A$ decreases

r' or r'^e increases $\Rightarrow A$ decreases

Figure: The New IS Curve with Expectations The ISLM Model

Given expectations, a decrease in the real interest rate leads to a small increase in output: the IS curve is steeply downward sloping. Increases in government spending or in expected future output shift the IS curve to the right. Increases in taxes, in expected future taxes or in the expected future real interest rate shift the IS curve to the left.



Discussion: Should we modify the LM Equation?

$$\frac{M}{P} = Y L(i)$$

Monetary Policy, Expectations and Output

The ISLM Model

$$r = i - \pi^e \qquad r'^e = i'^e - \pi'^e$$

When the central bank increases the money supply, the current nominal interest rate decreases.

The effects on the current and the expected future real interest rates depend on two factors:

- Whether the increase in the money supply leads financial markets to revise their expectations of the future nominal interest rate.
- Whether the increase in the money supply leads financial markets to revise their expectations of both current and future inflation.

Monetary Policy, Expectations and Output

Figure: The New ISLM Model

$$IS: Y = A(Y, T, r, Y^e, T^e, r^e) + G$$

$$LM: \frac{M}{P} = YL(r)$$

Assume $\pi^e = \pi'^e = 0$

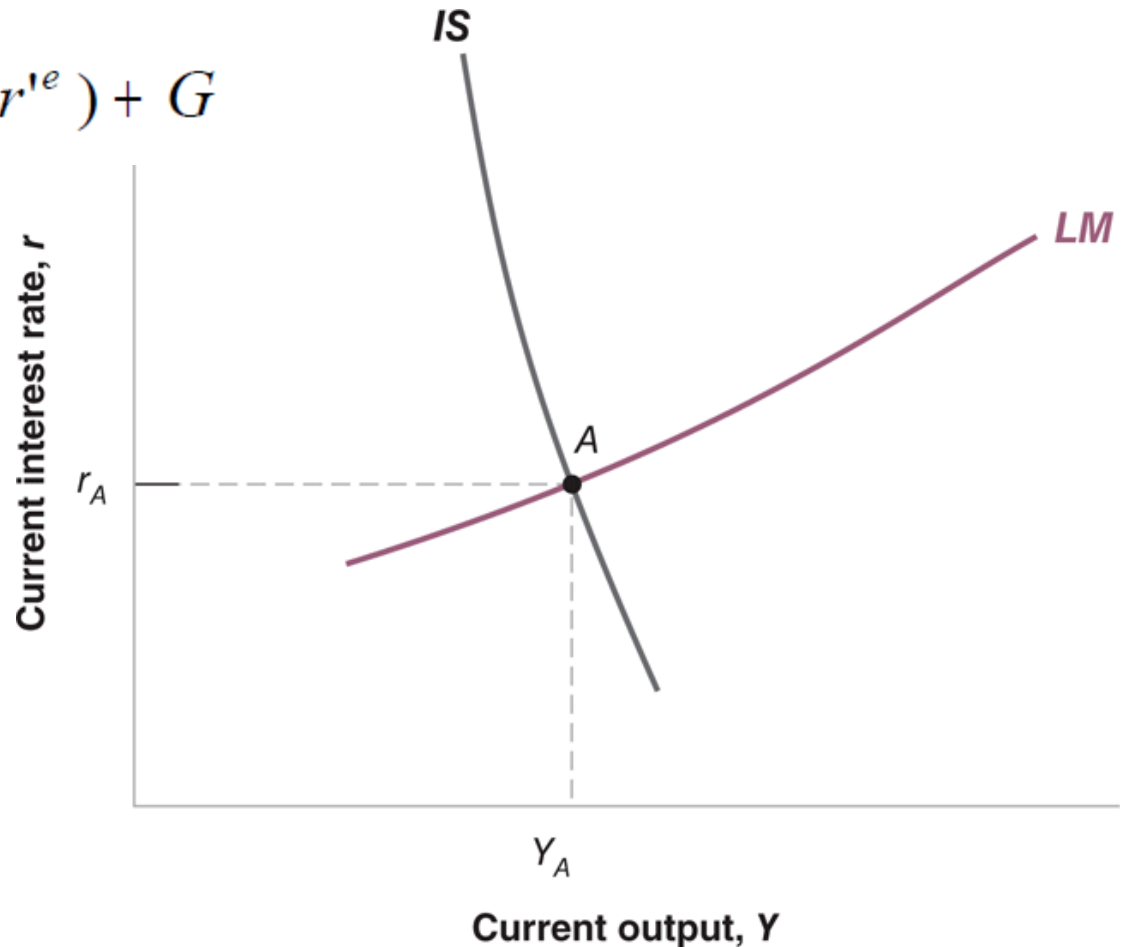
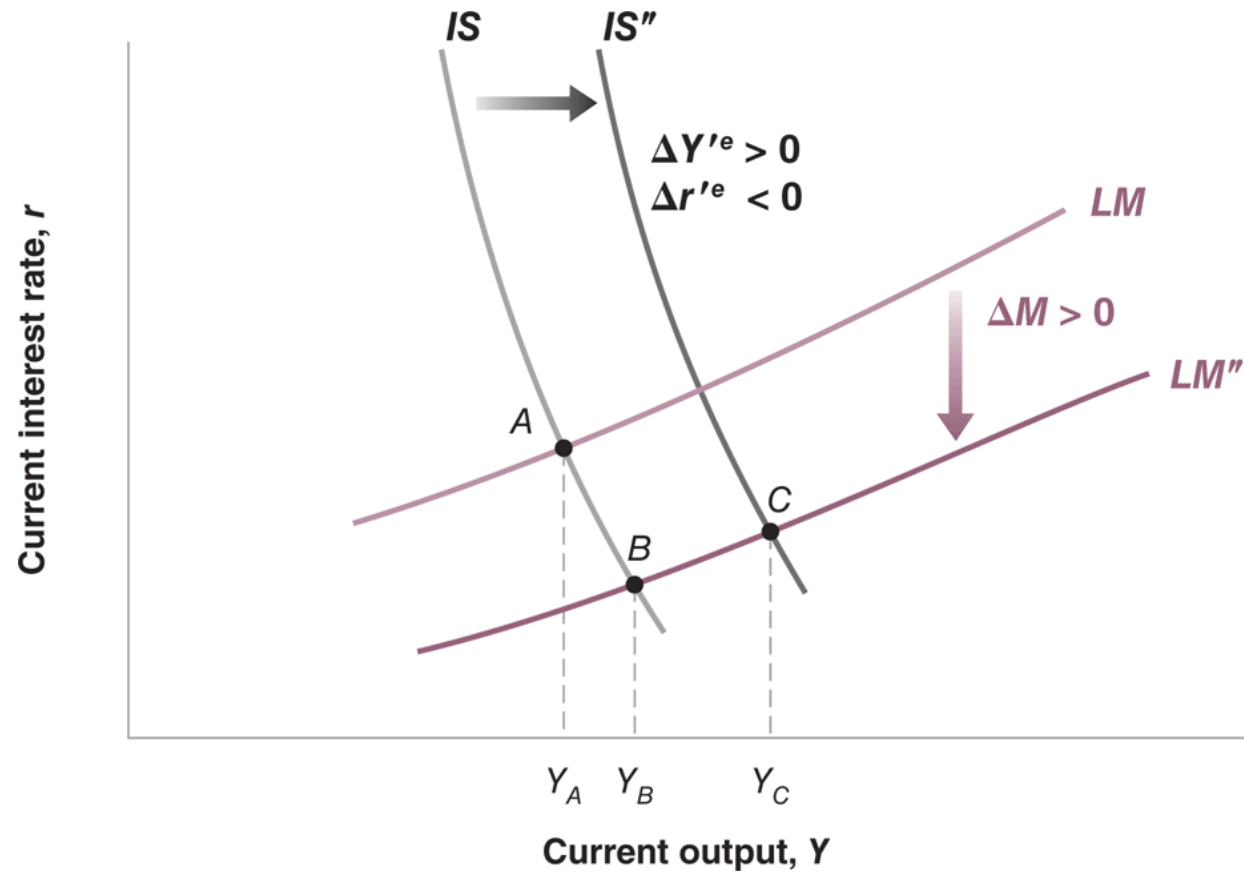


Figure: The Effects of an Expansionary Monetary Policy

The effects of monetary policy on output depend very much on whether and how monetary policy affects expectations.





Monetary Policy, Expectations and Output

The New ISLM Model

The effects of monetary policy depend crucially on its effect on expectations:

- If a monetary expansion leads economic actors to revise their expectations of future interest rates and output, then the effects of the monetary expansion on output may be very large.
- If expectations remain unchanged, the effects of the monetary expansion on output will be small.



Monetary Policy, Expectations and Output

The New ISLM Model

Shifts in expectations were considered important but were left unexplained until the early 1970s: called **animal spirits**.

Economists refer to expectations formed in forward-looking manner as **rational expectations**.

Or people were often assumed to have static expectations – that is, to expect the future to be like the present (backward-looking rules: **adaptive expectations**).



Deficit Reduction, Expectations, and Output

- In the long run, a reduction in the budget deficit is likely to be beneficial for the economy. In the medium run, a lower budget deficit implies higher saving and higher investment. In the long run, higher investment translates into higher capital and thus higher output.
- In the short run, however, a reduction in the budget deficit, unless it is offset by a monetary expansion, leads to lower spending and to a contraction in output.

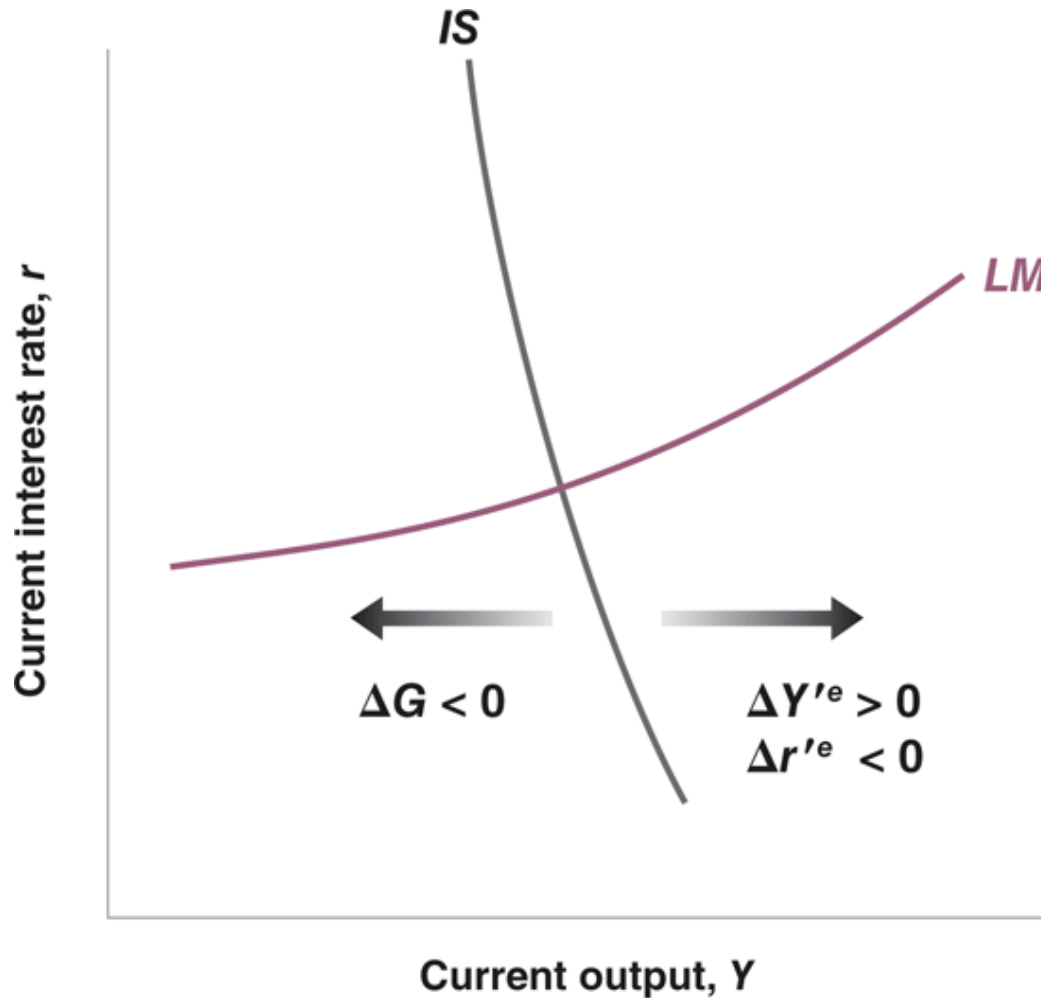


Deficit Reduction, Expectations, and Output

The Role of Expectations about the Future

- In the medium run, a deficit reduction has no effect on output. It leads, however, to a lower interest rate and to higher investment.
- In the long run – that is, taking into account the effects of capital accumulation on output – higher investment leads to a higher capital stock and, therefore, a higher level of output.

Figure: The Effects of a Deficit Reduction on Current Output



Deficit Reduction, Expectations, and Output

The Role of Expectations about the Future

- **Back loading** the deficit reduction program toward the future, with small cuts today and larger cuts in the future, is more likely to lead to an increase in output.
- On the other hand, announcing the need for painful cuts in spending and then leaving them to the future is likely to decrease the program's **credibility**.
- The government must play a delicate balancing act: enough cuts in the current period to show a commitment to deficit reduction and enough cuts left to the future to reduce the adverse effects on the economy in the short run.

Deficit Reduction, Expectations, and Output

The Role of Expectations about the Future

A program of deficit reduction may increase output even in the short run.

- The credibility of the program – will spending be cut or taxes increased in the future, as announced?
- The timing of the program – how large are spending cuts in the future relative to current spending cuts?
- The composition of the program – does the program remove some of the distortions in the economy?
- The state of government finances in the first place – how large is the initial deficit? Is this a 'last chance' program? What will happen if it fails?

Table: Can a Budget Deficit Reduction Lead to an Output Expansion? Ireland in the 1980s

		1981	1982	1983	1984	1986	1987	1988	1989
1	Budget deficit (% of GDP)	- 13.0	- 13.4	- 11.4	- 9.5	- 10.7	- 8.6	- 4.5	- 1.8
2	Output growth rate (%)	3.3	2.3	- 0.2	4.4	- 0.4	4.7	5.2	5.8
3	Unemployment rate (%)	9.5	11.0	13.5	15.0	17.1	16.9	16.3	15.1
4	Household saving rate (% of disposable income)	17.9	19.6	18.1	18.4	15.7	12.9	11.0	12.6

Source: OECD Economic Outlook, June 1998