Lecture 4: Intermediate macroeconomics, autumn 2009

Lars Calmfors

What have we done so far? Where are we going?

- **Lecture 1: National income, saving and investment in closed and small open economies**
- **Lecture 2: Economic growth**
- **Lecture 3: The labour market**
- **Lectures 4-7: Analytical framework for the analysis of macroeconomic policy in a small open economy (Krugman-Obstfeld)**
- **Lectures 8-10: In-depth analysis of specific topics (Mankiw and Taylor)**

Where are we going?

- **Equilibrium under floating exchange rates**

- **Lecture 4:**
  - **Exchange rates and interest rates (Krugman-Obstfeld ch. 13)**
  - **The role of money (Krugman-Obstfeld ch. 14)**

- **Lecture 5:**
  - **Price levels and the exchange rate in the long run (Krugman-Obstfeld ch. 15)**
  - **Output and the exchange rate in the short run (Krugman-Obstfeld ch. 16)**

- **Lecture 6:**
  - **Fixed exchange rates (Krugman-Obstfeld ch. 17)**

- **Lecture 7:**
  - **Optimal currency areas and EMU (Krugman-Obstfeld ch. 20)**

Topics for today

- **Exchange rate determination**
- **Non-covered and covered interest rate parity**
- **Money demand**
- **Equilibrium interest rates**
- **Determination of the long-run price level**
- **Neutrality of money**
- **The exchange rate under inflation targeting**

Literature: (Krugman-Obstfeld chapters 13 and 14)

The definition of exchange rates in Krugman-Obstfeld

Real exchange rate: the relative price between goods in different countries

Nominal exchange rate: the relative price between different currencies

The nominal exchange rate can be expressed either as the number of units of foreign currency per unit of domestic currency ($/SEK) or as the number of units of domestic currency per unit of foreign currency (SEK/$). Both conventions are used.

Krugman-Obstfeld use the number of units of domestic currency per unit of foreign currency (SEK/$). Mankiw-Taylor does the reverse.

With the Krugman-Obstfeld definition

***E*↑**	**SEK/$↑**	**Depreciation (devaluation) of the krona**
***E*↓**	**SEK/$↓**	**Appreciation (revaluation) of the krona**

Krugman-Obstfeld definition of the real exchange rate for the Swedish krona (Sweden)

$P_{US}E/P_{SW}$

P_{US} **= US product price in $**

E **= nominal exchange rate (SEK/$)**

P_{SW} **= Swedish product price in SEK**

Mankiw-Taylor has the reverse definition:

$P_{SW}E'/P_{US}$

E' **= $/SEK**

With the Krugman-Obstfeld definition

$P_{US}E/P_{SW}\uparrow$

Real depreciation (Swedish goods become relatively cheaper)

A real depreciation occurs if $E\uparrow$**,** $P_{US}\uparrow$ **or** $P_{SW}\downarrow$

$P_{US}E/P_{SW}\downarrow$

Real appreciation (Swedish goods become relatively more expensive)

A real appreciation occurs if $E\downarrow$**,** $P_{US}\downarrow$ **or** $P_{SW}\uparrow$

The real exchange rate cont.

- **At a given relative price, a change in the nominal. exchange rate implies a change in the real exchange rate.**
- **Since prices are sticky, the relative price is given in the short run.**
- **The nominal exchange rate is thus the most important determinant of real exchange rate changes in the short run.**
- **Note: The real exchange rate is usually defined in terms of consumer prices while Krugman-Obstfeld uses producer prices.**
- **Terms of trade: ratio of export to import prices.**
- **Since there is only one domestic and one foreign good in the model and Krugman-Obstfeld uses producer prices, the real exchange rate and the terms of trade are closely related: the terms of trade are the inverted exchange rate.**

Agents in the foreign currency market

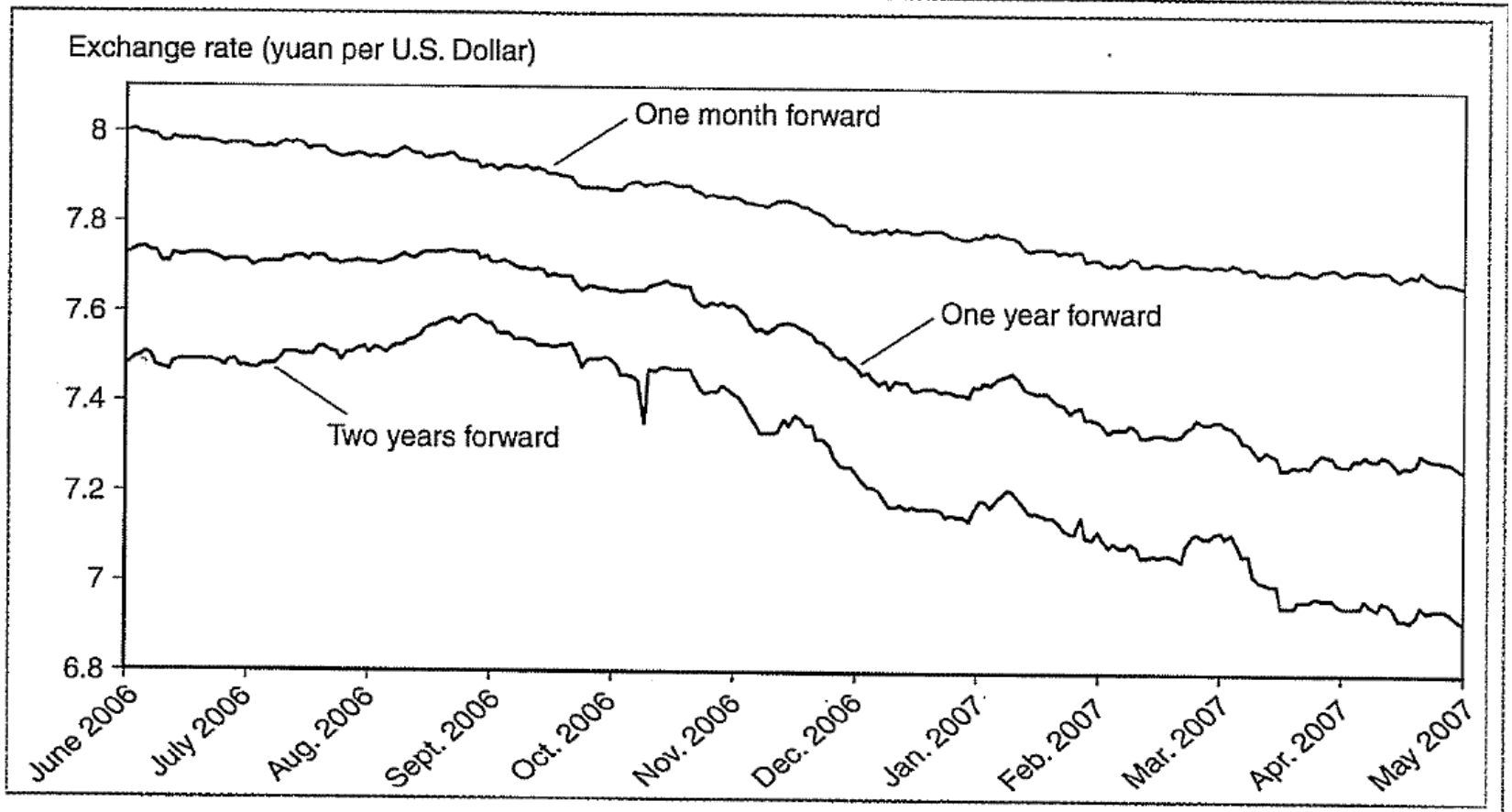
- **Commercial banks (interbank trading)**
- **Corporations (multinationals)**
- **Non-bank financial institutions (pension funds, hedge funds etc.)**
- **Central banks**

Arbitrage

All cross exchange rates must be consistent with each other

- **Spot exchange rates**
- **Forward exchange rates**

- **Forward contract – a contract to buy or sell currency at a given price at a given future point of time**
- **Futures contract – a contract to buy or sell currency at a given price at a given future point of time that can be traded in the market**
- **Option – the right to buy or sell currency at a certain price at a certain future point of time**
- **Swap – a combination of a spot and a forward transaction in the currency market**



Nondeliverable Forward Exchange Rates, China Yuan per Dollar

Source: *Datastream*.

Demand for currencies

- **Investors care about the real return (nominal return less inflation)**
- **When investors compare investments in different currencies, only differences in nominal returns matter for an investor from a particular country**

Relevant factors

1. **Nominal return**
2. **Risk**
3. **Liquidity**

For most OECD countries risk and liquidity is more or less the same, so it is mainly differences in expected returns that matter.

Equilibrium in the foreign currency market

Think in terms of an American investor, who compares returns in dollars

US interest rate: $R_{\$}$

Eurozone interest rate: $R_{€}$

Expected exchange rate gain from a euro investment:

$(E^{e}_{\$/€} - E_{\$/€})/E_{\$/€}$

Expected return of a euro investment: $R_{€} + (E^{e}_{\$/€} - E_{\$/€})/E_{\$/€}$

Difference in returns: $R_{\$} - R_{€} - (E^{e}_{\$/€} - E_{\$/€})/E_{\$/€}$

Interest rate parity

$$R_{\$} = R_{€} + (E^{e}_{\$/€} - E_{\$/€})/E_{\$/€}$$

A higher interest rate in the US than in the euro area must be matched by an expected exchange rate gain on a euro investment

$$R_{\$} - R_{€} > 0 \Leftrightarrow (E^{e}_{\$/€} - E_{\$/€})/E_{\$/€} > 0.$$

Fig. 13-3: The Relation Between the Current Dollar/Euro Exchange Rate and the Expected Dollar Return on Euro Deposits

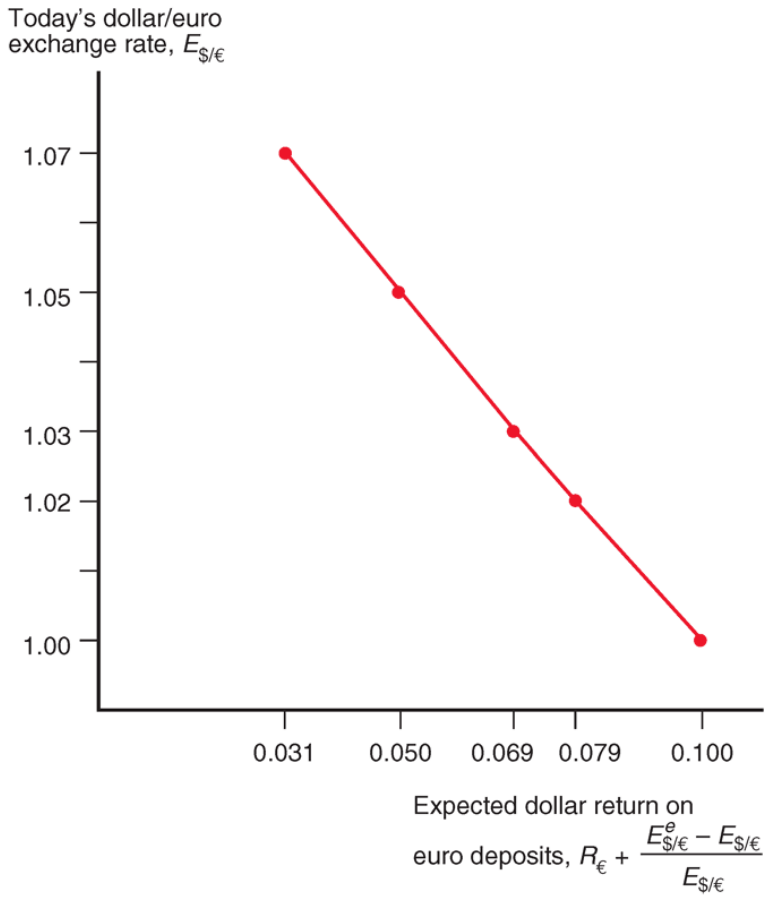


Fig. 13-4: Determination of the Equilibrium Dollar/Euro Exchange Rate

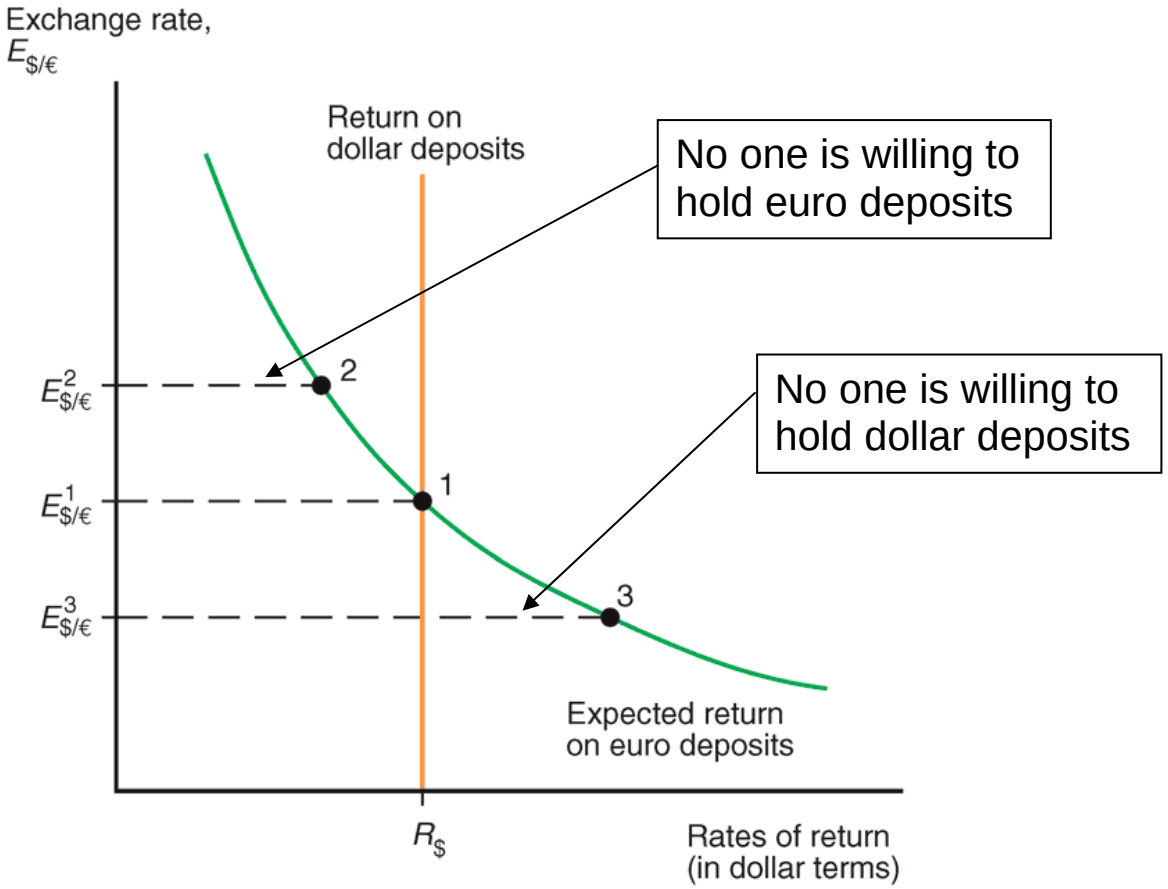


Fig. 13-5: Effect of a Rise in the Dollar Interest Rate

A depreciation of the euro is an appreciation of the dollar.

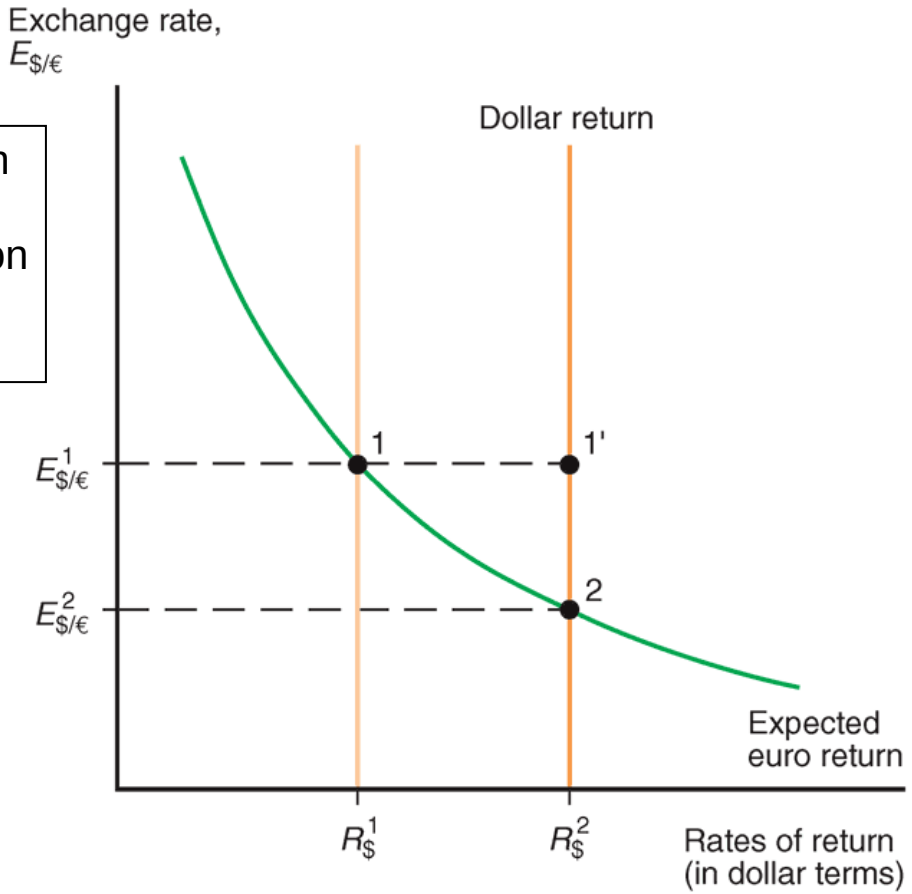
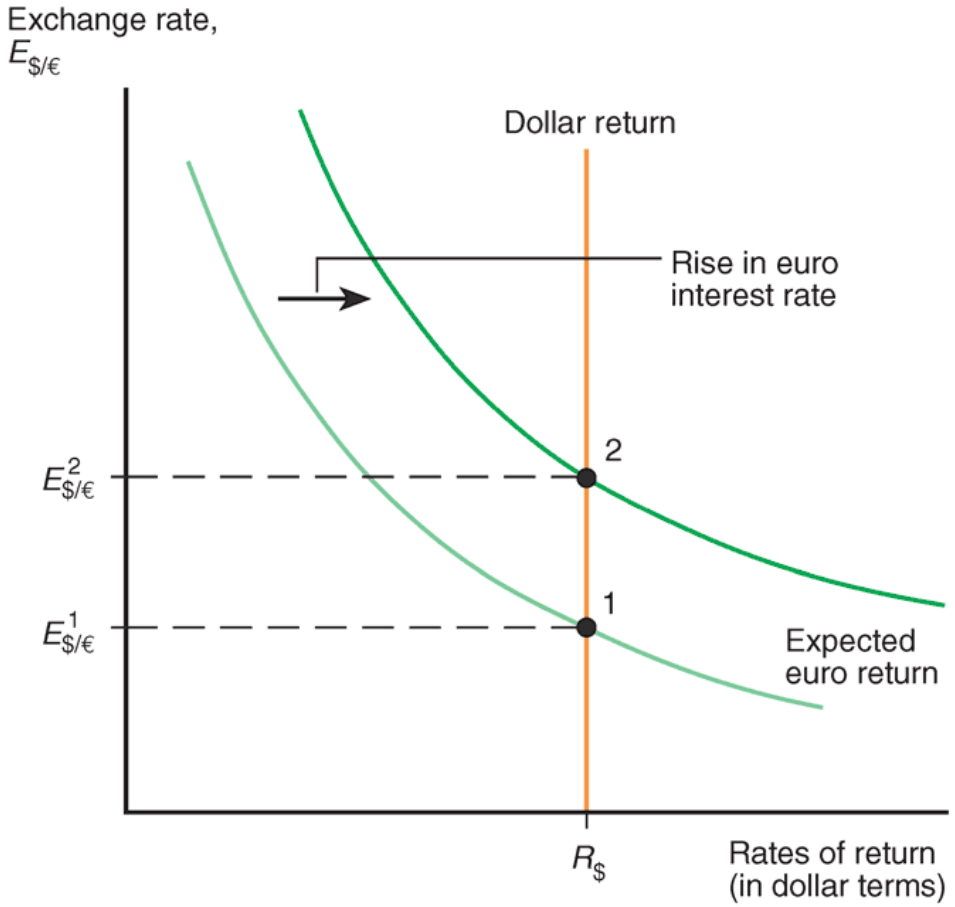


Fig. 13-6: Effect of a Rise in the Euro Interest Rate

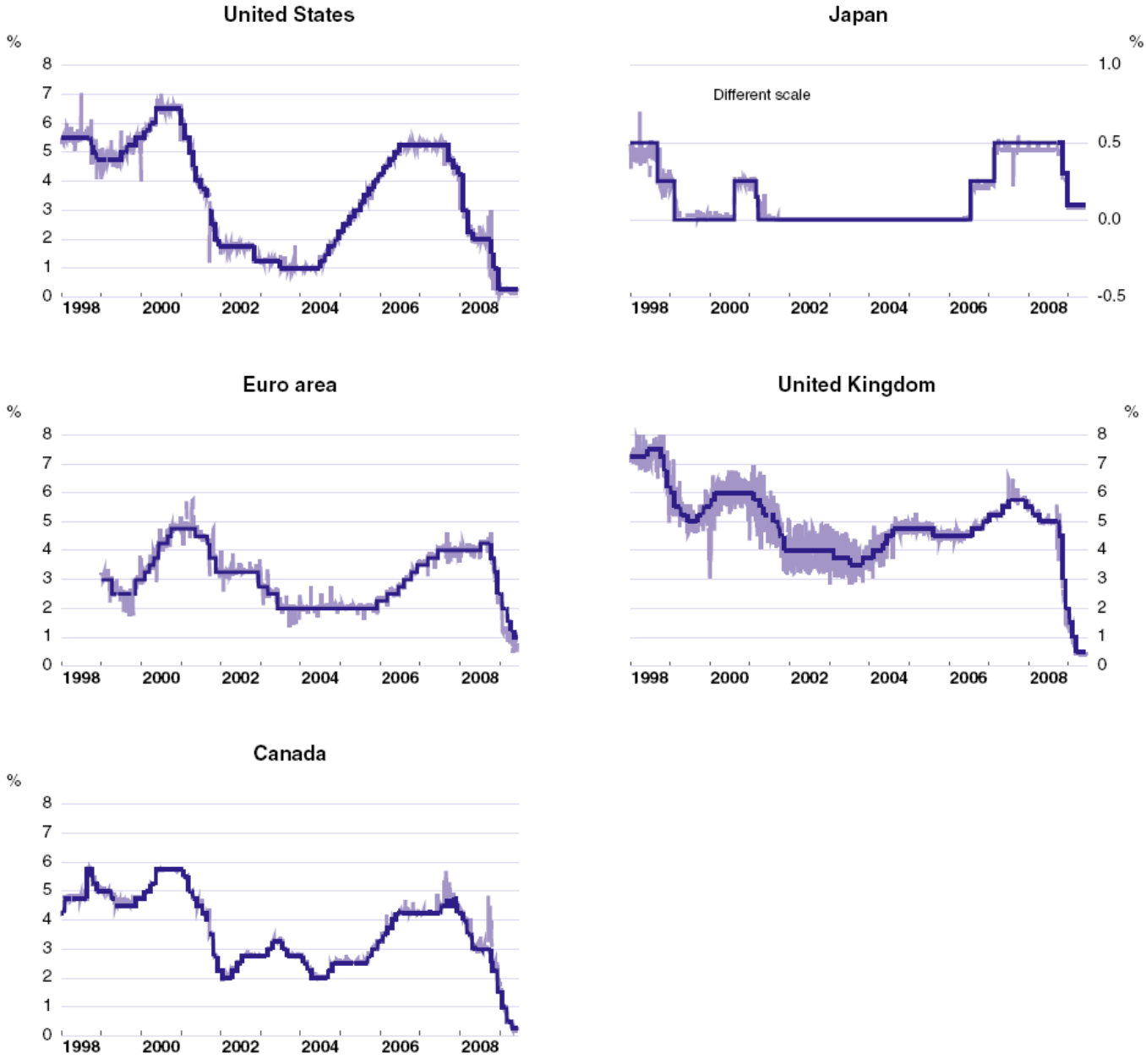


Complications

- **R should be interpreted as short-run interest rate, which is usually taken to be controlled by the central bank.**
- **Long-term interest rates are determined in the market and do not have a strong relationship to current short-term interest rates – they reflect future expected short-term interest rates.**
- **Currently most central bank policy rates are close to zero.**
- **In the current crisis interbank lending interest rates have diverged dramatically from central bank policy rates.**

Figure 1.19. **Policy rates are very close to zero in most major OECD economies**

Last observation: 10 June 2009



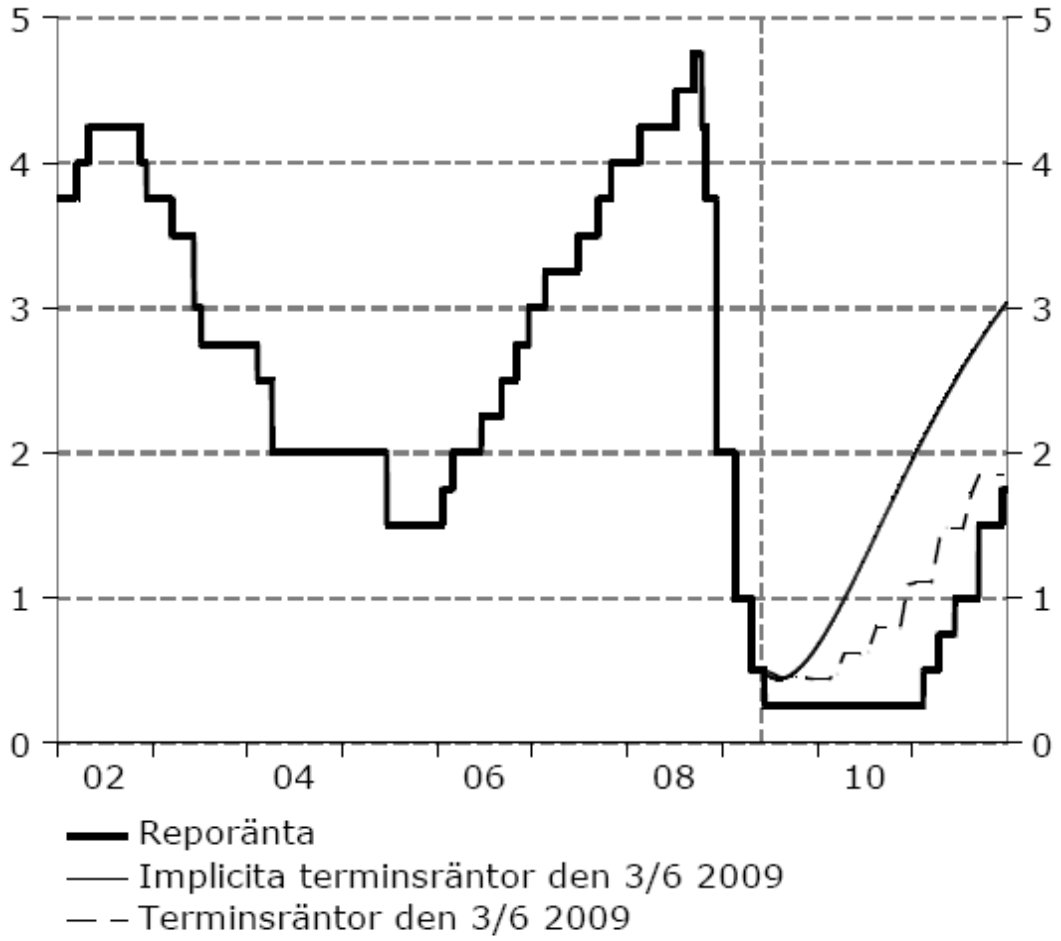
Note: The dark line represents the main policy rate of the central banks. The light line plots the effective overnight rate.

Source: Bloomberg, Bank of Japan, Datastream, ECB.

StatLink http://dx.doi.org/10.1787/656585873210

Diagram 50 Reporäntan och terminsräntor

Procent, dagsvärden

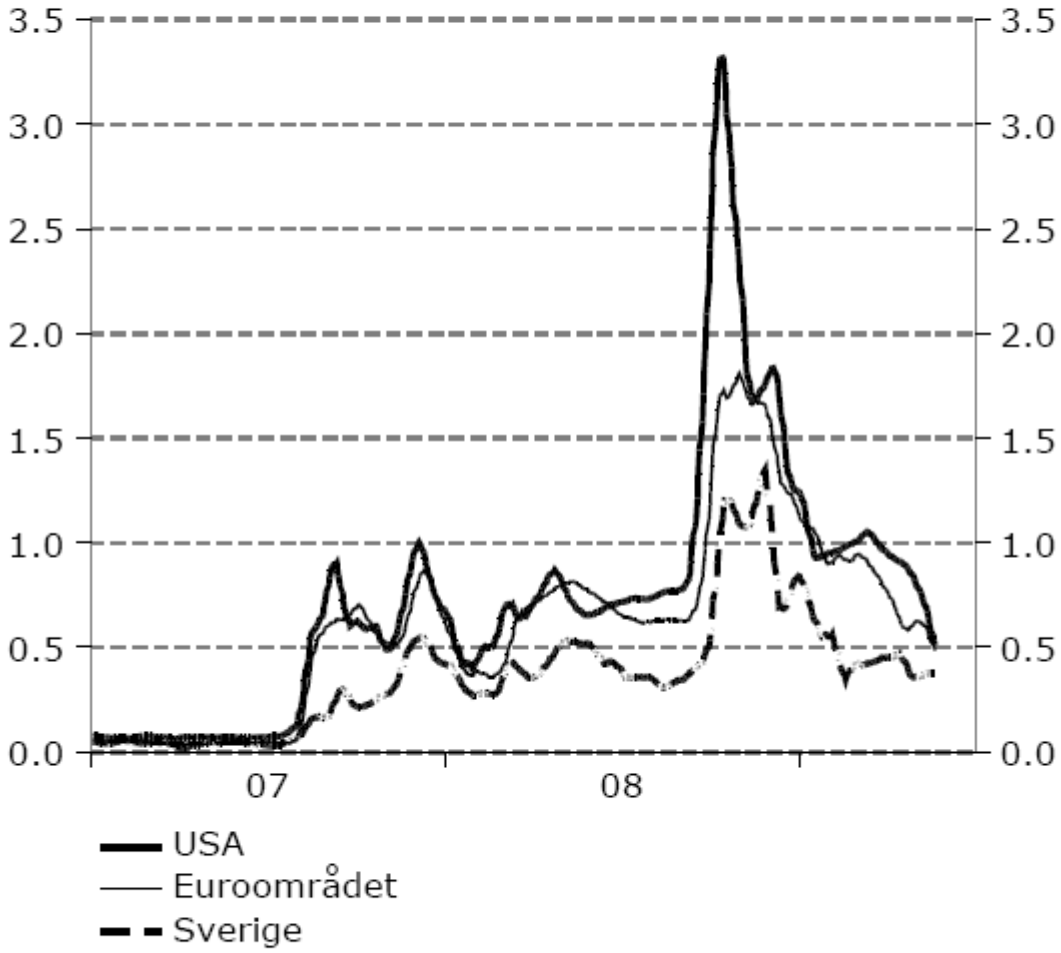


Anm. Implicita terminsräntor enligt avkastningskurvan den 3/6 2009.

Källor: Reuters, Riksbanken och Konjunktur-institutet.

Diagram 39 Ränta på interbanklån, differens mot förväntad styrränta (basis spread)

Procentenheter, dagsvärden, 10-dagars glidande medelvärde



Anm. Löptid: 3 månader.

Källor: British Bankers´Association och Reuters.

The relationship between non-covered and covered interest rate parity

- **Think in terms of an American investor who considers a financial investment in the euro area with a certain maturity that will be exchanged back into dollars (either via the spot or the forward currency market)!**

Non-covered interest rate parity

$R = R^* + (E^e - E)/E$

Covered interest rate parity

$R = R^* + (F - E)/E$

F **= forward exchange rate**

$(F - E)/E$ **= forward exchange rate premium on dollar relative to euro**

Simultaneous non-covered and covered interest rate parity require that $F = E^e$**.**

$F < E^e \Rightarrow (F - E)/E < (E^e - E)/E$**. If so, the expected return from a forward transaction is lower than from a spot transaction. This reduces the demand for dollars in the forward exchange market, which causes a depreciation of the forward dollar exchange (**$F\uparrow$**).**

Determinants of money demand

1. **Expected return relative to other assets**
2. **Risk**
3. **Liquidity**

Arguments in the money demand function

1. **Interest rate (the opportunity cost of holding money)**
2. **Price level (the value of each transaction)**
3. **Real income (the number of transactions)**

$$M^d = P \cdot L(R, Y)$$

$$M^d / P = L(R, Y)$$

Real money demand

Demand for real cash balances

Equilibrium in the money market

$$M^s = M^d = P \cdot L(R, Y)$$

$$M^s/P = M^d/P = L(R, Y)$$

Fig. 14-1: Aggregate Real Money Demand and the Interest Rate

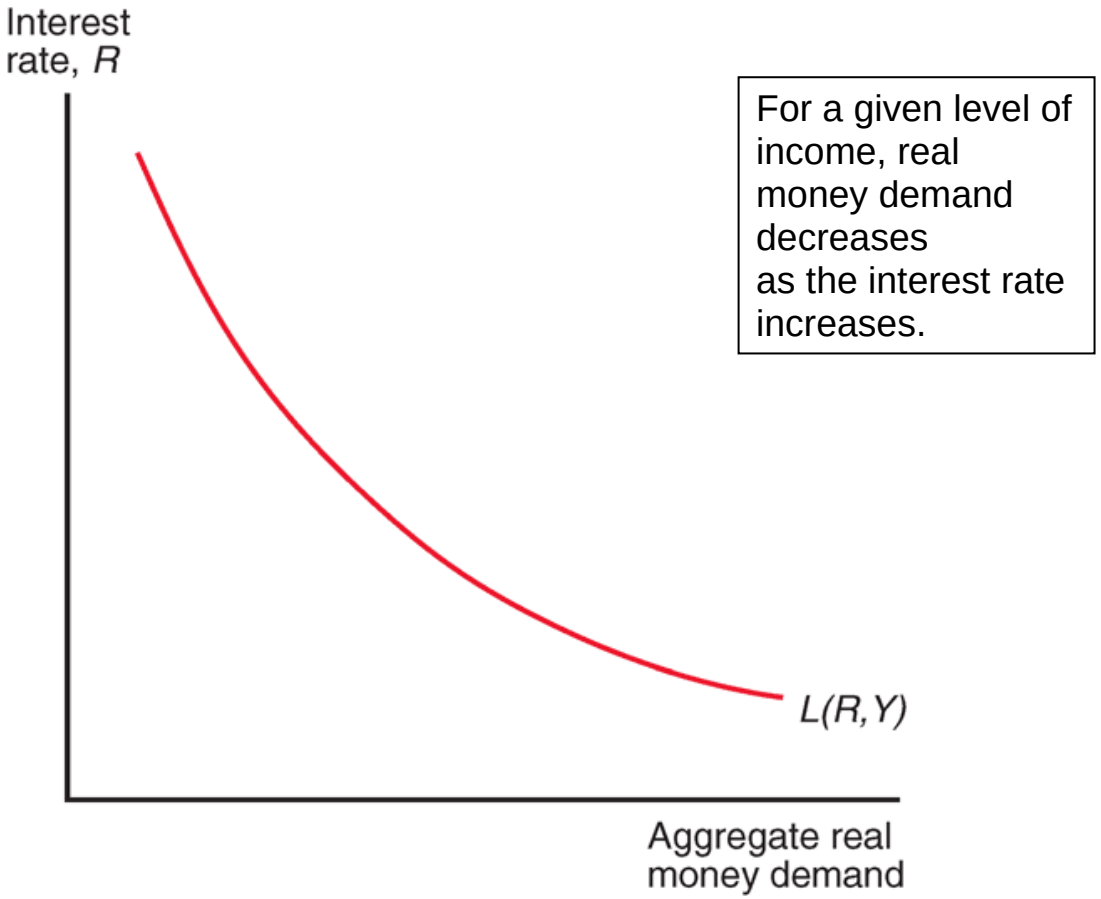


Fig. 14-2: Effect on the Aggregate Real Money Demand Schedule of a Rise in Real Income

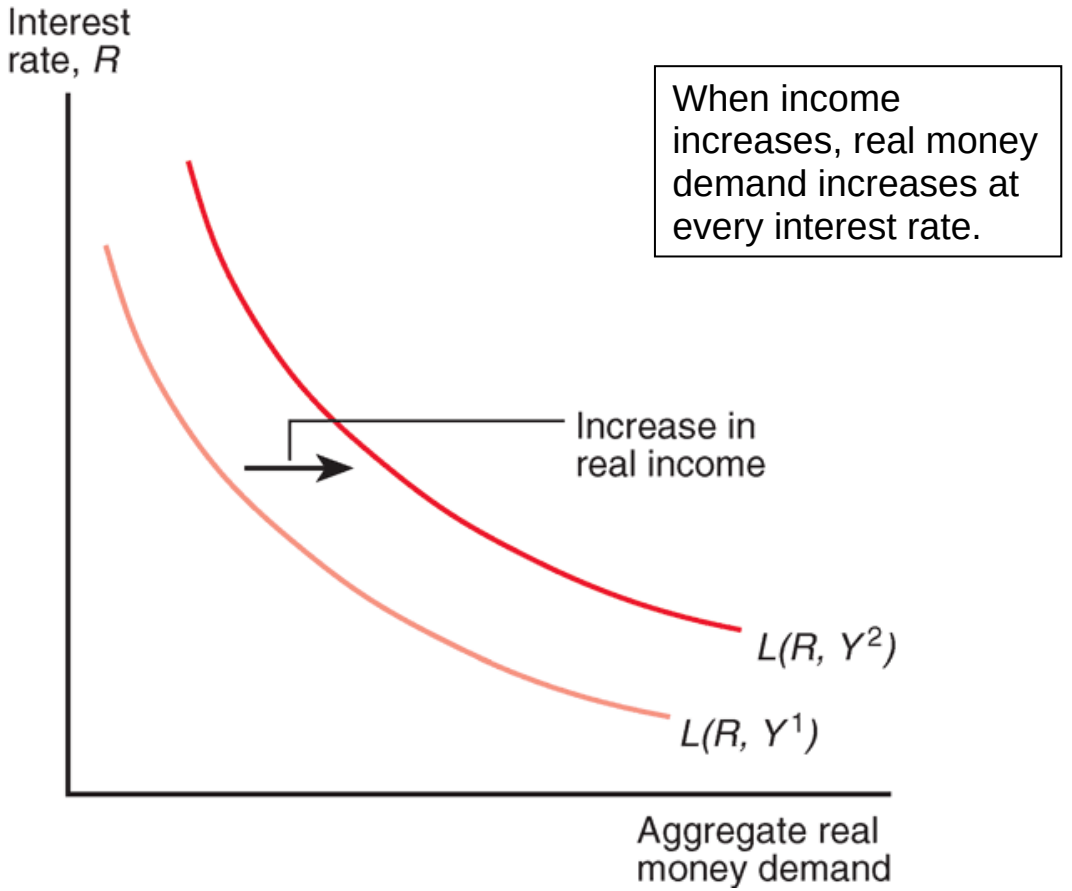


Fig 14-3: Determination of the Equilibrium Interest Rate

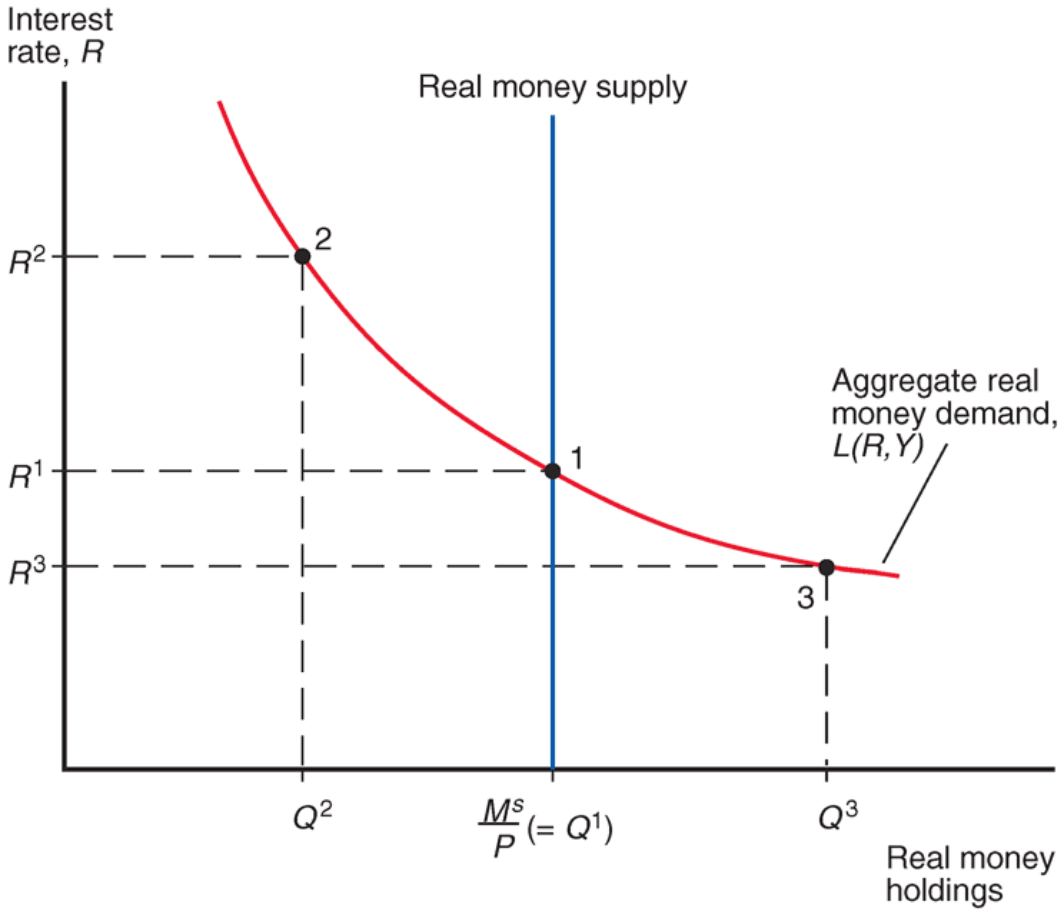
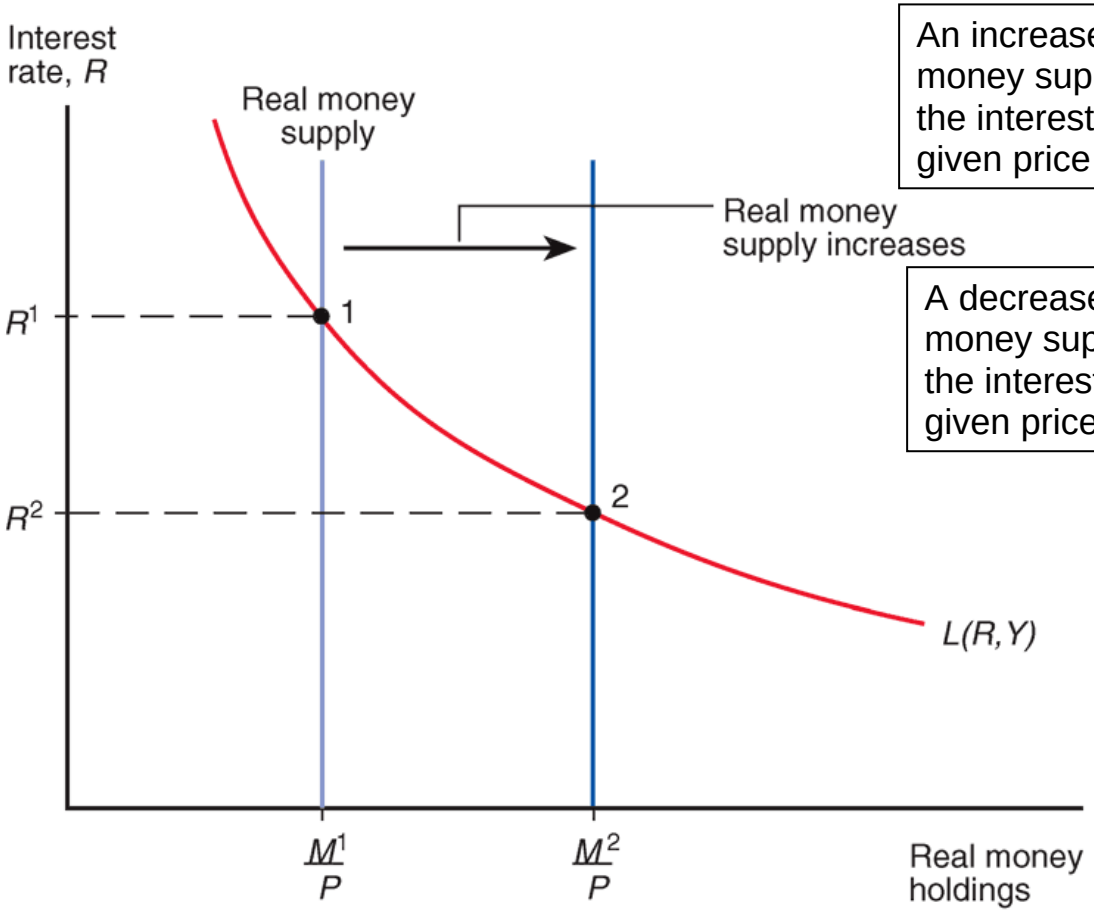


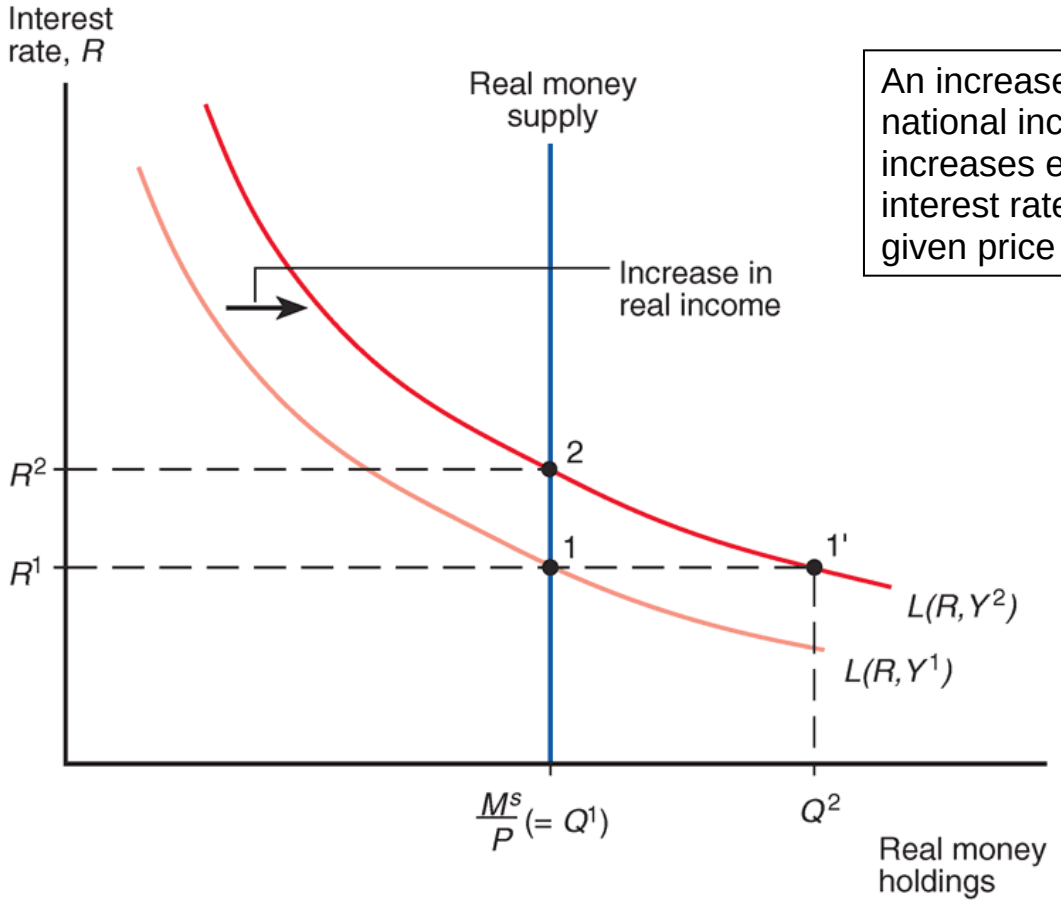
Fig 14-4: Effect of an Increase in the Money Supply on the Interest Rate



An increase in the money supply lowers the interest rate for a given price level.

A decrease in the money supply raises the interest rate for a given price level.

Fig 14-5: Effect on the Interest Rate of a Rise in Real Income



An increase in national income increases equilibrium interest rates for a given price level.

Fig 14-6: Simultaneous Equilibrium in the U.S. Money Market and the Foreign Exchange Market

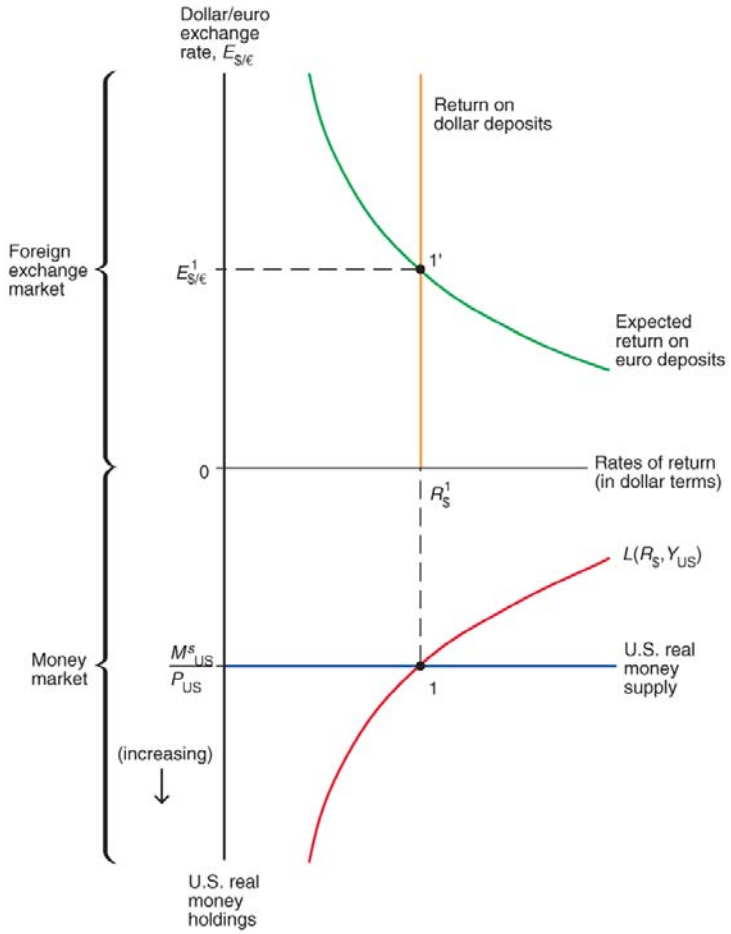


Fig 14-7: Money Market/Exchange Rate Linkages

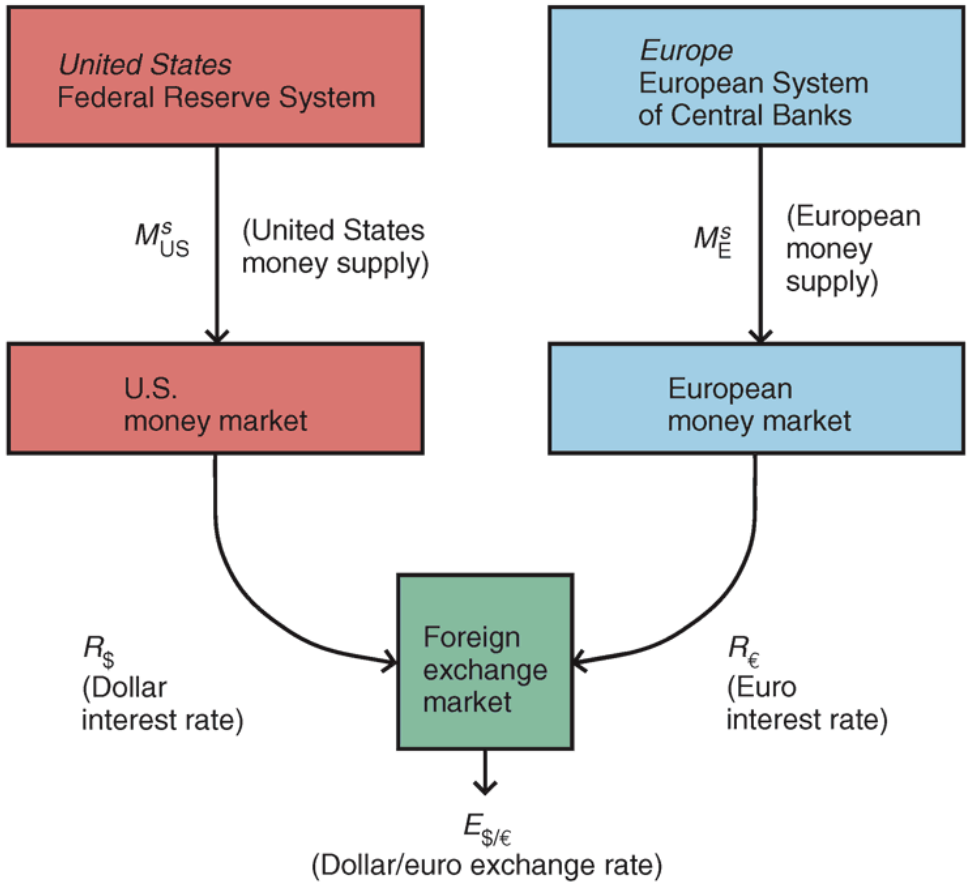


Fig 14-8: Effect on the Dollar/Euro Exchange Rate and Dollar Interest Rate of an Increase in the U.S. Money Supply

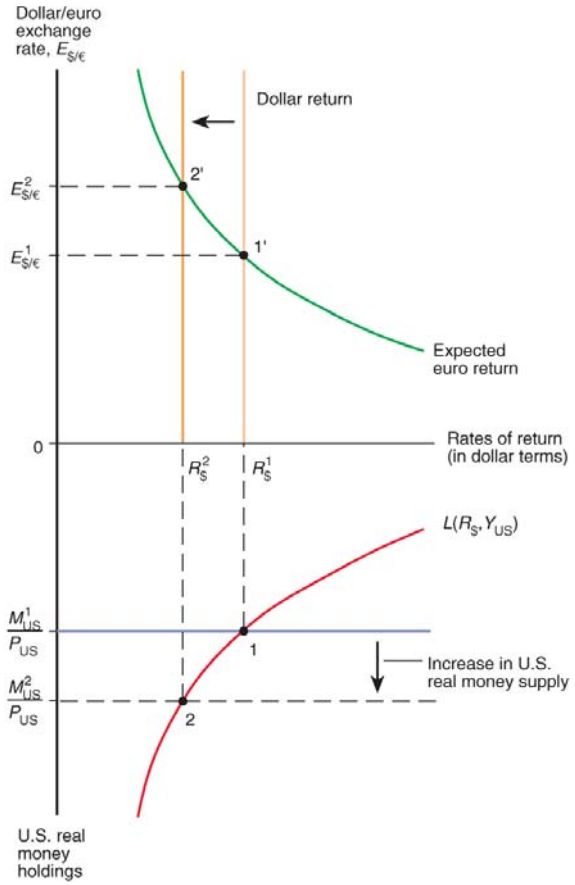
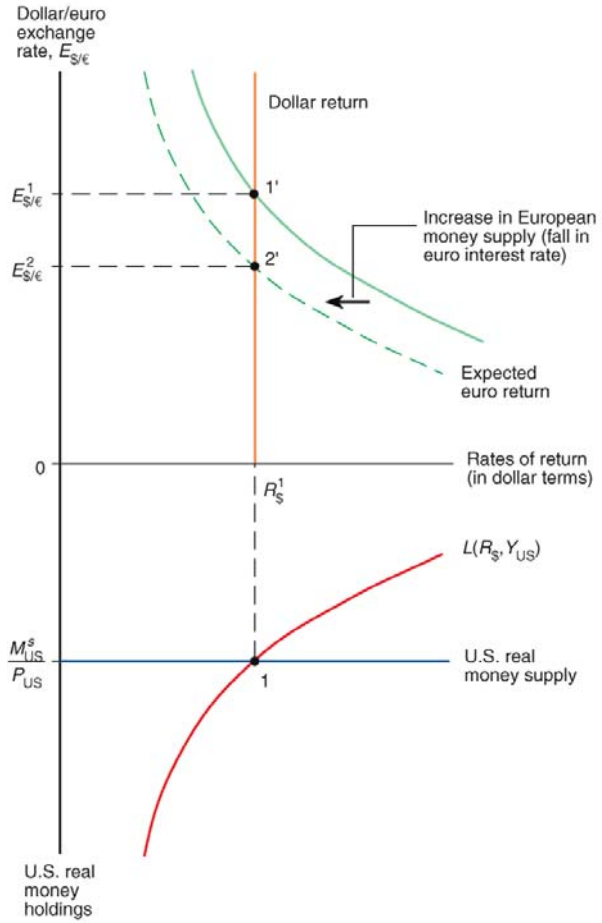


Fig 14-9: Effect of an Increase in the European Money Supply on the Dollar/Euro Exchange Rate



Different time horizons

1. **Instantaneous effects (day, week, month)**

- **Given output**
- **Given price level**

2. **Short run (1-2 years)**

- **Flexible output**
- **Given price level**

3. **Long run (5 years or more?)**

- **Given output (equilibrium level, natural rate, potential level, full-employment level)**
- **Flexible price level**

The determination of the long-run price level

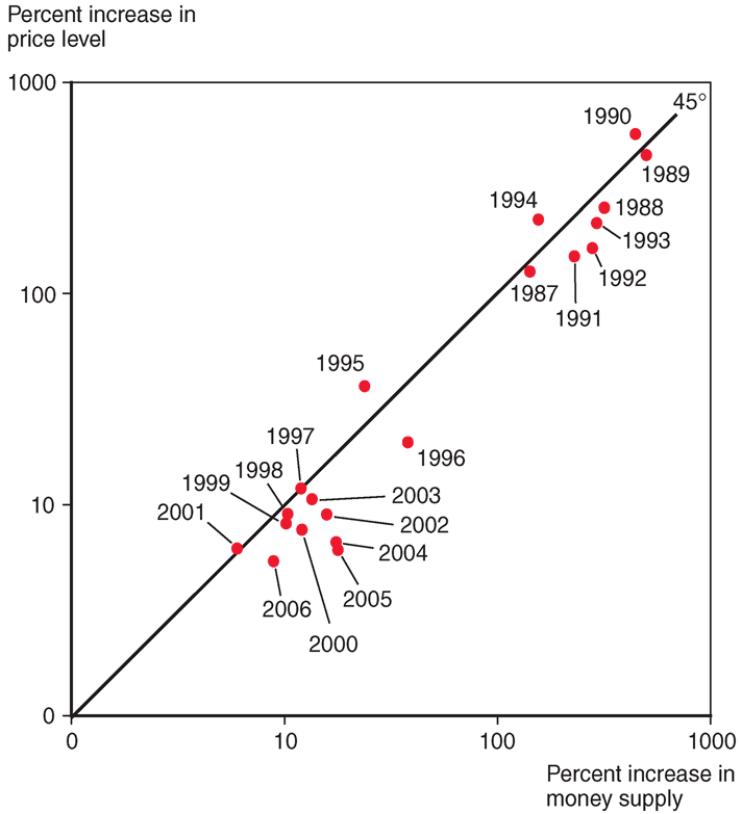
Money market equilibrium:

$M^s/P = M^d/P = L(R, Y)$

$P = M^s / L(R, Y)$

- **In the long run R and Y are at their equilibrium levels**
- **Long-run neutrality of money**
- **The price level is proportional to the money supply in the long run (the price level is doubled if the money supply is doubled etc.)**

Fig 14-10: Average Money Growth and Inflation in Western Hemisphere Developing Countries, by Year, 1987–2006



Source: IMF, *World Economic Outlook*, various issues. Regional aggregates are weighted by shares of dollar GDP in total regional dollar GDP.

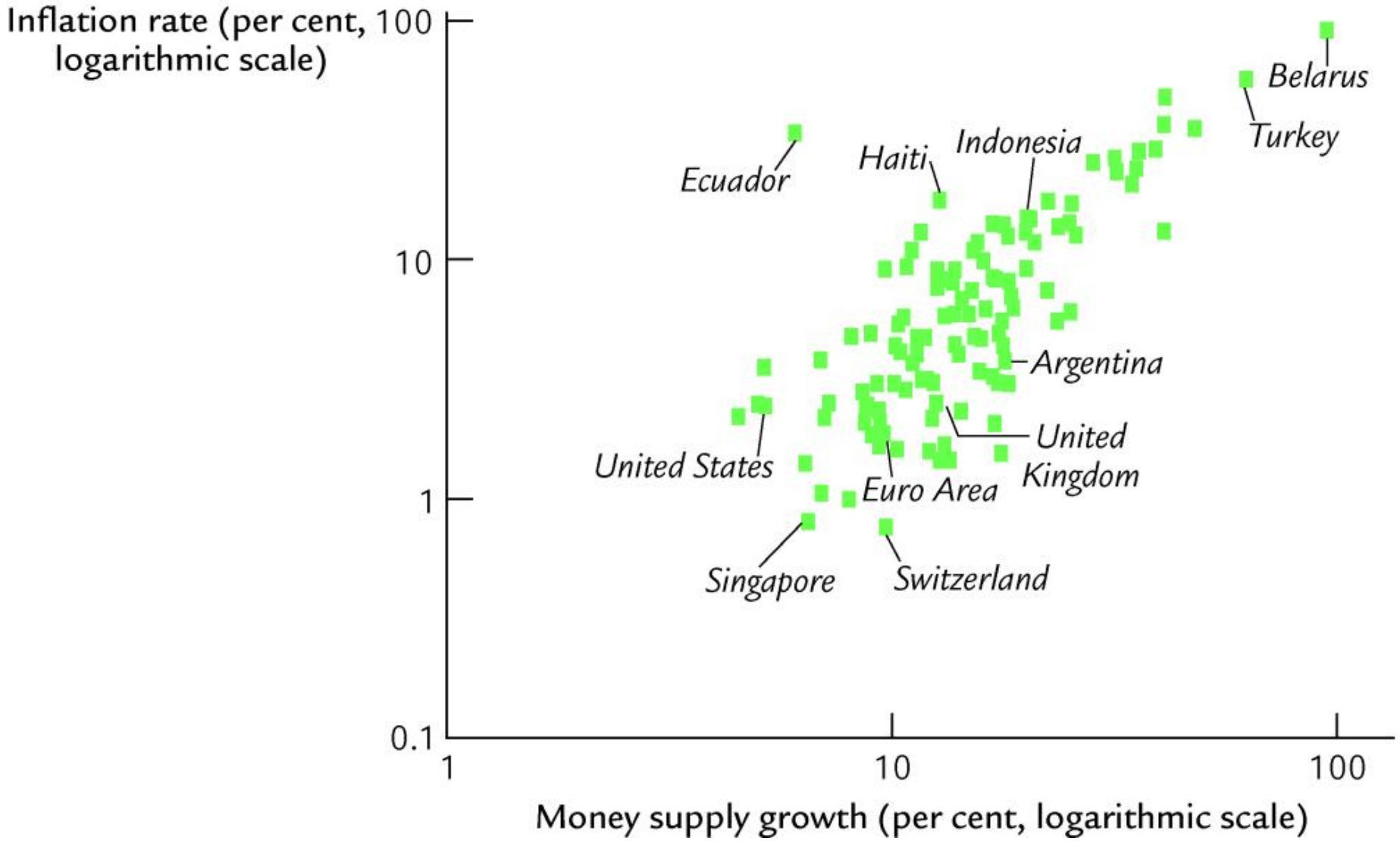


Figure 4-2: The Relationship Between Money Growth and Inflation

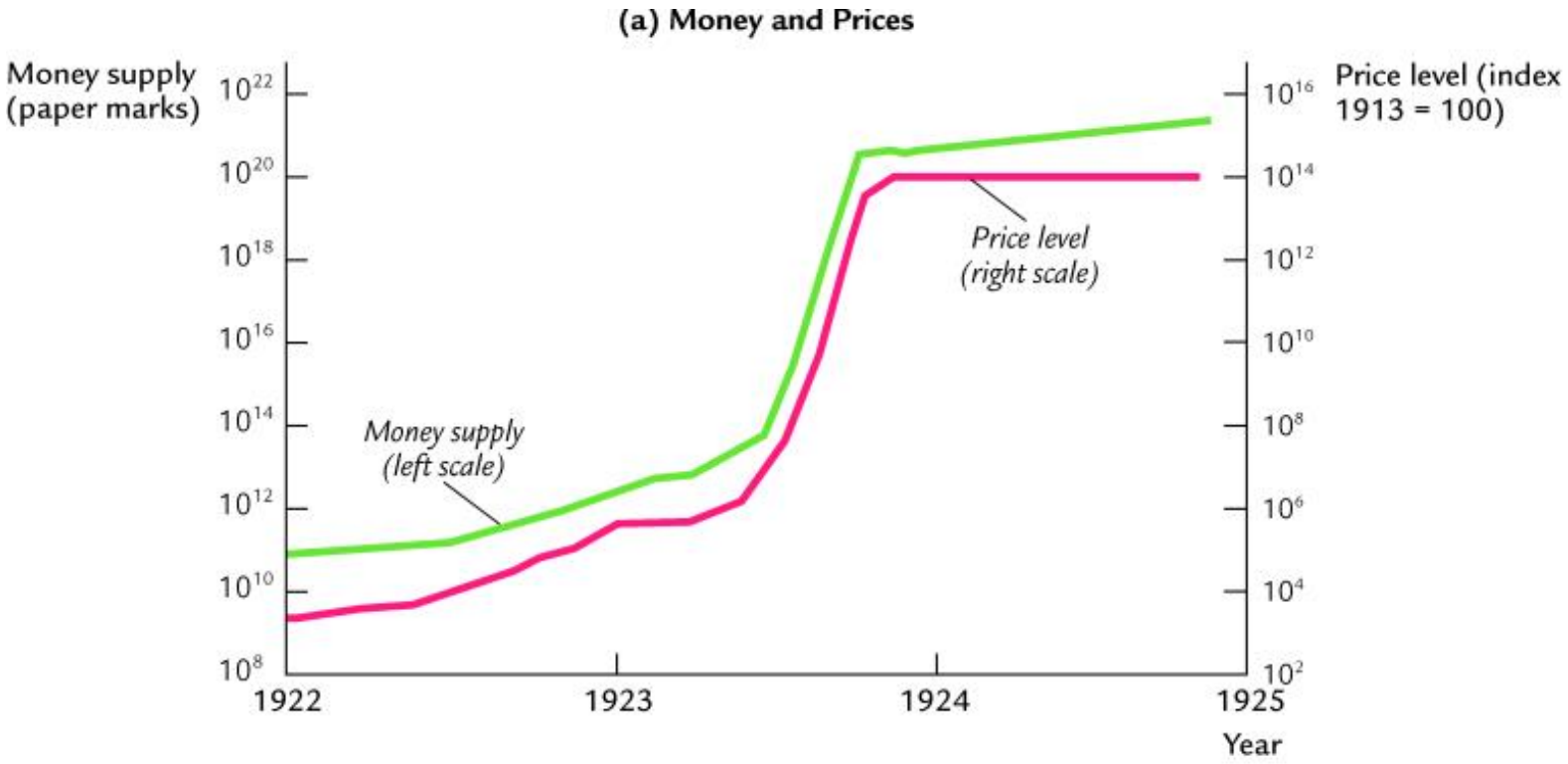
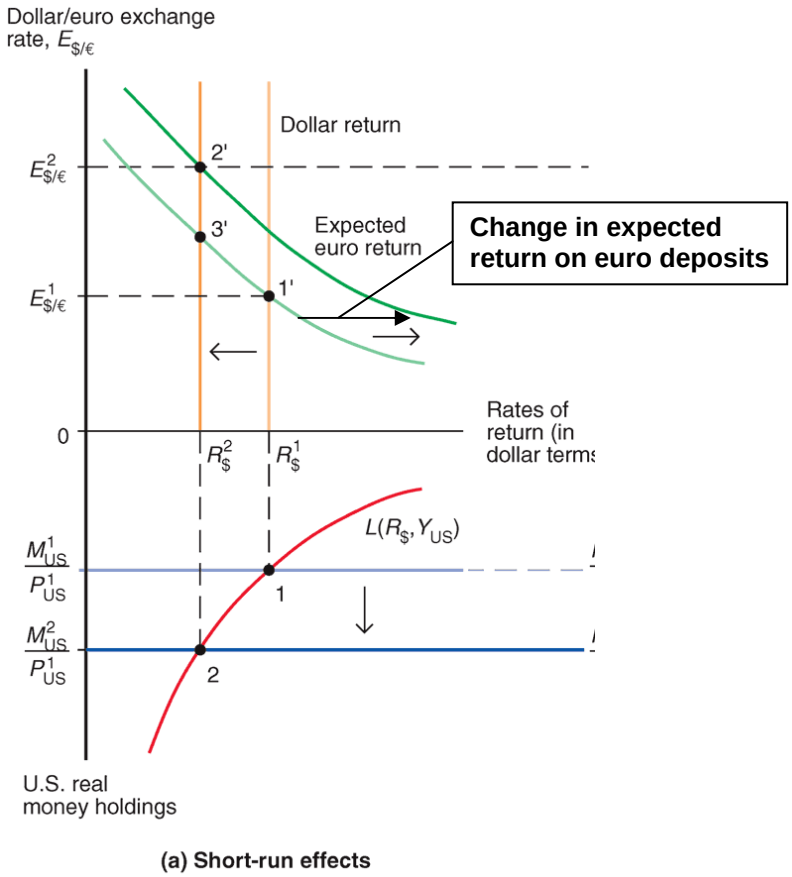


Figure 4-6a: Money and Prices in Interwar Germany

Fig 14-12: Short-Run and Long-Run Effects of an Increase in the U.S. Money Supply (Given Real Output, *Y*)



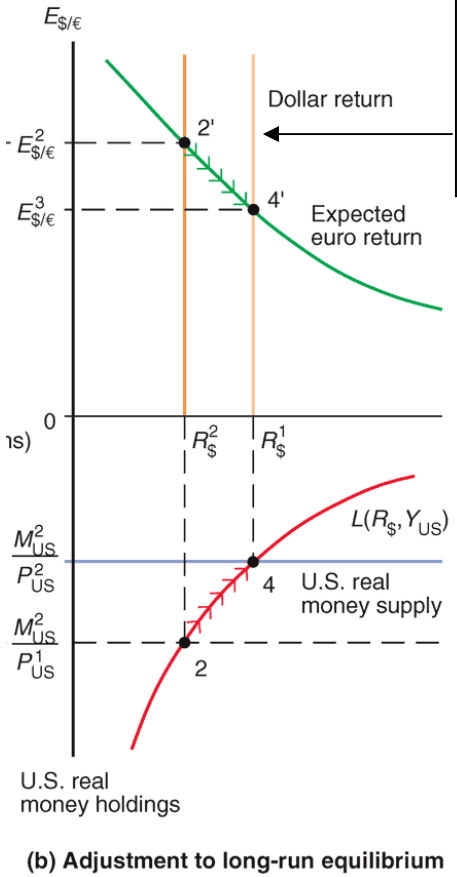
(a) Short-run effects

The expected return on euro deposits rises because of inflationary expectations:

- The dollar is expected to be less valuable when buying goods and services and less valuable when buying euros.
- The dollar is expected to depreciate, increasing the return on deposits in euros.

Fig 14-12: Short-Run and Long-Run Effects of an Increase in the U.S. Money Supply (Given Real Output, *Y*)

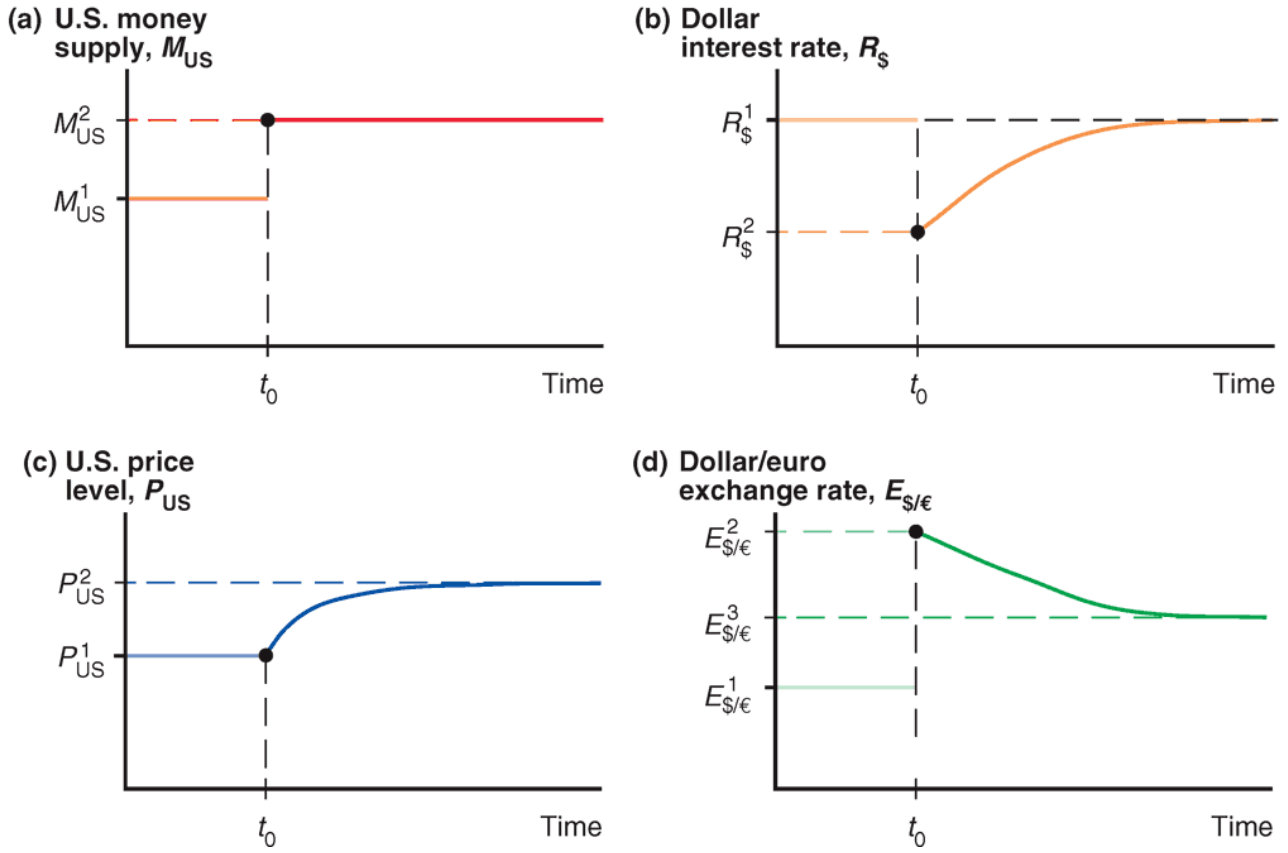
Original (long run) return on dollar deposits



(b) Adjustment to long-run equilibrium

As prices increase, the real money supply decreases and the domestic interest rate returns to its long run rate.

Fig 14-13: Time Paths of U.S. Economic Variables After a Permanent Increase in the U.S. Money Supply



How good are exchange rate models for forecasting?

The models are better for the long run than for the short run

The best short-run model is a "random walk" (like for the weather forecast):

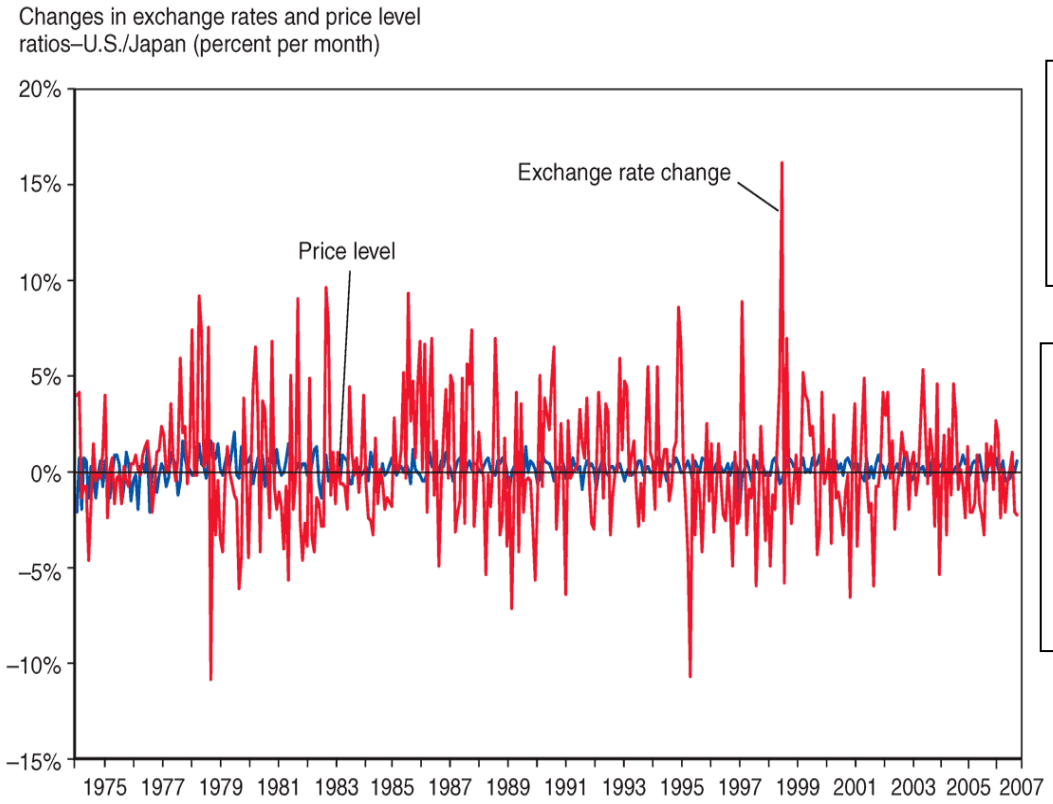
$E_t = E_{t-1} + \varepsilon_t$

ε_t **is a random variable with expected value = 0**

The exchange rate has the same characteristics as all asset prices (including stock prices): all available information is discounted in the price

Only *new* information (which by definition is unknown now and therefore random) can change the price.

Fig 14-11: Month-to-Month Variability of the Dollar/Yen Exchange Rate and of the U.S./Japan Price Level Ratio, 1974–2007



Changes in price levels are less volatile, suggesting that price levels change slowly.

Exchange rates are influenced by interest rates and expectations, which may change rapidly, making exchange rates volatile.

Source: International Monetary Fund, *International Financial Statistics*

Diagram 53 Växelkurser

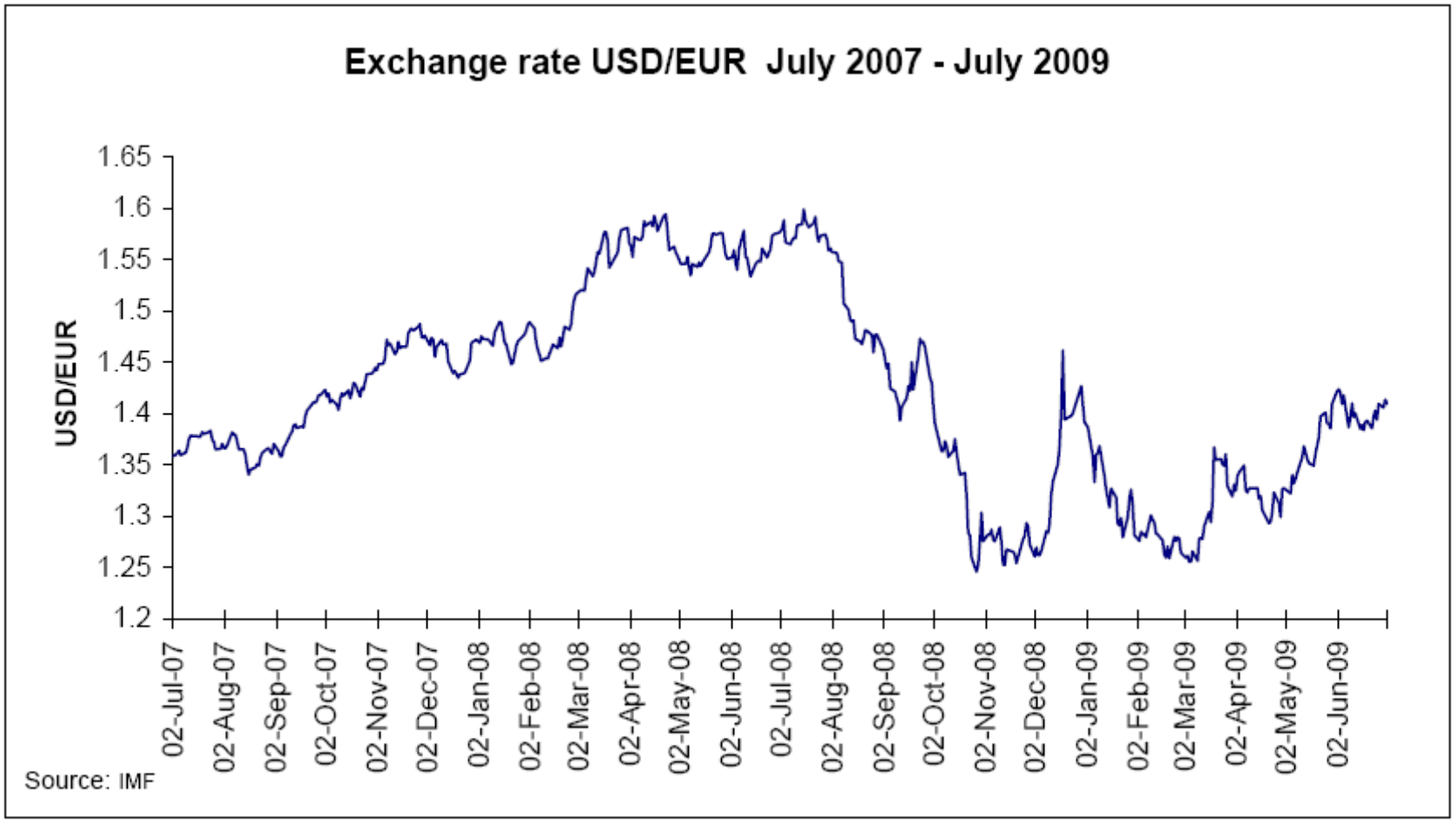
Månadsvärden

Källa: Reuters.

The exchange rate under inflation targeting

- **Modern central banks set the interest rate to reach an inflation target**
  - **If inflation rises above the target, the interest rate is raised and vice versa.**
  - **Monetary policy is framed in terms of interest rates rather than money supply growth**

- **An increase in inflation (the price level) above the target typically causes an appreciation of the currency**
  - **the central bank is expected to raise the interest rate to bring down inflation again (the price level)**
  - **if unchanged price levels (and money supply) in the future, the future expected exchange rate is unchanged**
  - **interest rate parity requires that there is an expected exchange rate loss to compensate for the interest rate differential**
  - **this only occurs if the exchange rate appreciates today**
  - **empirical evidence in favour of this**


Exchange rate USD/EUR July 2007 - July 2009
USD/EUR
1.65
1.6
1.55
1.5
1.45
1.4
1.35
1.3
1.25
1.2
02-Jul-07
02-Aug-07
02-Sep-07
02-Oct-07
02-Nov-07
02-Dec-07
02-Jan-08
02-Feb-08
02-Mar-08
02-Apr-08
02-May-08
02-Jun-08
02-Jul-08
02-Aug-08
02-Sep-08
02-Oct-08
02-Nov-08
02-Dec-08
02-Jan-09
02-Feb-09
02-Mar-09
02-Apr-09
02-May-09
02-Jun-09
Source: IMF