Exchange Rates I: The Monetary Approach in the Long Run

3

Introduction

- *In the long run*, prices and exchange rates will always adjust so that the purchasing power of each currency remains comparable over baskets of goods in different countries.
- Example:
- A standard basket of goods in Canada cost C$100 in 1970 and C$392 in 1990. (Inflation rate: 292%)
- A basket of goods that cost $100 in the US in 1970 cost $336 by 1990. (Inflation rate: 236%)
- Did US goods become cheaper? Would US consumers buy less Canadian goods? Would Canadian consumers buy more US goods?

Introduction

- *The answer to all three questions: No.*
- Let's look at the exchange rate.
- In 1970: C$1 was almost exactly $1.
- So in 1970, both baskets cost equal amounts when expressed in the same currency ($100 or about C$100)
- By 1990, the Canadian dollar depreciated relative to 1970. $1 was C$1.16.
- Thus, the $336 US basket in 1990 actually cost $336X1.16=C$390 (almost the same price as the C$392 Canadian basket in 1990!!)

Introduction

- *In the long run*, prices and exchange rates will always adjust so that the purchasing power of each currency remains comparable over baskets of goods in different countries.
- This hypothesis provides another key building block in the theory of how exchange rates are determined.
- In the last chapter we learned how the spot exchange rate is determined.
- Remember UIP:

$$E_{\$/€} = E^{e}_{\$/€} \frac{1+i_{€}}{1+i_{\$}}$$

Introduction

- In this chapter we look at the long run to see how the expected future exchange rate is determined.
- If investors are to make forecasts of future exchange rates, they need a plausible theory of how exchange rates are determined in the long run.

Introduction

- The theory we develop in this chapter has two parts. The first part involves the theory of purchasing power, which links the exchange rate to price levels in each country in the long run.
- In the second part of the chapter, we explore how price levels are related to monetary conditions in each country.
- Combining the monetary theory of price level determination with the purchasing power theory of exchange rate determination, we emerge with a long-run theory known as the **monetary approach to exchange rates**.
- The goal of this chapter is to set out the long-run relationships between money, prices, and exchange rates.

1 Exchange Rates and Prices in the Long Run: Purchasing Power Parity and Goods Market Equilibrium

Just as arbitrage occurs in the international market for financial assets, it also occurs in the international markets for goods.

The result of goods market arbitrage is that the prices of goods in different countries expressed in a common currency tend to be equalized.

Applied to a single good, this idea is referred to as the *law of one price*; applied to an entire basket of goods, it is called the theory of *purchasing power parity*.

1 Exchange Rates and Prices in the Long Run: Purchasing Power Parity and Goods Market Equilibrium

- Our goal is to develop a simple yet useful theory based on an idealized world of *frictionless trade* where transaction costs can be neglected.
- We start at the microeconomic level with single goods and the law of one price.
- We then move to the macroeconomic level to consider baskets of goods and purchasing power parity.

1 Exchange Rates and Prices in the Long Run: Purchasing Power Parity and Goods Market Equilibrium

The Law of One Price

The **law of one price (LOOP)** states that in the absence of trade frictions (such as transport costs and tariffs), and under conditions of free competition and price flexibility (where no individual sellers or buyers have power to manipulate prices and prices can freely adjust), identical goods sold in different locations must sell for the same price when prices are expressed in a common currency.

By definition, in a market equilibrium there are no arbitrage opportunities. If diamonds can be freely moved between New York and Amsterdam, both markets must offer the same price. Economists refer to this situation in the two locations as an *integrated market*.

1 Exchange Rates and Prices in the Long Run: Purchasing Power Parity and Goods Market Equilibrium

The Law of One Price

We can mathematically state the law of one price as follows, for the case of any good *g* sold in two locations:

$$\underbrace{q^g_{US/EUR}}_{\substack{\text{Relative price of good } g \\ \text{in Europe versus U.S.}}} = \underbrace{(E_{\$/€} P^g_{EUR})}_{\substack{\text{European price} \\ \text{of good } g \text{ in } \$}} / \underbrace{P^g_{US}}_{\substack{\text{U.S. price} \\ \text{of good } g \text{ in } \$}}$$

$q^g_{US/EUR}$ expresses the rate at which goods can be exchanged: it tells us how many units of the U.S. good are needed to purchase one unit of the same good in Europe.

$E_{\$/€}$ expresses the rate at which currencies can be exchanged (\$/€).

1 Exchange Rates and Prices in the Long Run: Purchasing Power Parity and Goods Market Equilibrium

The Law of One Price

We can rearrange the equation for price equality

$$E_{\$/€} P_{EUR}^{g} = P_{US}^{g}$$

to show that the exchange rate must equal the ratio of the goods' prices expressed in the two currencies:

$$\underbrace{E_{\$/€}}_{\text{Exchange rate}} = \underbrace{P_{US}^{g} / P_{EUR}^{g}}_{\text{Ratio of goods' prices}}$$

1 Exchange Rates and Prices in the Long Run: Purchasing Power Parity and Goods Market Equilibrium

The Law of One Price

$$\underbrace{E_{\$/€}}_{\text{Exchange rate}} = \underbrace{P_{US}^{g} / P_{EUR}^{g}}_{\text{Ratio of goods' prices}}$$

Notice that the units on each side correspond: the left-hand side is expressed in dollars per euro and the right-hand side is also a ratio of dollars to euros ($ per unit of goods divided by € per unit of goods).

1 Exchange Rates and Prices in the Long Run: Purchasing Power Parity and Goods Market Equilibrium

Purchasing Power Parity

The principle of **purchasing power parity (PPP)** is the macroeconomic counterpart to the microeconomic law of one price (LOOP). To express PPP algebraically, we can compute the relative price of the two baskets of goods in each location:

$$\underbrace{q_{US/EUR}}_{\substack{\text{Relative price}\\ \text{of basket}\\ \text{in Europe}\\ \text{versus U.S.}}} = \underbrace{(E_{\$/€} P_{EUR})}_{\substack{\text{European price}\\ \text{of basket}\\ \text{expressed}\\ \text{in \$}}} / \underbrace{P_{US}}_{\substack{\text{U.S. price}\\ \text{of basket}\\ \text{expressed}\\ \text{in \$}}}$$

There is no arbitrage when the basket is the same price in both locations $q_{US/EUR} = 1$. PPP holds *when price levels in two countries are equal when expressed in a common currency*. This statement about equality of price levels is also called **absolute PPP.**

1 Exchange Rates and Prices in the Long Run: Purchasing Power Parity and Goods Market Equilibrium

Purchasing Power Parity

$$\underbrace{q_{US/EUR}}_{\substack{\text{Relative price}\\\text{of basket}\\\text{in Europe}\\\text{versus U.S.}}} = \underbrace{(E_{\$/€}P_{EUR})}_{\substack{\text{European price}\\\text{of basket}\\\text{expressed}\\\text{in \$}}} / \underbrace{P_{US}}_{\substack{\text{U.S. price}\\\text{of basket}\\\text{expressed}\\\text{in \$}}}$$

For example, suppose the European basket costs €100, and the exchange rate is \$1.20 per euro. For PPP to hold, the U.S. basket would have to cost 1.20 × 100 = \$120.

1 Exchange Rates and Prices in the Long Run: Purchasing Power Parity and Goods Market Equilibrium

The Real Exchange Rate

The relative price of the baskets is one of the most important variables in international macroeconomics, and it has a special name: it is known as the **real exchange rate**.

The U.S. real exchange rate $q_{US/EUR} = E_{\$/€} P_{EUR}/P_{US}$ tells us how many U.S. baskets are needed to purchase one European basket; it is the price of the European basket in terms of the U.S. basket.

The exchange rate for currencies is a *nominal* concept. The real exchange rate is a *real* concept; it says how many U.S. baskets can be exchanged for one European basket.

1 Exchange Rates and Prices in the Long Run: Purchasing Power Parity and Goods Market Equilibrium

The Real Exchange Rate

The real exchange rate has some terminology similar to that used with the nominal exchange rate:

- If the real exchange rate rises (more Home goods are needed in exchange for Foreign goods), we say Home has experienced a **real depreciation.**
- If the real exchange rate falls (fewer Home goods are needed in exchange for Foreign goods), we say Home has experienced a **real appreciation.**

Absolute PPP and the Real Exchange Rate

Purchasing power parity states that the real exchange rate is equal to 1.

- If the real exchange rate $q_{US/EUR}$ is below 1 by *x*%, then Foreign goods are relatively cheap, *x*% cheaper than Home goods. In this case, the Home currency (the dollar) is said to be *strong,* the euro is *weak,* and we say the euro is **undervalued** by *x*%.
- If the real exchange rate $q_{US/EUR}$ is above 1 by *x*%, then Foreign goods are relatively expensive, *x*% more expensive than Home goods. In this case, the Home currency (the dollar) is said to be *weak,* the euro is *strong,* and we say the euro is **overvalued** by *x*%.

Absolute PPP and the Real Exchange Rate

For example, if a European basket costs
$E_{\$/€}P_{EUR}$ = \$550 in dollar terms,
and a U.S. basket costs only P_{US} = \$500, then
$q_{US/EUR} = E_{\$/€}P_{EUR} / P_{US}$ = \$550/\$500 = 1.10,
the euro is strong, and the euro is 10% overvalued against the dollar.

1 Exchange Rates and Prices in the Long Run: Purchasing Power Parity and Goods Market Equilibrium

Absolute PPP, Prices, and the Nominal Exchange Rate

We can rearrange the no-arbitrage equation for the equality of price levels, $E_{\$/€}P^g_{EUR} = P^g_{US}$ to allow us to solve for the exchange rate that would be implied by absolute PPP:

Absolute PPP: $$\underbrace{E_{\$/€}}_{\text{Exchange rate}} = \underbrace{P_{US} / P_{EUR}}_{\text{Ratio of price levels}} \qquad (3\text{-}1)$$

Purchasing power parity implies that the exchange rate at which two currencies trade equals the relative price levels of the two countries.

1 Exchange Rates and Prices in the Long Run: Purchasing Power Parity and Goods Market Equilibrium

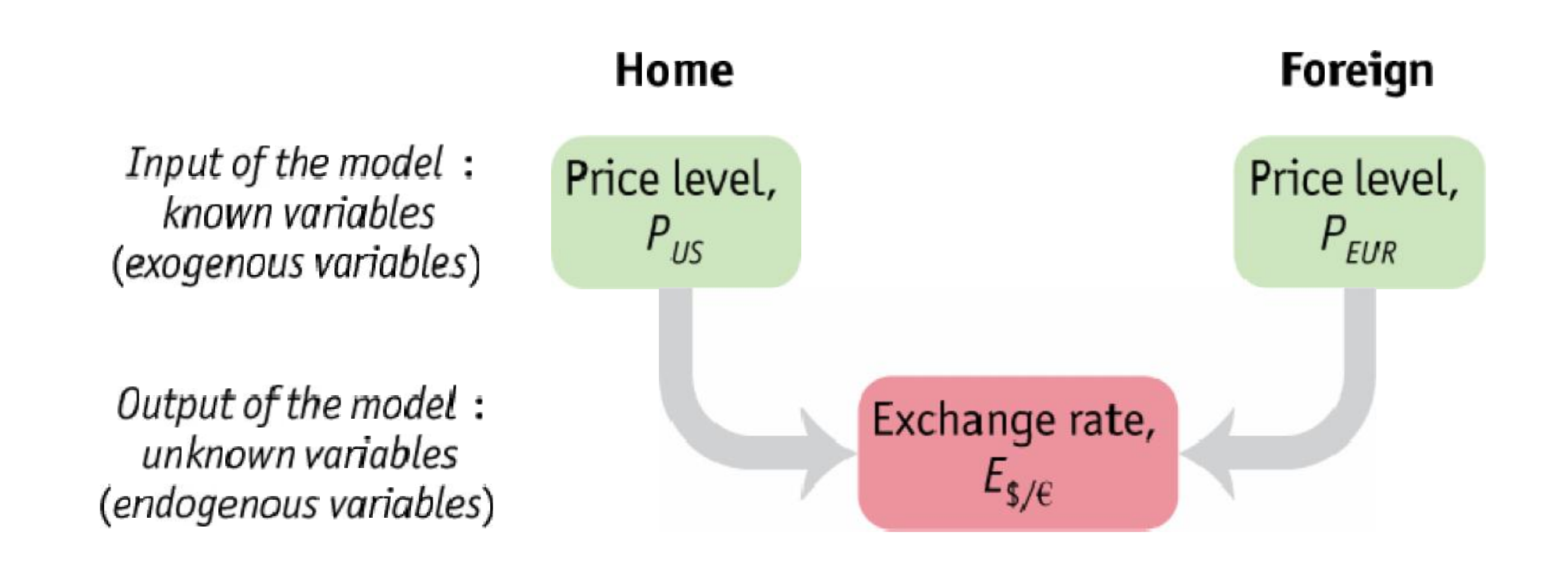
Absolute PPP, Prices, and the Nominal Exchange Rate

For example, if a basket of goods costs $460 in the United States and the same basket costs €400 in Europe, the theory of PPP predicts an exchange rate of $460/€400 = $1.15 per euro.

1 Exchange Rates and Prices in the Long Run: Purchasing Power Parity and Goods Market Equilibrium

Absolute PPP, Prices, and the Nominal Exchange Rate

FIGURE 3-1



Building Block: Price Levels and Exchange Rates in the Long Run According to the PPP Theory In this model, the price levels are treated as known exogenous variables (in the green boxes).

The model uses these variables to predict the unknown endogenous variable (in the red box), which is the exchange rate.

Relative PPP, Inflation, and Exchange Rate Depreciation

- The rate of change of the price level is known as the rate of inflation, or simply **inflation**. e.g. if the price level today is 100, and one year from now it is 103.5, then the rate of inflation is 3.5% (per year).
- We now examine the implications of PPP for the study of inflation.
- On the left-hand side of equation 3-1, the rate of change of the exchange rate in Home is given by

$$\frac{\Delta E_{\$/€,t}}{E_{\$/€,t}} = \underbrace{\frac{E_{\$/€,t+1} - E_{\$/€,t}}{E_{\$/€,t}}}_{\text{Rate of change in the nominal exchange rate}}$$

Relative PPP, Inflation, and Exchange Rate Depreciation

On the right of Equation (3-1), the rate of change of the ratio of two price levels equals the rate of change of the numerator minus the rate of change of the denominator:

$$\frac{\Delta(P_{US}/P_{EUR})}{(P_{US}/P_{EUR})} = \frac{\Delta P_{US,t}}{P_{US,t}} - \frac{\Delta P_{EUR,t}}{P_{EUR,t}}$$

$$= \underbrace{\left(\frac{P_{US,t+1} - P_{US,t}}{P_{US,t}}\right)}_{\substack{\text{Rate of inflation in U.S.} \\ \pi_{US,t}}} - \underbrace{\left(\frac{P_{EUR,t+1} - P_{EUR,t}}{P_{EUR,t}}\right)}_{\substack{\text{Rate of inflation in Europe} \\ \pi_{EUR,t}}} = \pi_{US} - \pi_{EUR}$$

where the terms in brackets are the inflation rates in each location, denoted π_{US} and π_{EUR}, respectively.

1 Exchange Rates and Prices in the Long Run: Purchasing Power Parity and Goods Market Equilibrium

Relative PPP, Inflation, and Exchange Rate Depreciation

If Equation (3-1) holds for levels of exchange rates and prices, then it must also hold for rates of change in these variables. By combining the last two expressions, we obtain

$$\underbrace{\frac{\Delta E_{\$/€,t}}{E_{\$/€,t}}}_{\text{Rate of depreciation}} = \underbrace{\circledR_{US,t} - \circledR_{EUR,t}}_{\text{Inflation differential}} \qquad \textbf{(3-2)}$$

This way of expressing PPP is called **relative PPP,** and it *implies that the rate of depreciation of the nominal exchange rate equals the difference between the inflation rates of two countries (the inflation differential)*.

Relative PPP, Inflation, and Exchange Rate Depreciation

Important points:
First, unlike absolute PPP, relative PPP predicts a relationship between ***changes*** in prices and ***changes*** in exchange rates, rather than a relationship between their **levels**.

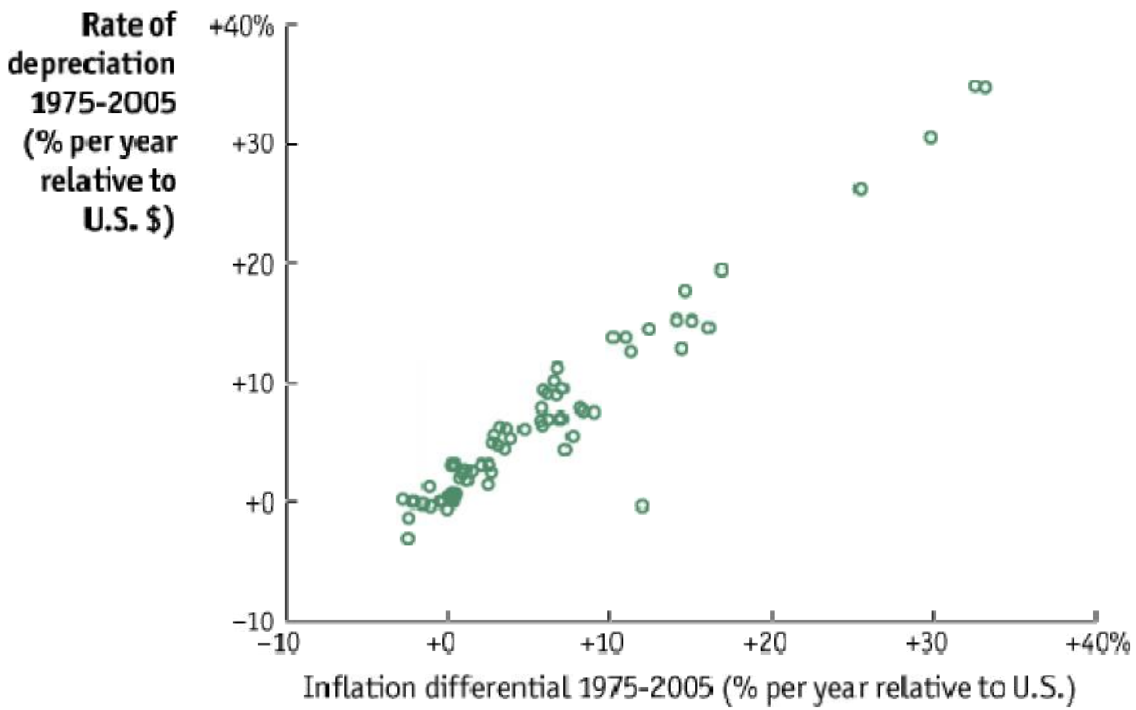
Also remember that relative PPP is *derived from* absolute PPP. If *absolute PPP holds, this implies that relative PPP must hold also*. But the converse need not be true: *relative PPP does not necessarily imply absolute PPP* (if relative PPP holds, absolute PPP can hold or fail).

e.g. Imagine that all goods consistently cost 20% more in country A than in country B, so absolute PPP fails; however, it still can be the case that the inflation differential between A and B (say, 5%) is always equal to the rate of depreciation (say, 5%), so relative PPP will still hold.

APPLICATION

Evidence for PPP in the Long Run and Short Run

FIGURE 3-2 (1 of 2)

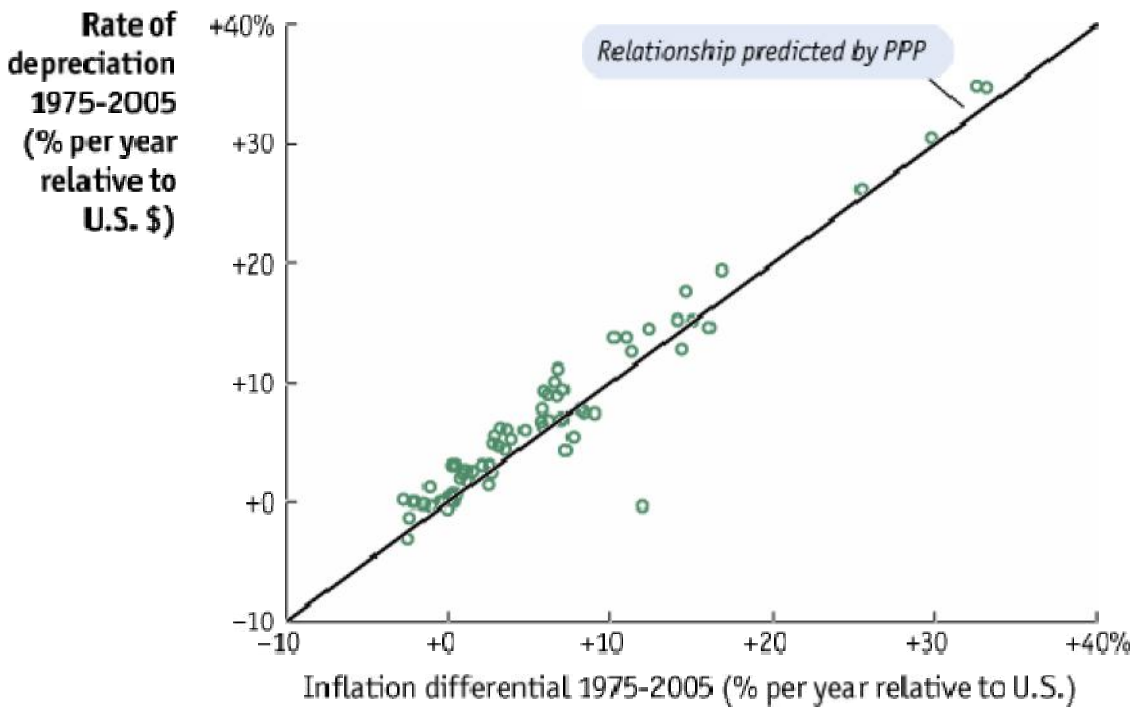


Inflation Differentials and the Exchange Rate, 1975–2005

This scatterplot shows the relationship between the rate of exchange rate depreciation against the U.S. dollar (the vertical axis) and the inflation differential against the United States (horizontal axis) over the long run, based on data for a sample of 82 countries.

Evidence for PPP in the Long Run and Short Run

FIGURE 3-2 (2 of 2)



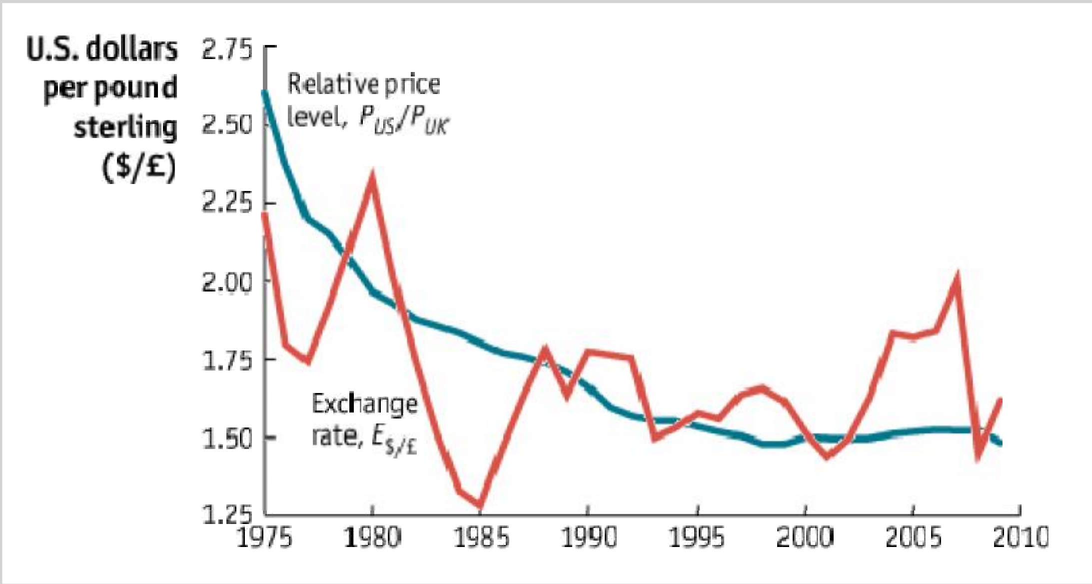
Inflation Differentials and the Exchange Rate, 1975–2005 (continued)

The correlation between the two variables is strong and bears a close resemblance to the theoretical prediction of PPP that all data points would appear on the 45-degree line.

APPLICATION

Evidence for PPP in the Long Run and Short Run

FIGURE 3-3



Exchange Rates and Relative Price Levels Data for the United States and United Kingdom for 1975 to 2009 show that the exchange rate and relative price levels do not always move together in the short run. Relative price levels tend to change slowly and have a small range of movement; exchange rates move more abruptly and experience large fluctuations. Therefore, absolute PPP does not hold in the short run. However, it is a better guide to the long run, and we can see that the two series do tend to drift together over the decades.

How Slow Is Convergence to PPP?

- Research shows that price differences—the deviations from PPP—can be quite persistent. Estimates suggest that these deviations may die out at a rate of about 15% per year. This kind of measure is often called a *speed of convergence*.
- Approximately half of any PPP deviation still remains after four years: economists would refer to this as a four-year *half-life*.
- Such estimates provide a rule of thumb that is useful as a guide to forecasting real exchange rates.

1 Exchange Rates and Prices in the Long Run: Purchasing Power Parity and Goods Market Equilibrium

How Slow Is Convergence to PPP?

For example, suppose the home basket costs $100 and the foreign basket $90, in home currency. Home's real exchange rate is 0.900, and the home currency is overvalued, with foreign goods less expensive than home goods.

The deviation of the real exchange rate from the PPP-implied level of 1 is −10% (or −0.1). Our rule of thumb tells us that next year 15% of this deviation will have disappeared (i.e., 0.015), so the new deviation will be only −0.085, meaning that Home's real exchange rate would be forecast to be 0.915 after one year and thus end up a little bit closer to 1, after a small depreciation. Similarly, after four years, all else being equal, 52% of the deviation (or 0.052) would have been erased, and the real exchange rate would by then be 0.952, only −5% from PPP.

SIDE BAR

Forecasting When the Real Exchange Rate Is Undervalued or Overvalued

•When relative PPP holds, forecasting exchange rate changes is simple: just compute the inflation differential.

•But how do we forecast when PPP doesn't hold, as is often the case? Knowing the real exchange rate and the convergence speed may still allow us to construct a forecast of real and nominal exchange rates.

•The rate of change of the nominal exchange rate equals the rate of change of the real exchange rate plus home inflation minus foreign inflation:

$$\underbrace{\frac{\Delta E_{\$/€,t}}{E_{\$/€,t}}}_{\text{Rate of depreciation of the nominal exchange rate}} = \underbrace{\frac{\Delta q_{US/EUR,t}}{q_{US/EUR,t}}}_{\text{Rate of depreciation of the real exchange rate}} + \underbrace{\pi_{US,t} - \pi_{EUR,t}}_{\text{Inflation differential}}$$

What Explains Deviations from PPP?

Economists have found a variety of reasons why PPP fails in the short run:

- *Transaction costs.* Include costs of transportation, tariffs, duties, and other costs due to shipping and delays associated with developing distribution networks and satisfying legal and regulatory requirements in foreign markets. On average, they are more than 20% of the price of goods traded internationally.
- *Nontraded goods.* Some goods are inherently nontradable; they have infinitely high transaction costs. Most goods and services fall somewhere between tradable and nontradable.

1 Exchange Rates and Prices in the Long Run: Purchasing Power Parity and Goods Market Equilibrium

What Explains Deviations from PPP?

- *Imperfect competition and legal obstacles.* Many goods are not simple undifferentiated commodities, as LOOP and PPP assume, but are differentiated products with brand names, copyrights, and legal protection. Such differentiated goods create conditions of *imperfect competition* because firms have some power to set the price of their good. With this kind of market power, firms can charge different prices not just across brands but also across countries.
- *Price stickiness.* Prices do not or cannot adjust quickly and flexibly to changes in market conditions.

HEADLINES

The Big Mac Index

For more than 20 years, The Economist newspaper has engaged in a whimsical attempt to judge PPP theory based a well-known, globally uniform consumer good: the McDonald's Big Mac. The over- or undervaluation of a currency against the U.S. dollar is gauged by comparing the relative prices of a burger in a common currency, and expressing the difference as a percentage deviation from one:

Home of the undervalued burger?

$$\text{Big Mac Index} = q^{\text{Big Mac}} - 1 = \left(\frac{E_{\$/\text{local currency}} P_{\text{local}}^{\text{Big Mac}}}{P_{\text{US}}^{\text{Big Mac}}} \right) - 1$$

1 Exchange Rates and Prices in the Long Run: Purchasing Power Parity and Goods Market Equilibrium

TABLE 3-1 (1 of 3)

The Big Mac Index The table shows the price of a Big Mac in July 2009 in local currency (column 1) and converted to U.S. dollars (column 2) using the actual exchange rate (column 4). The dollar price can then be compared with the average price of a Big Mac in the United States ($3.22 in column 1, row 1). The difference (column 5) is a measure of the overvaluation (+) or undervaluation (−) of the local currency against the U.S. dollar. The exchange rate against the dollar implied by PPP (column 3) is the hypothetical price of dollars in local currency that would have equalized burger prices, which may be compared with the actual observed exchange rate (column 4).

	Big Mac Prices		Exchange rate (local currency per U.S. dollar)		Over (+)/ under(−) valuation against dollar, %
	In local currency (1)	In U.S. dollars (2)	Implied by PPP (3)	Actual, July 13th (4)	(5)
United States	$ 3.57	3.57			
Argentina	Peso 11.5	3.02	3.22	3.81	−15
Australia	A$ 4.34	3.37	1.22	1.29	−6
Brazil	Real 8.03	4.02	2.25	2.00	+13
Britain	£ 2.29	3.69	0.64	0.62	+3
Canada	C$ 3.89	3.35	1.09	1.16	−6
Chile	Peso 1750	3.19	490	549	−11
China	Yuan 12.5	1.83	3.50	6.83	−49
Colombia	Peso 7000	3.34	1,961	2,096	−6
Costa Rica	Colones 2000	3.43	560	583	−4
Czech Rep.	Koruna 67.92	3.64	19.0	18.7	+2

1 Exchange Rates and Prices in the Long Run: Purchasing Power Parity and Goods Market Equilibrium

TABLE 3-1 (2 of 3)

The Big Mac Index (continued)

	Big Mac Prices		Exchange rate (local currency per U.S. dollar)		Over (+)/ under(−) valuation against dollar, %
	In local currency (1)	In U.S. dollars (2)	Implied by PPP (3)	Actual, July 13th (4)	(5)
Denmark	DK 29.5	5.53	8.26	5.34	+55
Estonia	Kroon 32	2.85	8.96	11.2	−20
Eygpt	Pound 13	2.33	3.64	5.58	−35
Euro area	€ 3.31	4.62	0.93	0.72	+29
Hong Kong	HK$ 13.3	1.72	3.73	7.75	−52
Hungary	Forint 720	3.62	202	199	+1
Iceland	Kronur 640	4.99	179	128	+40
Indonesia	Rupiah 20900	2.05	5,854	10,200	−43
Israel	Shekel 15	3.77	4.20	3.97	+6
Japan	Yen 320	3.46	89.6	92.6	−3
Latvia	Lats 1.55	3.09	0.43	0.50	−13
Lithuania	Litas 7.1	2.87	1.99	2.48	−20
Malaysia	Ringgit 6.77	1.88	1.90	3.60	−47
Mexico	Peso 33	2.39	9.24	13.8	−33
New Zealand	NZ$ 4.9	3.08	1.37	1.59	−14
Norway	Kroner 40	6.15	11.2	6.51	+72
Pakistan	Rupee 190	2.30	53.2	82.6	−36

1 Exchange Rates and Prices in the Long Run: Purchasing Power Parity and Goods Market Equilibrium

TABLE 3-1 (3 of 3)

The Big Mac Index (continued)

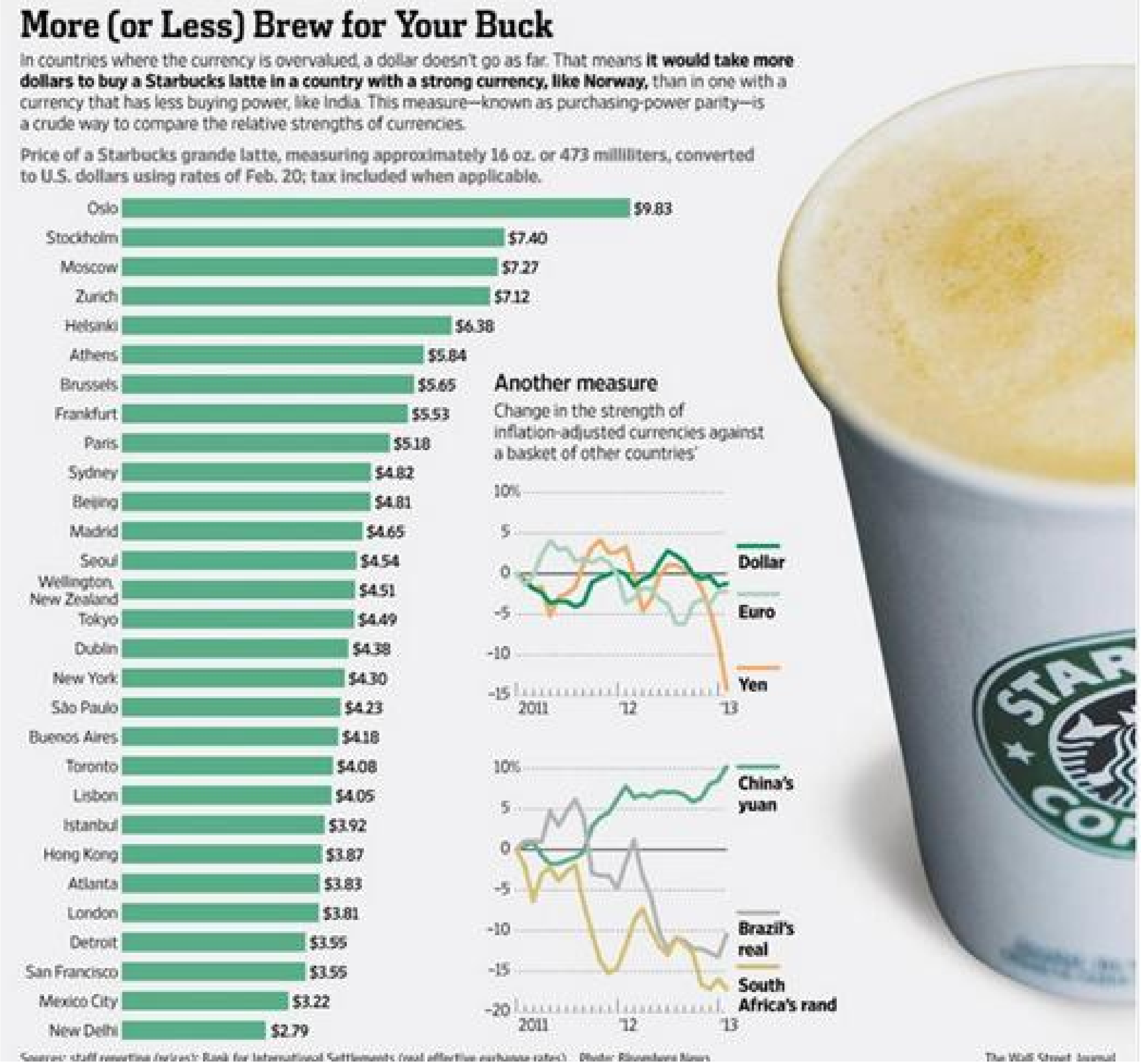
	Big Mac Prices		Exchange rate (local currency per U.S. dollar)		Over (+)/ under(−) valuation against dollar, %
	In local currency (1)	In U.S. dollars (2)	Implied by PPP (3)	Actual, July 13th (4)	(5)
Peru	New Sol 8.056	2.66	2.26	3.03	−25
Philippines	Peso 99.39	2.05	27.8	48.4	−42
Poland	Zloty 7.6	2.41	2.13	3.16	−33
Russia	Rouble 67	2.04	18.8	32.8	−43
Saudi Arabia	Riyal 11	2.93	3.08	3.75	−18
Singapore	S$ 4.22	2.88	1.18	1.46	−19
South Africa	Rand 17.95	2.17	5.03	8.28	−39
South Korea	Won 3400	2.59	952	1,315	−28
Sri Lanka	Rupee 210	1.83	58.8	115	−49
Sweden	SKr 39	4.93	10.9	7.90	+38
Switzerland	SFr 6.50	5.98	1.82	1.09	+68
Taiwan	Taiwan $ 75	2.26	21.0	33.2	−37
Thailand	Baht 64.49	1.89	18.1	34.2	−47
Turkey	Lire 5.65	3.65	1.58	1.55	+2
UAE	Dirhams 10	2.72	2.80	3.67	−24
Ukraine	Hryvnia 14	1.83	3.92	7.66	−49
Uruguay	Peso 61	2.63	17.1	23.2	−26

From Burgernomics to Lattenomics: The Starbucks Tall Latte Index

What can the price of Starbucks coffee—served in more than 32 countries—tell us about exchange rates?

Introduced by the Economist.

Also based on the theory of PPP.


More (or Less) Brew for Your Buck
In countries where the currency is overvalued, a dollar doesn't go as far. That means **it would take more dollars to buy a Starbucks latte in a country with a strong currency, like Norway,** than in one with a currency that has less buying power, like India. This measure—known as purchasing-power parity—is a crude way to compare the relative strengths of currencies.
Price of a Starbucks grande latte, measuring approximately 16 oz. or 473 milliliters, converted to U.S. dollars using rates of Feb. 20; tax included when applicable.
Oslo $9.83
Stockholm $7.40
Moscow $7.27
Zurich $7.12
Helsinki $6.38
Athens $5.84
Brussels $5.65
Frankfurt $5.53
Paris $5.18
Sydney $4.82
Beijing $4.81
Madrid $4.65
Seoul $4.54
Wellington, New Zealand $4.51
Tokyo $4.49
Dublin $4.38
New York $4.30
São Paulo $4.23
Buenos Aires $4.18
Toronto $4.08
Lisbon $4.05
Istanbul $3.92
Hong Kong $3.87
Atlanta $3.83
London $3.81
Detroit $3.55
San Francisco $3.55
Mexico City $3.22
New Delhi $2.79
Another measure
Change in the strength of inflation-adjusted currencies against a basket of other countries'
10%
5
0
-5
-10
-15
2011
'12
'13
Dollar
Euro
Yen
10%
5
0
-5
-10
-15
-20
2011
'12
'13
China's yuan
Brazil's real
South Africa's rand
The Wall Street Journal

The Big Mac Index vs. Tall Latte Index

It turns out that the Tall Latte index tells almost the same story as the Big Mac Index for most major currencies.

Both indices show that the Euro is overvalued against the US dollar.

But they show mixed results for Asian currencies. Why?

2 Money, Prices, and Exchange Rates in the Long Run: Money Market Equilibrium in a Simple Model

- In the long run the exchange rate is determined by the ratio of the price levels in two countries. But this prompts a question: What determines those price levels?
- Monetary theory supplies an answer: in the long run, price levels are determined in each country by the relative demand and supply of money.
- This section recaps the essential elements of monetary theory and shows how they fit into our theory of exchange rates in the long run.

2 Money, Prices, and Exchange Rates in the Long Run: Money Market Equilibrium in a Simple Model

What Is Money?

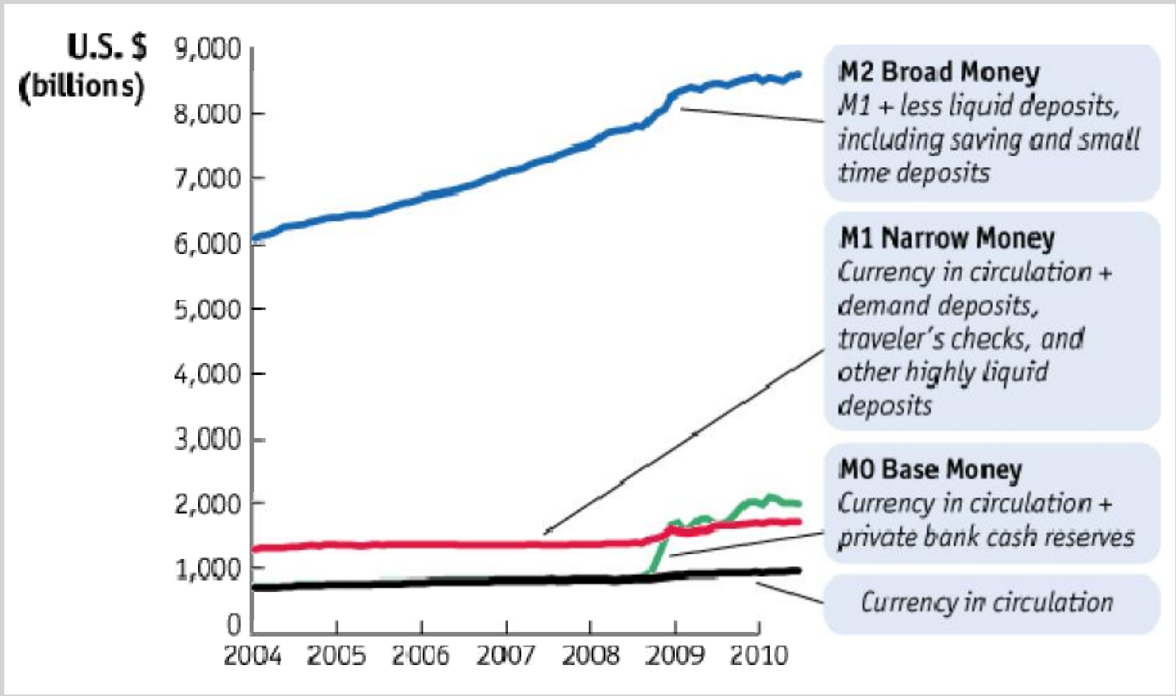
Economists think of **money** as performing three key functions in an economy:

1. Money is a *store of value* because it can be used to buy goods and services in the future. If the opportunity cost of holding money is low, we will hold money more willingly than we hold other assets (stocks, bonds, etc.).
2. Money also gives us a *unit of account* in which all prices in the economy are quoted.
3. Money is a *medium of exchange* that allows us to buy and sell goods and services without the need to engage in inefficient barter (direct swaps of goods). Money is the most liquid asset of all.

2 Money, Prices, and Exchange Rates in the Long Run: Money Market Equilibrium in a Simple Model

The Measurement of Money

FIGURE 3-4



The Measurement of Money This figure shows the major kinds of monetary aggregates (currency, M0, M1, and M2) for the United States from 2004 to 2010. Normally, bank reserves are very close to zero, so M0 and currency are virtually identical, but reserves spiked up during the financial crisis in 2008, as private banks sold securities to the Fed and stored up the cash proceeds in their Fed reserve accounts as a precautionary hoard of liquidity.

2 Money, Prices, and Exchange Rates in the Long Run: Money Market Equilibrium in a Simple Model

The Supply of Money

- How is the supply of money determined? In practice, a country's **central bank** controls the **money supply.**
- In our analysis, we make the simplifying assumption that the central bank's policy tools are sufficient to allow it to control indirectly, but accurately, the level of M1.

2 Money, Prices, and Exchange Rates in the Long Run: Money Market Equilibrium in a Simple Model

The Demand for Money: A Simple Model

- A simple theory of household money demand is motivated by the assumption that the need to conduct transactions is in proportion to an individual's income.
- We can infer that the aggregate **money demand** will behave similarly.
- *All else equal, a rise in national dollar income (nominal income) will cause a proportional increase in transactions and, hence, in aggregate money demand.*
- A simple model in which the demand for money is proportional to dollar income is known as the **quantity theory of money:**

$$\underbrace{M^d}_{\text{Demand for money (\$)}} = \underbrace{\bar{L}}_{\text{A constant}} \times \underbrace{PY}_{\text{Nominal income (\$)}}$$

The Demand for Money: A Simply Model

- Dividing the previous equation by *P,* the price level, we can derive the *demand for real money balances*:

$$\underbrace{\frac{M^d}{P}}_{\substack{\text{Demand}\\ \text{for real}\\ \text{money}}} = \underbrace{\bar{L}}_{\text{A constant}} \times \underbrace{Y}_{\text{Real income}}$$

- Real money balances are simply a measure of the purchasing power of the stock of money in terms of goods and services. The demand for real money balances is strictly proportional to real income.

2 Money, Prices, and Exchange Rates in the Long Run: Money Market Equilibrium in a Simple Model

Equilibrium in the Money Market

The condition for equilibrium in the money market is simple to state: the demand for money M^d must equal the supply of money M, which we assume to be under the control of the central bank.

Imposing this condition on the last two equations, we find that nominal money supply equals nominal money demand:

$$M = \bar{L}PY$$

and, equivalently, that real money supply equals real money demand:

$$\frac{M}{P} = \bar{L}Y$$

2 Money, Prices, and Exchange Rates in the Long Run: Money Market Equilibrium in a Simple Model

A Simple Monetary Model of Prices

- An expression for the price levels in the U.S. and Europe is:

$$P_{US} = \frac{M_{US}}{\overline{L}_{US} Y_{US}} \qquad P_{EUR} = \frac{M_{EUR}}{\overline{L}_{EUR} Y_{EUR}}$$

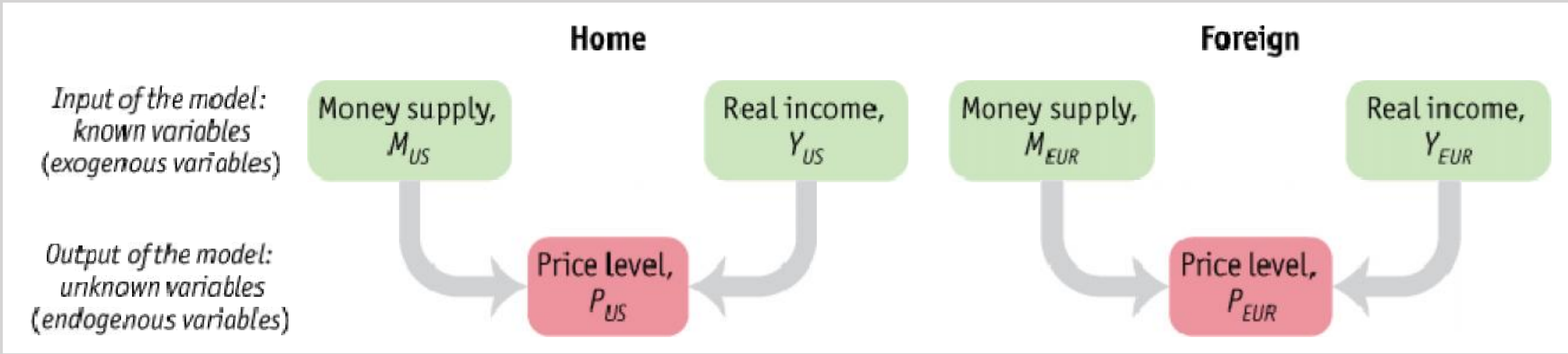
- These two equations are examples of the **fundamental equation of the monetary model of the price level.**

- In the long run, we assume prices are flexible and will adjust to put the money market in equilibrium.

2 Money, Prices, and Exchange Rates in the Long Run: Money Market Equilibrium in a Simple Model

A Simple Monetary Model of Prices

FIGURE 3-5



Building Block: The Monetary Theory of the Price Level According to the Long-Run Monetary Model In these models, the money supply and real income are treated as known exogenous variables (in the green boxes).

The models use these variables to predict the unknown endogenous variables (in the red boxes), which are the price levels in each country.

A Simple Monetary Model of the Exchange Rate

Plugging the expression for the price level in the monetary model to Equation (11-1), we can use absolute PPP to solve for the exchange rate:

$$\underbrace{E_{\$/EU}}_{\text{Exchange rate}} = \underbrace{\frac{P_{US}}{P_E}}_{\text{Ratio of price levels}} = E\frac{\left(\dfrac{M_{US}}{\bar{L}_{US}Y_{US}}\right)}{\left(\dfrac{M_{EUR}}{\bar{L}_{EUR}Y_{EUR}}\right)} = \underbrace{\frac{(M_{US}/M_{EUR})}{(\bar{L}_{US}Y_{US}/\bar{L}_{EUR}Y_{EUR})}}_{\substack{\text{Relative nominal money supplies} \\ \text{divided by} \\ \text{relative real money demands}}} \quad \textbf{(11-3)}$$

This is the **fundamental equation of the monetary approach to exchange rates.**

Money Growth, Inflation, and Depreciation

The implications of the fundamental equation of the monetary approach to exchange rates are intuitive:

- Suppose the U.S. money supply increases, all else equal. The right-hand side increases (the U.S. nominal money supply increases relative to Europe), causing the exchange rate to increase (the U.S. dollar depreciates against the euro).
- Now suppose the U.S. real income level increases, all else equal. Then the right-hand side decreases (the U.S. real money demand increases relative to Europe), causing the exchange rate to decrease (the U.S. dollar appreciates against the euro).

2 Money, Prices, and Exchange Rates in the Long Run: Money Market Equilibrium in a Simple Model

Money Growth, Inflation, and Depreciation

The U.S. money supply is M_{US}, and its growth rate is μ_{US}:

$$\mu_{US,t} = \underbrace{\frac{M_{US,t+1} - M_{US,t}}{M_{US,t}}}_{\text{Rate of money supply growth in U.S.}}$$

The growth rate of real income in the U.S. is g_{US}:

$$g_{US,t} = \underbrace{\frac{Y_{US,t+1} - Y_{US,t}}{Y_{US,t}}}_{\text{Rate of real income growth in U.S.}}$$

2 Money, Prices, and Exchange Rates in the Long Run: Money Market Equilibrium in a Simple Model

Money Growth, Inflation, and Depreciation

Putting all the pieces together, the growth rate of $P_{US} = M_{US}/\bar{L}_{US}Y_{US}$ equals the money supply growth rate μ_{US} minus the real income growth rate g_{US}. The growth rate of P_{US} is the inflation rate π_{US}. Thus, we know that:

$$\pi_{US,t} = \mu_{US,t} - g_{US,t} \qquad \textbf{(3-4)}$$

The rate of change of the European price level is calculated similarly:

$$\pi_{EUR,t} = \mu_{EUR,t} - g_{EUR,t} \qquad \textbf{(3-5)}$$

When money growth is higher than income growth, we have “more money chasing fewer goods” and this leads to inflation.

Money Growth, Inflation, and Depreciation

Combining Equation (3-4) and Equation (3-5), we can now solve for the inflation differential in terms of monetary fundamentals and finish our task of computing the rate of depreciation of the exchange rate:

$$\underbrace{\frac{\Delta E_{\$/€t}}{E_{\$/€,t}}}_{\substack{\text{Rate of depreciation} \\ \text{of the nominal exchange rate}}} = \underbrace{\pi_{US,t} - \pi_{EUR,t}}_{\text{Inflation differential}} = \left(\mu_{US,t} - g_{US,t}\right) - \left(\mu_{EUR,t} - g_{EUR,t}\right) \quad \textbf{(11-6)}$$

$$= \underbrace{\left(\mu_{US,t} - \mu_{EUR,t}\right)}_{\substack{\text{Differential in} \\ \text{nominal money supply} \\ \text{growth rates}}} - \underbrace{\left(g_{US,t} - g_{EUR,t}\right)}_{\substack{\text{Differential in} \\ \text{real output} \\ \text{growth rates}}}.$$

2 Money, Prices, and Exchange Rates in the Long Run: Money Market Equilibrium in a Simple Model

Money Growth, Inflation, and Depreciation

The intuition behind Equation (3-6) is as follows:

- If the United States runs a looser monetary policy in the long run measured by a faster money growth rate, the dollar will depreciate more rapidly, all else equal.
- If the U.S. economy grows faster in the long run, the dollar will appreciate more rapidly, all else equal.

3 The Monetary Approach: Implications and Evidence

Exchange Rate Forecasts Using the Simple Model

- Whenever one uses the monetary model for forecasting, one is answering a hypothetical question: What path would exchange rates follow from now on *if prices were flexible and PPP held*?

Forecasting Exchange Rates: An Example

- Assume that U.S. and European real income growth rates are identical and equal to zero (0%). Also, the European price level is constant, and European inflation is zero.
- Based on these assumptions, we examine two cases.

3 The Monetary Approach: Implications and Evidence

Exchange Rate Forecasts Using the Simple Model

Forecasting Exchange Rates: An Example

Case 1: A one-time increase in the money supply.

a. There is a 10% increase in the money supply *M*.

b. Real money balances *M/P* remain constant, because real income is constant.

c. These last two statements imply that price level *P* and money supply *M* must move in the same proportion, so there is a 10% increase in the price level *P*.

d. PPP implies that the exchange rate *E* and price level *P* must move in the same proportion, so there is a 10% increase in the exchange rate *E*; that is, the dollar depreciates by 10%.

3 The Monetary Approach: Implications and Evidence

Exchange Rate Forecasts Using the Simple Model

Forecasting Exchange Rates: An Example

Case 2: An increase in the rate of money growth.

The U.S. money supply grows at a steady fixed rate μ. Then, at time T that the United States will raise the rate of money supply growth to a slightly higher rate of $\mu + \Delta\mu$.

a. Money supply M is growing at a constant rate.

b. Real money balances M/P remain constant, as before.

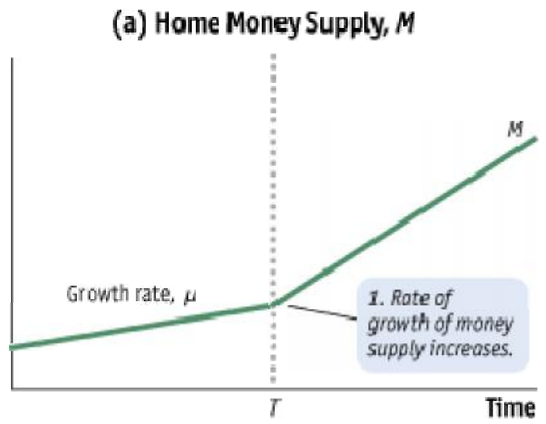
c. These last two statements imply that price level P and money supply M must move in the same proportion, so P is always a constant multiple of M.

d. PPP implies that the exchange rate E and price level P must move in the same proportion, so E is always a constant multiple of P (and hence of M).

Exchange Rate Forecasts Using the Simple Model

Forecasting Exchange Rates: An Example

FIGURE 3-6 (1 of 4)



An Increase in the Growth Rate of the Money Supply in the Simple Model

Before time T, money, prices, and the exchange rate all grow at rate μ. Foreign prices are constant.

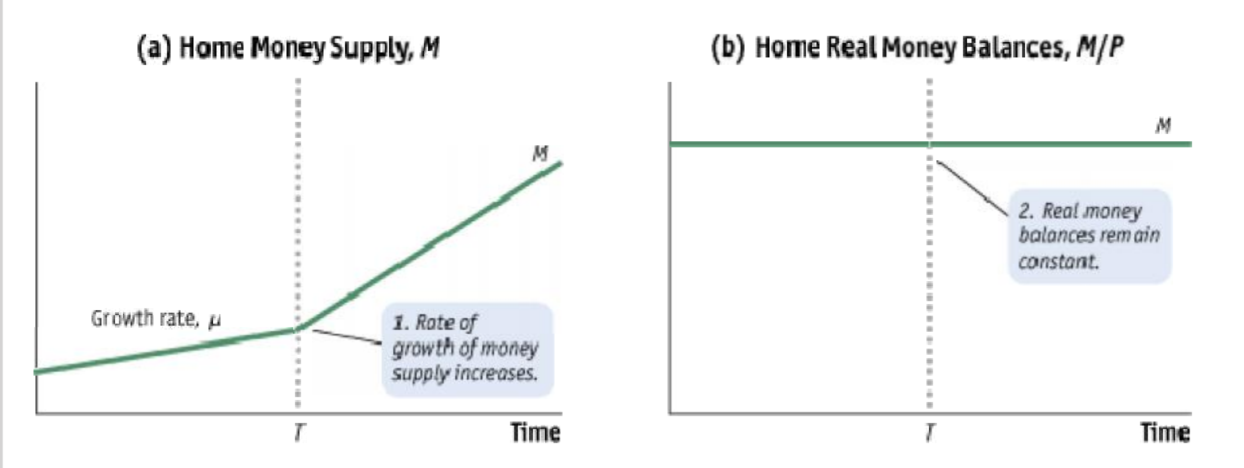
In panel (a), we suppose at time *T* there is an increase $\Delta\mu$ in the rate of growth of home money supply *M*.

3 The Monetary Approach: Implications and Evidence

Exchange Rate Forecasts Using the Simple Model

Forecasting Exchange Rates: An Example

FIGURE 3-6 (2 of 4)



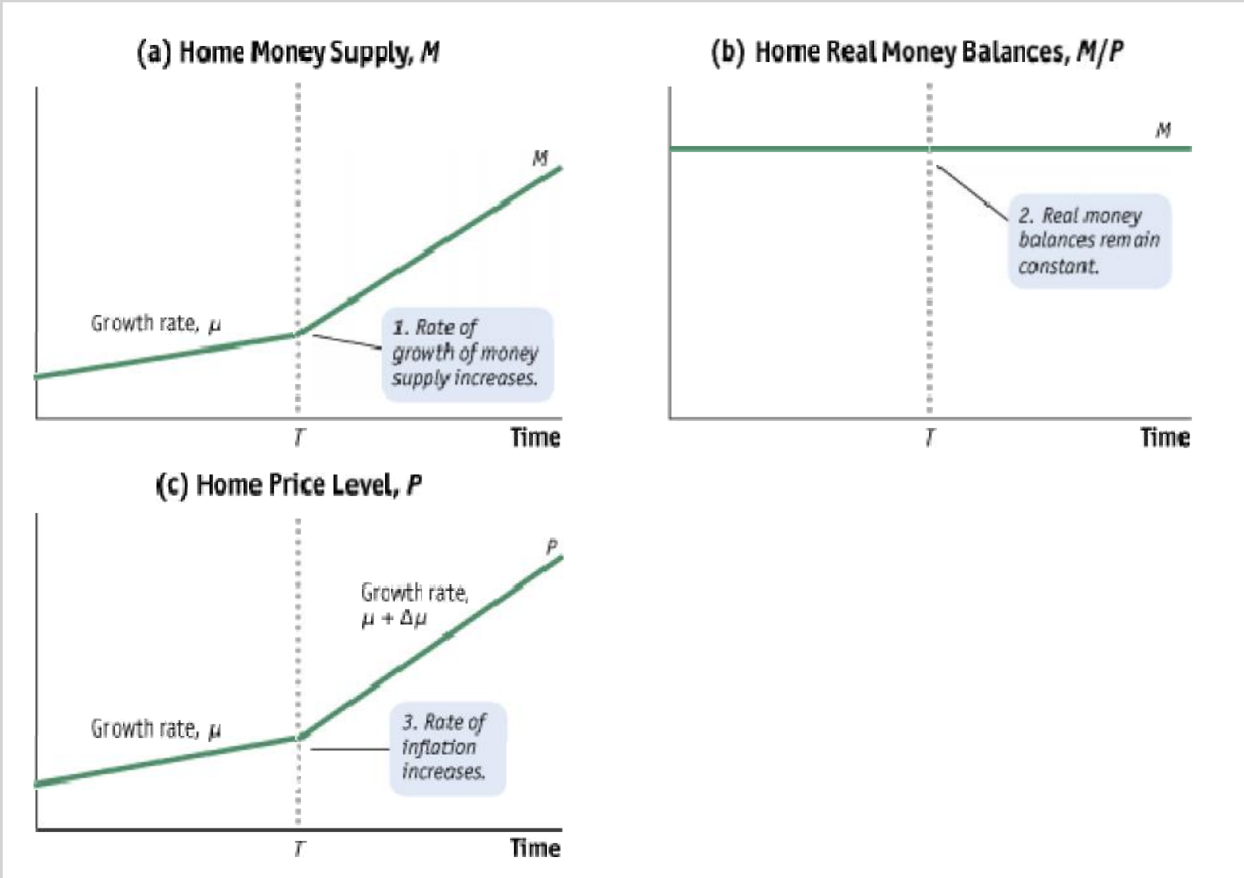
An Increase in the Growth Rate of the Money Supply in the Simple Model (continued)

In panel (b), the quantity theory assumes that the level of real money balances remains unchanged.

Exchange Rate Forecasts Using the Simple Model

Forecasting Exchange Rates: An Example

FIGURE 3-6 (3 of 4)



An Increase in the Growth Rate of the Money Supply in the Simple Model (continued)

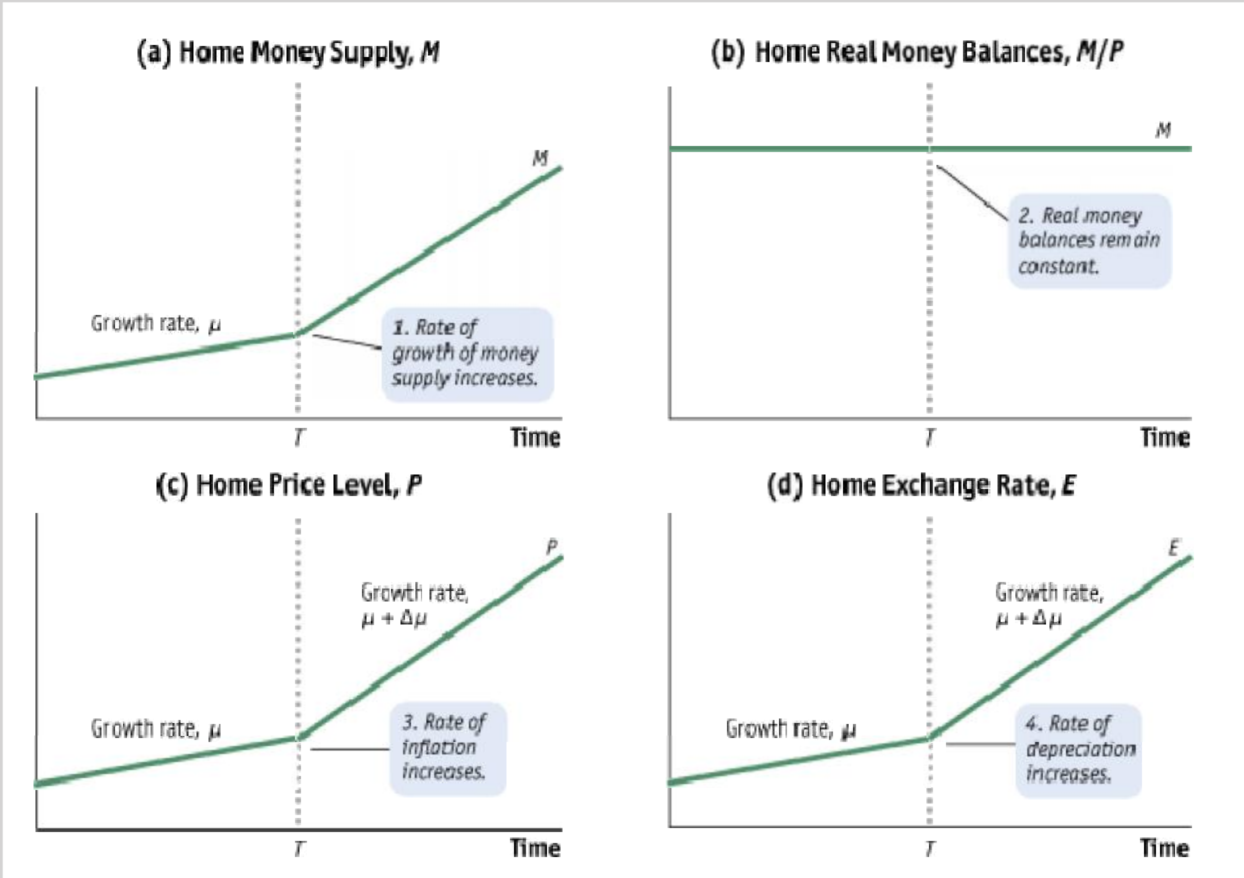
After time *T*, if real money balances (*M*/*P*) are constant, then money *M* and prices *P* still grow at the same rate, which is now $\mu + \Delta\mu$, so the rate of inflation rises by $\Delta\mu$, as shown in panel (c).

3 The Monetary Approach: Implications and Evidence

Exchange Rate Forecasts Using the Simple Model

Forecasting Exchange Rates: An Example

FIGURE 3-6 (4 of 4)



An Increase in the Growth Rate of the Money Supply in the Simple Model (continued)

PPP and an assumed stable foreign price level imply that the exchange rate will follow a path similar to that of the domestic price level, so *E* also grows at the new rate $\mu + \Delta\mu$, and the rate of depreciation rises by $\Delta\mu$, as shown in panel (d).

APPLICATION

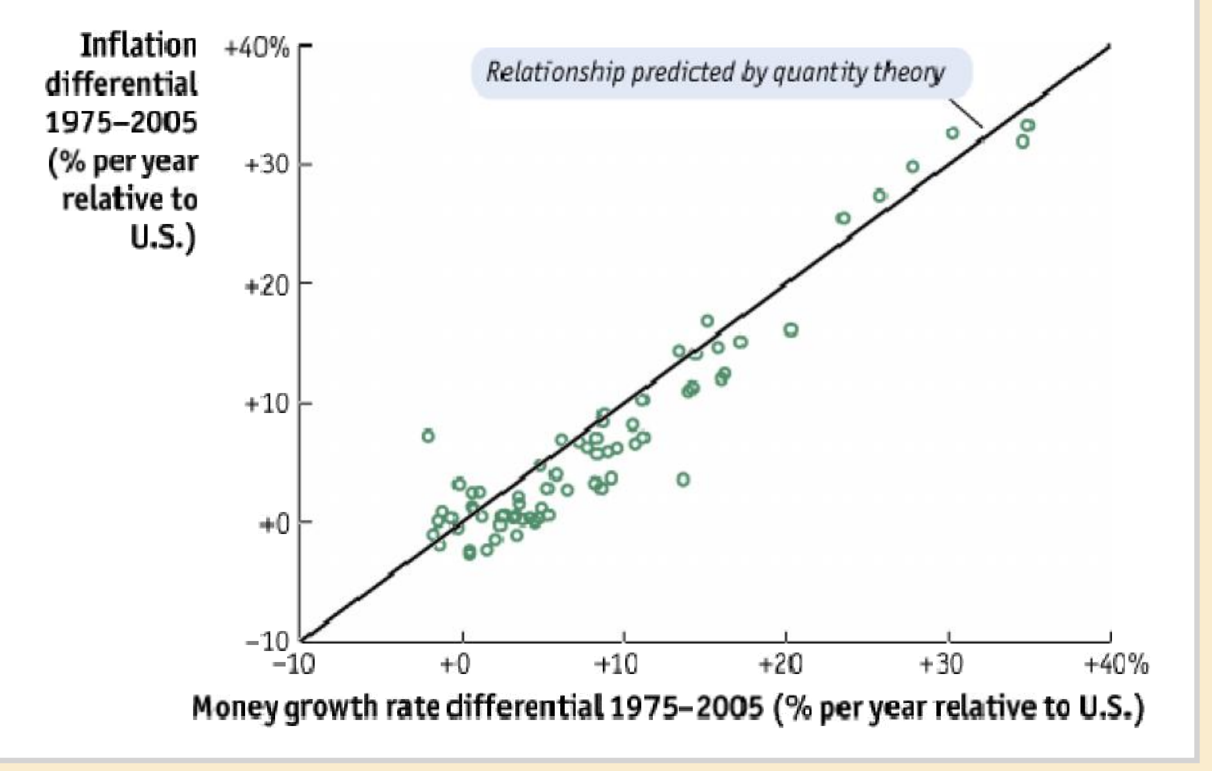
Evidence for the Monetary Approach

The monetary approach to prices and exchange rates suggests that, all else equal, increases in the rate of money supply growth should be the same size as increases in the rate of inflation and the rate of exchange rate depreciation.

APPLICATION

Evidence for the Monetary Approach

FIGURE 3-7



Inflation Rates and Money Growth Rates, 1975–2005

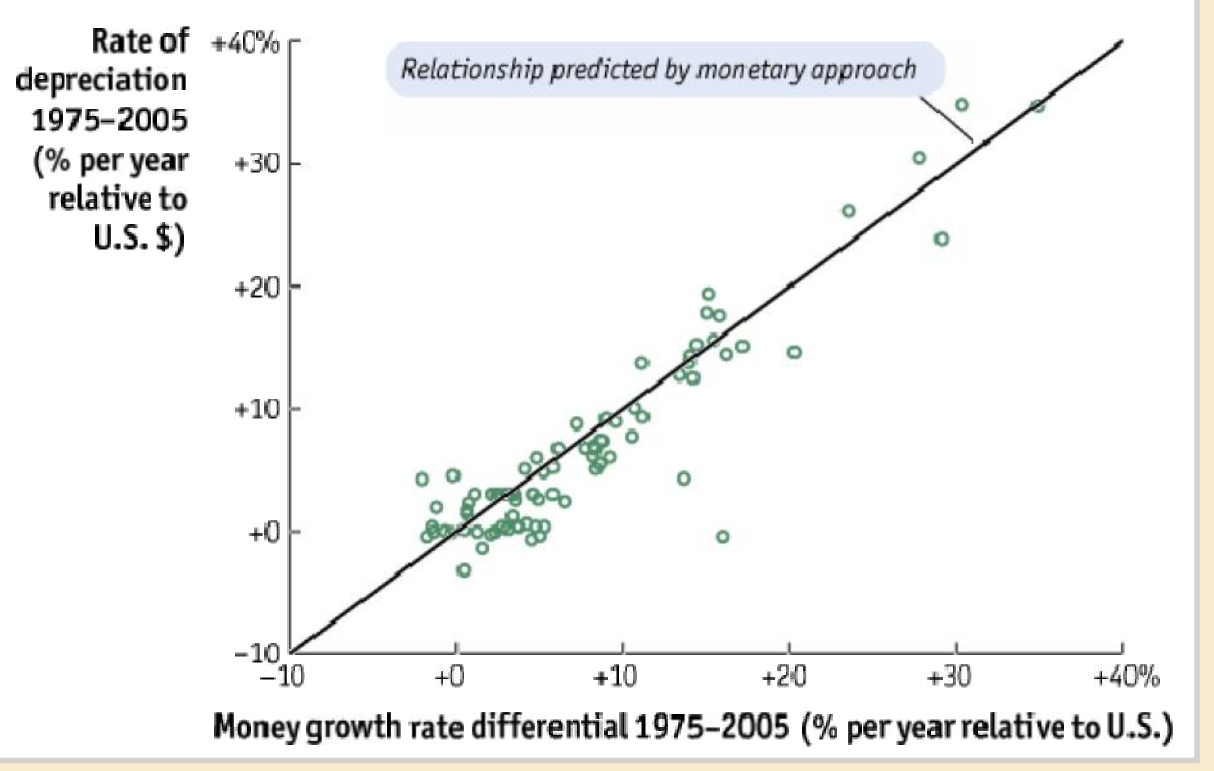
This scatterplot shows the relationship between the rate of inflation and the money supply growth rate over the long run, based on data for a sample of 76 countries.

The correlation between the two variables is strong and bears a close resemblance to the theoretical prediction of the monetary model that all data points would appear on the 45-degree line.

APPLICATION

Evidence for the Monetary Approach

FIGURE 3-8



Money Growth Rates and the Exchange Rate, 1975–2005

This scatterplot shows the relationship between the rate of exchange rate depreciation and the money growth rate differential relative to the United States over the long run, based on data for a sample of 82 countries.

The data show a strong correlation between the two variables and a close resemblance to the theoretical prediction of the monetary approach to exchange rates, which would predict that all data points would appear on the 45-degree line.

APPLICATION

Hyperinflations of the Twentieth Century

Economists traditionally define a **hyperinflation** as a sustained inflation of more than 50% *per month.*

HEADLINES

The First Hyperinflation of the Twenty-First Century

By 2007 Zimbabwe was almost at an economic standstill, except for the printing presses churning out the banknotes. A creeping inflation—58% in 1999, 132% in 2001, 385% in 2003, and 586% in 2005—was about to become hyperinflation, and the long-suffering people faced an accelerating descent into even deeper chaos. Three years later, shortly after this news report, the local currency disappeared from use, replaced by U.S. dollars and South African rand.

Ink on their hands: Under President Robert Mugabe and Central Bank Governor Gideon Gono (seen clutching a Z$50 million note), Zimbabwe became the latest country to join a rather exclusive club.

Hyperinflations of the Twentieth Century

SIDE BAR

Currency Reform

Hyperinflations help us understand how some currencies become extinct if they cease to function well and lose value rapidly. Dollarization in Ecuador is a recent example.

A government may then *redenominate* a new unit of currency equal to 10^N (10 raised to the power *N*) old units.

Sometimes *N* can get quite large. In the 1980s, Argentina suffered hyperinflation. On June 1, 1983, the *peso argentino* replaced the (old) peso at a rate of 10,000 to 1. Then on June 14, 1985, the *austral* replaced the peso argentino at 1,000 to 1. Finally, on January 1, 1992, the *convertible peso* replaced the austral at a rate of 10,000 to 1 (i.e., 10,000,000,000 old pesos).

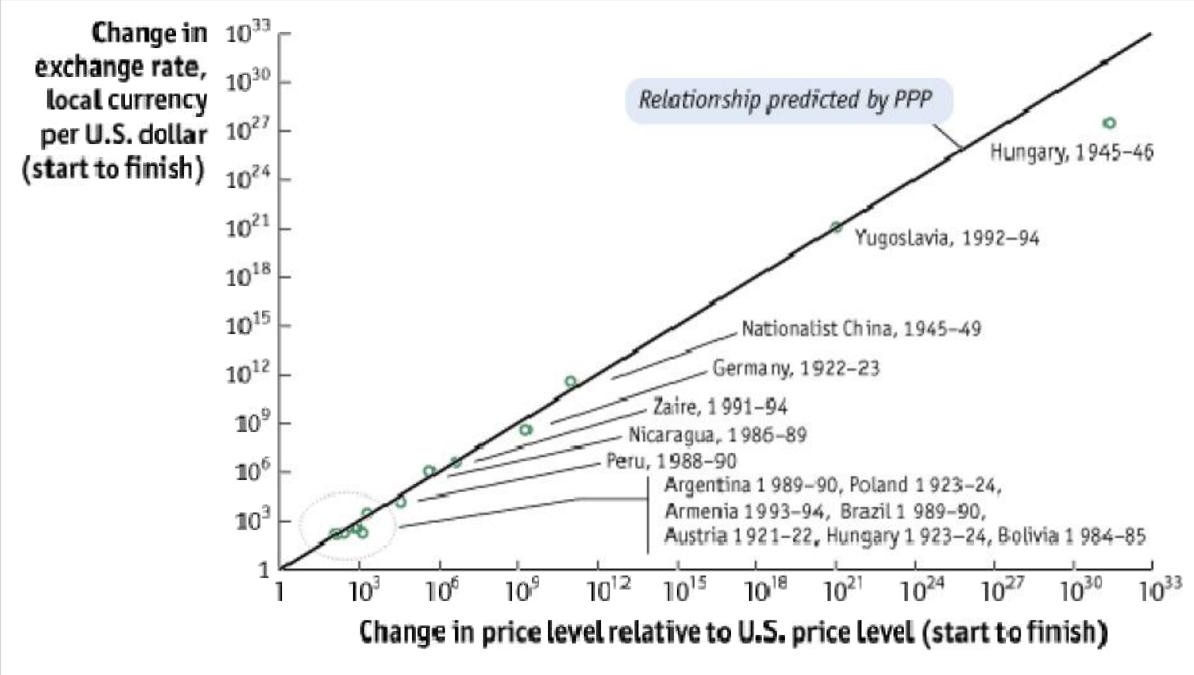
In 1946 the Hungarian *pengö* became worthless. By July 15, 1946, there were 76,041,000,000,000,000,000,000,000 pengö in circulation.

APPLICATION

Hyperinflations of the Twentieth Century

PPP in Hyperinflations

FIGURE 3-9



Inflation Rates and Money Growth Rates, 1975–2005 The scatterplot shows the relationship between the cumulative start-to-finish exchange rate depreciation against the U.S. dollar and the cumulative start-to-finish rise in the local price level for hyperinflations in the twentieth century. Note the use of logarithmic scales.

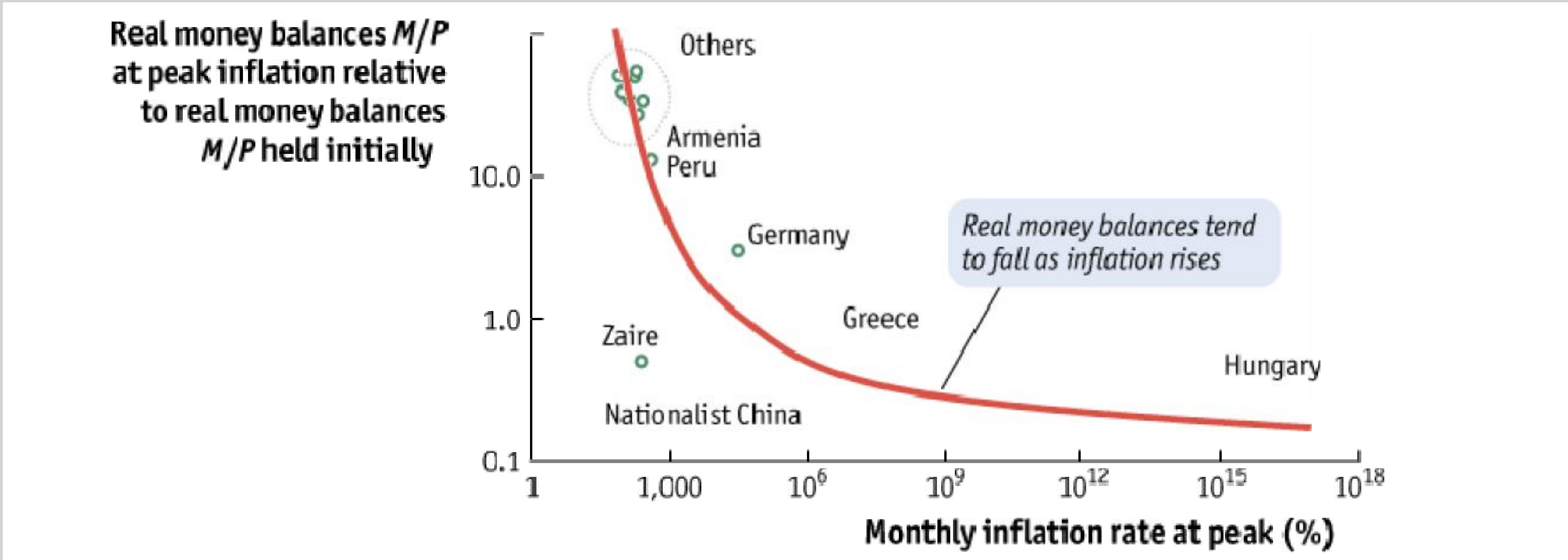
The data show a strong correlation between the two variables and a very close resemblance to the theoretical prediction of PPP that all data points would appear on the 45-degree line.

APPLICATION

Hyperinflations of the Twentieth Century

Money Demand in Hyperinflations

FIGURE 3-10



The Collapse of Real Money Balances during Hyperinflations This figure shows that real money balances tend to collapse in hyperinflations as people economize by reducing their holdings of rapidly depreciating notes. The horizontal axis shows the peak monthly inflation rate (%), and the vertical axis shows the ratio of real money balances in that peak month relative to real money balances at the start of the hyperinflationary period. The data are shown using log scales for clarity.

4 Money, Interest Rates, and Prices in the Long Run: A General Model

- The trouble with the *quantity theory* we studied earlier is that it assumes that the demand for money is stable, and this is implausible.
- In this section, we explore a more general model that allows for money demand to vary with the nominal interest rate.
- We consider the links between inflation and the nominal interest rate in an open economy, and then return to the question of how best to understand what determines exchange rates in the long run.

4 Money, Interest Rates, and Prices in the Long Run: A General Model

The Demand for Money: The General Model

- *All else equal, a rise in national dollar income (nominal income) will cause a proportional increase in transactions and, hence, in aggregate money demand.*
- *All else equal, a rise in the nominal interest rate will cause the aggregate demand for money to fall.*

$$\underbrace{M^d}_{\substack{\text{Demand} \\ \text{for money (\$)}}} = \underbrace{L(i)}_{\substack{\text{A} \\ \text{decreasing} \\ \text{function}}} \times \underbrace{P \times Y}_{\substack{\text{Nominal} \\ \text{income (\$)}}}$$

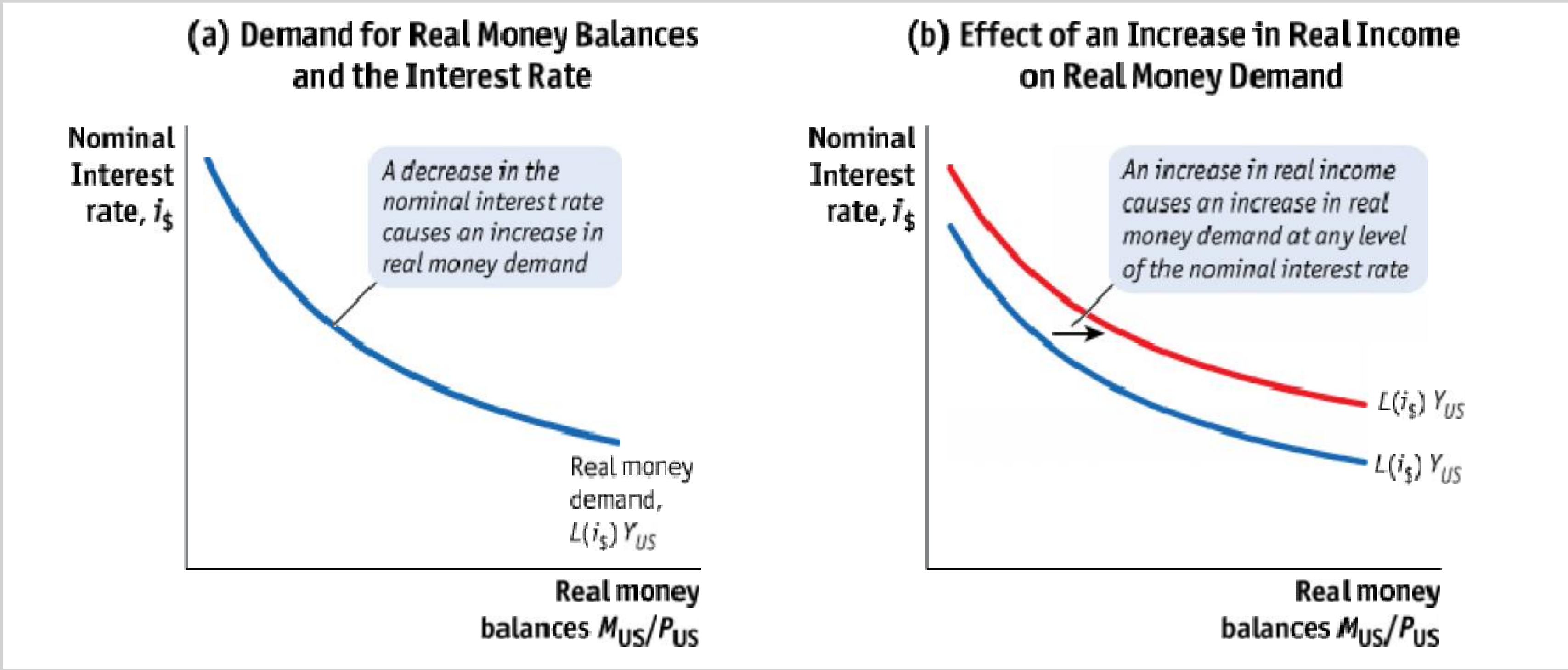
- Dividing by P, we can derive the demand for real money balances:

$$\underbrace{\frac{M^d}{P}}_{\substack{\text{Demand} \\ \text{for real money}}} = \underbrace{L(i)}_{\substack{\text{A} \\ \text{decreasing} \\ \text{function}}} \times \underbrace{Y}_{\substack{\text{Real} \\ \text{income}}}$$

4 Money, Interest Rates, and Prices in the Long Run: A General Model

The Demand for Money: The General Model

FIGURE 3-11



The Standard Model of Real Money Demand Panel (a) shows the real money demand function for the United States. The downward slope implies that the quantity of real money demand rises as the nominal interest rate $i_\$$ falls.

Panel (b) shows that an increase in real income from Y^1_{US} to Y^2_{US} causes real money demand to rise at all levels of the nominal interest rate i$.

4 Money, Interest Rates, and Prices in the Long Run: A General Model

Long-Run Equilibrium in the Money Market

$$\underbrace{\frac{M}{P}}_{\text{Real money supply}} = \underbrace{L(i)Y}_{\text{Real money demand}} \quad \textbf{(3-7)}$$

Inflation and Interest Rates in the Long Run

- With two relationships in hand, PPP and UIP, we can derive a powerful and striking result concerning interest rates that has profound implications for our study of open economy macroeconomics. We use:

$$\underbrace{\frac{\Delta E^e_{\$/€}}{E_{\$/€}}}_{\text{Expected rate of dollar depreciation}} = \underbrace{\pi^e_{US} - \pi^e_{EUR}}_{\text{Expected inflation differential}} \quad \text{and} \quad \underbrace{\frac{\Delta E^e_{\$/€}}{E_{\$/€}}}_{\text{Expected rate of dollar depreciation}} = \underbrace{i_{\$}}_{\text{Net dollar interest rate}} - \underbrace{i_{€}}_{\text{Net euro interest rate}}$$

4 Money, Interest Rates, and Prices in the Long Run: A General Model

The Fisher Effect

- The nominal interest differential equals the expected inflation differential:

$$\underbrace{i_{\$} - i}_{\text{Nominal interest rate differential}} = \underbrace{\pi^e_{US} - \pi^e_{EUR}}_{\substack{\text{Nominal inflation rate differential} \\ \text{(expected)}}}$$

- *All else equal, a rise in the expected inflation rate in a country will lead to an equal rise in its nominal interest rate.*
- This result is known as the **Fisher effect**.
- The Fisher effect predicts that the change in the opportunity cost of money is equal not just to the change in the nominal interest rate but also to the change in the inflation rate.

4 Money, Interest Rates, and Prices in the Long Run: A General Model

Real Interest Parity

- Rearranging the last equation, we find

$$i_{\$} - \pi^{e}_{US} = i_{€} - \pi^{e}_{EUR} \qquad \textbf{(3-8)}$$

- When the inflation rate (*π*) is subtracted from a *nominal* interest rate (*i*), the result is a **real interest rate** (*r*), the inflation-adjusted return on an interest-bearing asset.

$$r^{e}_{US} = r^{e}_{EUR}$$

- This remarkable result states the following: *If PPP and UIP hold, then expected real interest rates are equalized across countries.* This powerful condition is called **real interest parity**.
- Real interest parity implies the following: *Arbitrage in goods and financial markets alone is sufficient, in the long run, to cause the equalization of real interest rates across countries*.

4 Money, Interest Rates, and Prices in the Long Run: A General Model

Real Interest Parity

- In the long run, all countries will share a common expected real interest rate, the long-run expected **world real interest rate** denoted *r**, so

$$r^e_{US} = r^e_{EUR} = r^* \qquad \textbf{(3-9)}$$

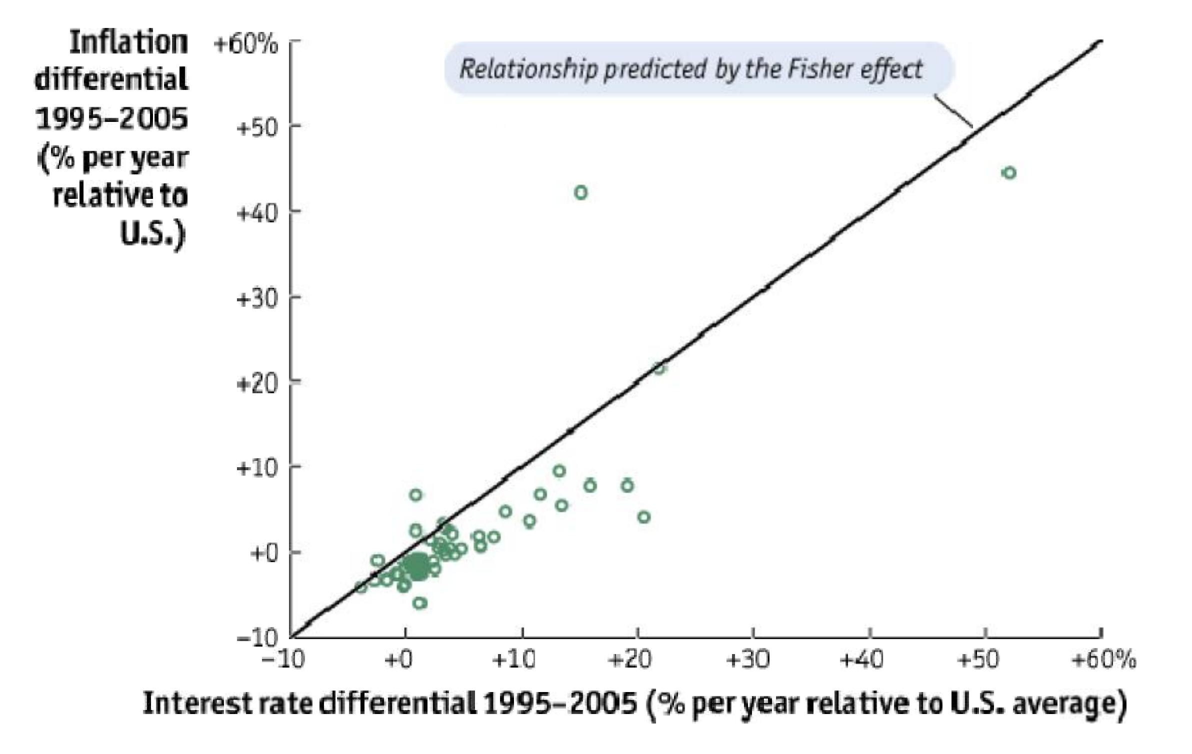
- We treat *r** as a given, exogenous variable, something outside the control of a policy maker in any particular country.
- Under these conditions, the Fisher effect is even clearer, because, by definition,

$$i_{\$} = r^e_{US} + ®^e_{US} = r^* + ®^e_{US}, \qquad i_{€} = r^e_{EUR} + ®^e_{EUR} = r^* + ®^e_{EUR}.$$

APPLICATION

Evidence on the Fisher Effect

FIGURE 3-12



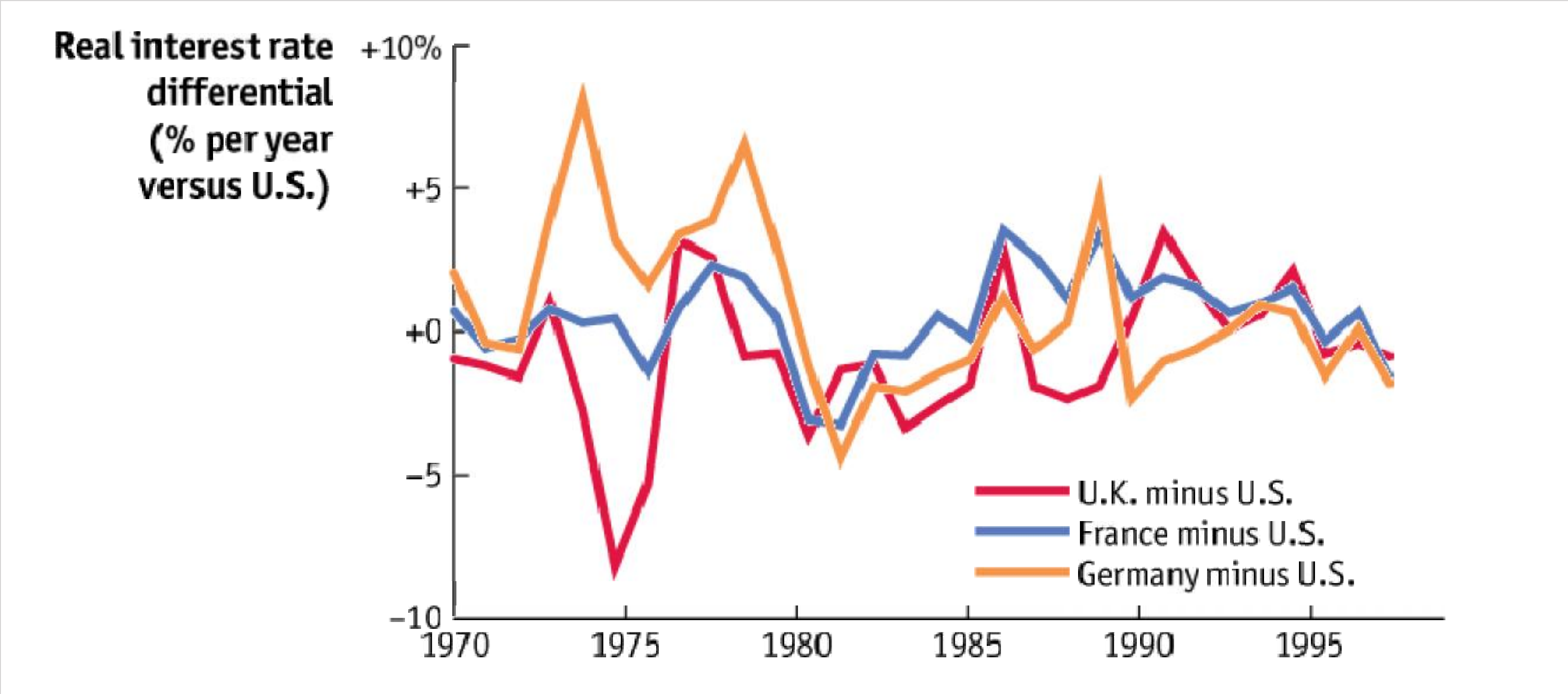
Inflation Rates and Nominal Interest Rates, 1995–2005

This scatterplot shows the relationship between the average annual nominal interest rate differential and the annual inflation differential relative to the United States over a ten-year period for a sample of 62 countries.

The correlation between the two variables is strong and bears a close resemblance to the theoretical prediction of the Fisher effect that all data points would appear on the 45-degree line.

Evidence on the Fisher Effect

FIGURE 3-13



Real Interest Rate Differentials, 1970–1999 **This figure shows actual real interest rate differentials over three decades for the United Kingdom, Germany, and France relative to the United States. These differentials were not zero, so real interest parity did not hold continuously. But the differentials were on average close to zero, meaning that real interest parity (like PPP) is a general long-run tendency in the data.**

4 Money, Interest Rates, and Prices in the Long Run: A General Model

The Fundamental Equation under the General Model

- This model differs from the simple model (the *quantity theory*) *only* by allowing *L* to vary as a function of the nominal interest rate *i*.

$$\underbrace{E_{\$/€}}_{\text{Exchange rate}} = \underbrace{\frac{P_{US}}{P_{EUR}}}_{\text{Ratio of price levels}} = \frac{\left(\dfrac{M_{US}}{L_{US}(i_\$)Y_{US}}\right)}{\left(\dfrac{M_{EUR}}{L_{EUR}(i_€)Y_{EUR}}\right)} = \underbrace{\frac{(M_{US}/M_{EUR})}{(L_{US}(i_\$)Y_{US}/L_{EUR}(i_€)Y_{EUR})}}_{\substack{\text{Relative nominal money supplies} \\ \text{divided by} \\ \text{Relative real money demands}}} \quad (3\text{-}10)$$

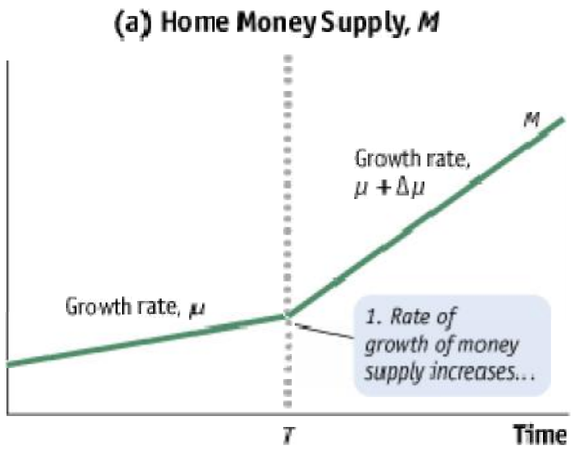
- It is only when nominal interest rates change that the general model has different implications, and we now have the right tools for that situation.

Exchange Rate Forecasts Using the General Model

- We now reexamine the forecasting problem for the case in which there is an increase in the U.S. rate of money growth. We learn at time *T* that the United States is raising the rate of money supply growth from some fixed rate μ to a slightly higher rate $\mu + \Delta\mu$.

Exchange Rate Forecasts Using the General Model

FIGURE 3-14 (1 of 4)



An Increase in the Growth Rate of the Money Supply in the Standard Model

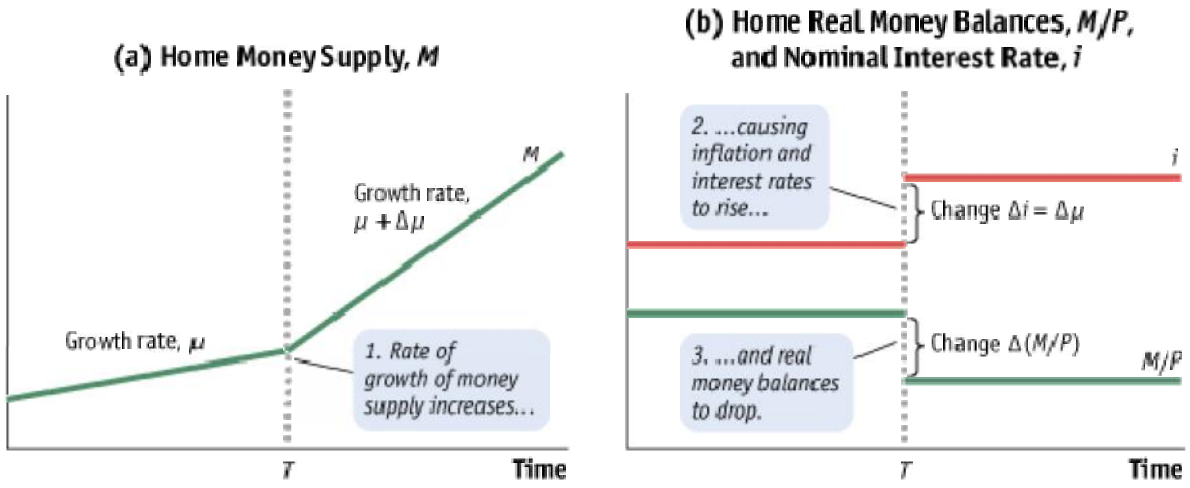
Before time *T*, money, prices, and the exchange rate all grow at rate μ. Foreign prices are constant.

In panel (a), we suppose at time *T* there is an increase $\Delta\mu$ in the rate of growth of home money supply *M*.

4 Money, Interest Rates, and Prices in the Long Run: A General Model

Exchange Rate Forecasts Using the General Model

FIGURE 3-14 (2 of 4)



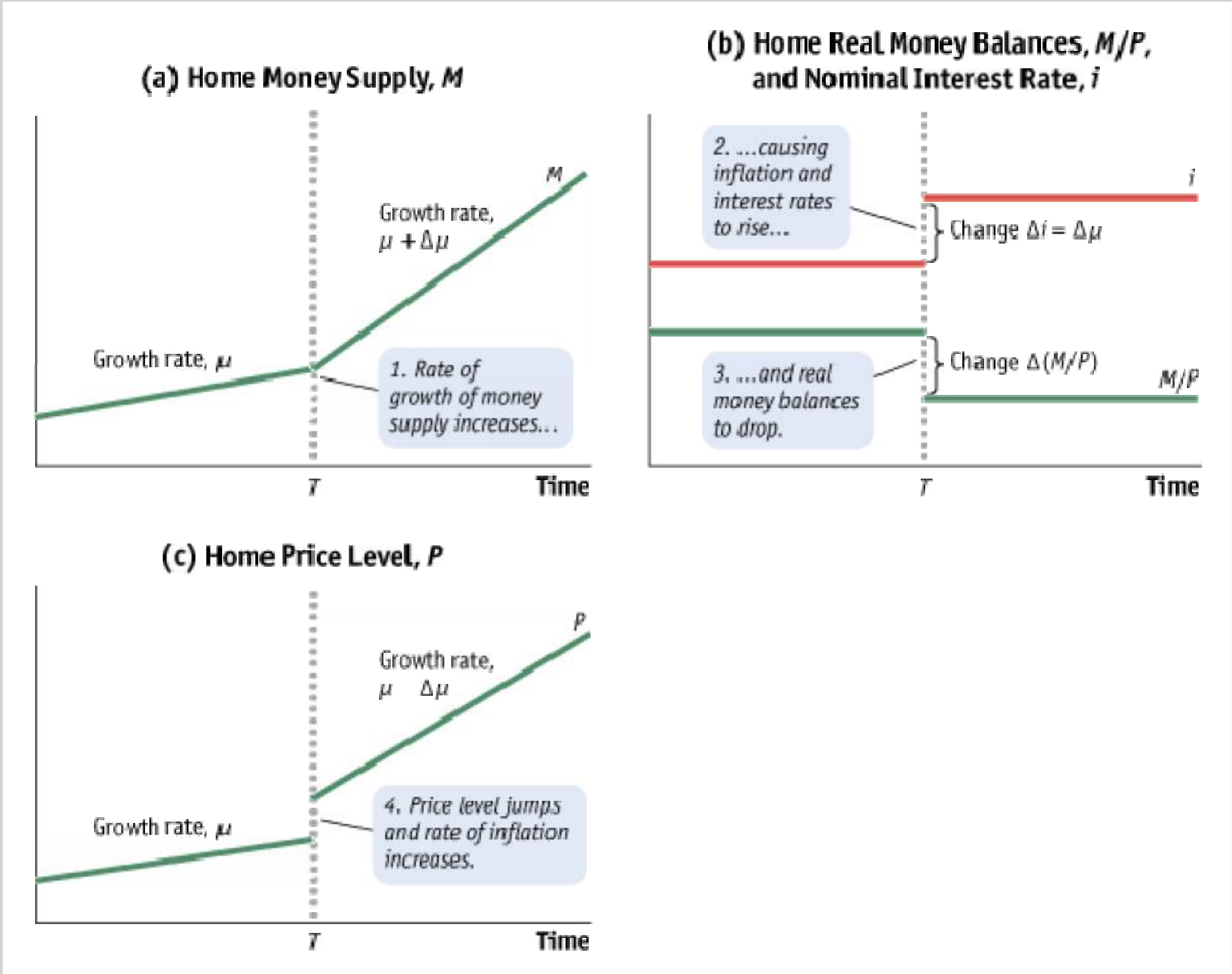
An Increase in the Growth Rate of the Money Supply in the Standard Model (continued)

This causes an increase $\Delta\mu$ in the rate of inflation; the Fisher effect means that there will be a $\Delta\mu$ increase in the nominal interest rate; as a result, as shown in panel (b), real money demand falls with a discrete jump at *T*.

4 Money, Interest Rates, and Prices in the Long Run: A General Model

Exchange Rate Forecasts Using the General Model

FIGURE 3-14 (3 of 4)



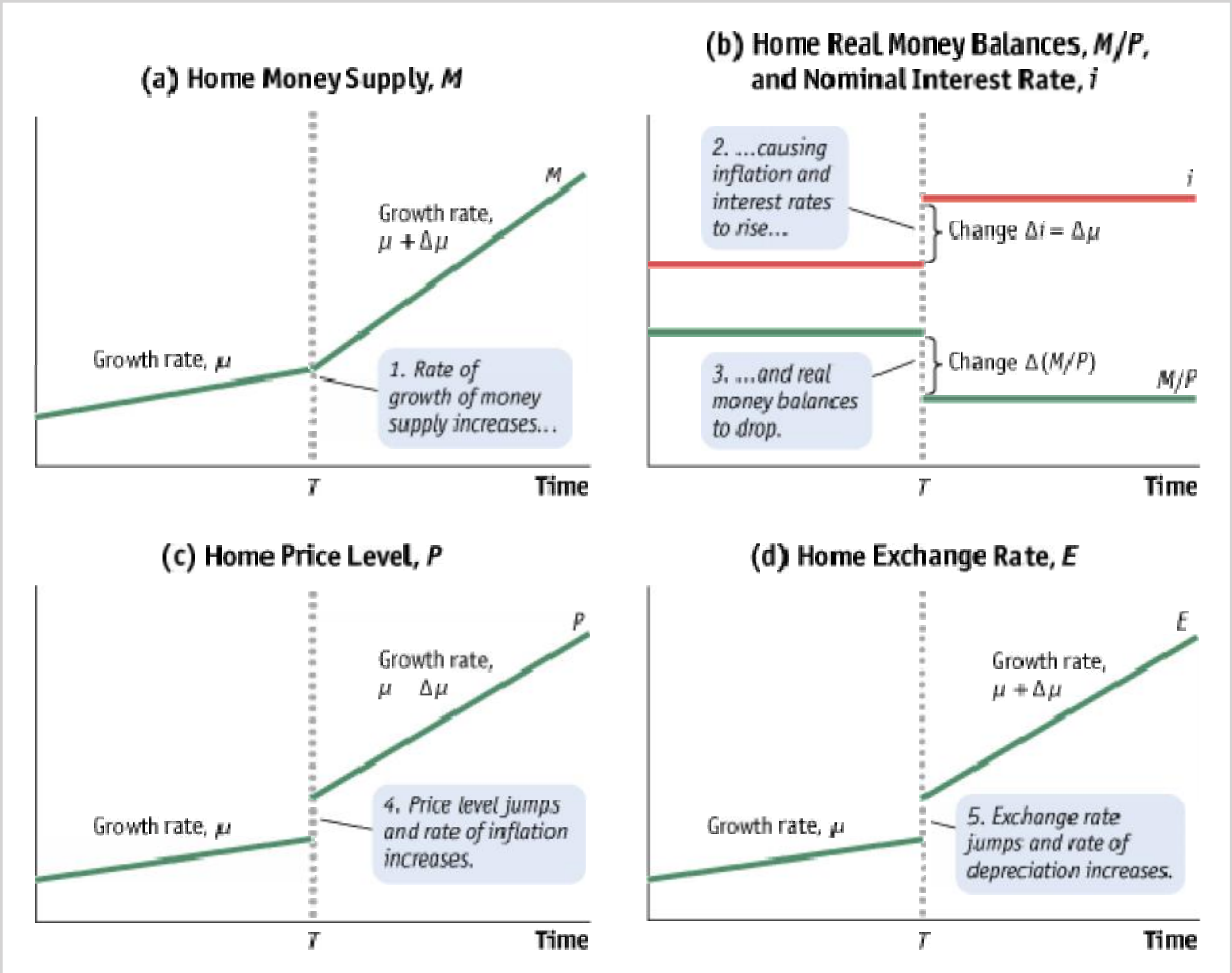
An Increase in the Growth Rate of the Money Supply in the Standard Model (continued)

If real money balances are to fall when the nominal money supply expands continuously, then the domestic price level must make a discrete jump up at time *T*, as shown in panel (c).

4 Money, Interest Rates, and Prices in the Long Run: A General Model

Exchange Rate Forecasts Using the General Model

FIGURE 3-14 (4 of 4)



An Increase in the Growth Rate of the Money Supply in the Standard Model (continued)

Subsequently, prices grow at the new higher rate of inflation; and given the stable foreign price level, PPP implies that the exchange rate follows a similar path to the domestic price level, as shown in panel (d).

4 Monetary Regimes and Exchange Rate Regimes

- An overarching aspect of a nation's economic policy is the desire to keep inflation within certain bounds. To achieve such an objective requires that policy makers be subject to some kind of constraint in the long run. Such constraints are called **nominal anchors**.
- Long-run nominal anchoring and short-run flexibility are the characteristics of the policy framework that economists call the **monetary regime**.

4 Monetary Regimes and Exchange Rate Regimes

The Long Run: The Nominal Anchor

We relabel the countries Home (H) and Foreign (F) instead of United States and Europe.

The three main nominal anchor choices that emerge are exchange rate target, money supply target, and Inflation target plus interest rate policy.

- **Exchange rate target:**

$$\underbrace{\pi_H}_{\text{Inflation}} = \underbrace{\frac{\Delta E_{H/F}}{E_{H/F}}}_{\substack{\text{Rate of} \\ \text{depreciation}}} + \underbrace{\pi_F}_{\substack{\text{Foreign} \\ \text{inflation}}}.$$

Anchor variable (the rate of depreciation)

•Relative PPP says that home inflation equals the rate of depreciation plus foreign inflation. A simple rule would be to set the rate of depreciation equal to a constant.

The Long Run: The Nominal Anchor

- **Money supply target:**

$$\underbrace{\pi_H}_{\text{Inflation}} = \underbrace{\mu_H}_{\text{Money supply growth}} - \underbrace{g_H}_{\text{Real output growth}}.$$

Anchor variable (Money supply growth)

•A simple rule of this sort is: set the growth rate of the money supply equal to a constant, say, 2% a year.

•Again the drawback is the final term in the previous equation: real income growth can be unstable. In periods of high growth, inflation will be below the desired level. In periods of low growth, inflation will be above the desired level.

4 Monetary Regimes and Exchange Rate Regimes

The Long Run: The Nominal Anchor

- **Inflation target plus interest rate policy:**

$$i = r^{*} + \text{®}$$

•The Fisher effect says that home inflation is the home nominal interest rate minus the foreign real interest rate. If the latter can be assumed to be constant, then as long as the average home nominal interest rate is kept stable, inflation can also be kept stable. This type of nominal anchoring framework is an increasingly common policy choice. Assuming a stable world real interest rate is not a bad assumption.

4 Monetary Regimes and Exchange Rate Regimes

TABLE 3-2

Exchange Rate Regimes and Nominal Anchors This table illustrates the possible exchange rate regimes that are consistent with various types of nominal anchors. Countries that are dollarized or in a currency union have a "superfixed" exchange rate target. Pegs, bands, and crawls also target the exchange rate. Managed floats have no preset path for the exchange rate, which allows other targets to be employed. Countries that float freely or independently are judged to pay no serious attention to exchange rate targets; if they have anchors, they will involve monetary targets or inflation targets with an interest rate policy. The countries with "freely falling" exchange rates have no serious target and have high rates of inflation and depreciation. It should be noted that many countries engage in implicit targeting (e.g., inflation targeting) without announcing an explicit target and that some countries may use a mix of more than one target.

	COMPATIBLE EXCHANGE RATE REGIMES				
Type of Nominal Anchor	Countries without a Currency of Their Own	Pegs/ Bands/Crawls	Managed Floating	Freely Floating	Freely Falling (rapid depreciation)
Exchange rate target	✔	✔	✔		
Money supply target			✔	✔	
Inflation target (plus interest rate policy)			✔	✔	
None				✔	✔

Chapter 3: Exchange Rates I: The Monetary Approach in the Long Run

APPLICATION

Nominal Anchors in Theory and Practice

An appreciation of the importance of nominal anchors has transformed monetary policy making and inflation performance throughout the global economy in recent decades.

In the 1970s, most of the world was struggling with high inflation. In the 1980s, inflationary pressure continued. In the 1990s, policies designed to create effective nominal anchors were put in place in many countries.

Most, but not all, of those policies have turned out to be credible, too, thanks to political developments in many countries that have fostered *central-bank independence*.

Nominal Anchors in Theory and Practice

TABLE 3-3

Global Disinflation Cross-country data from 1980 to 2004 show the gradual reduction in the annual rate of inflation around the world. This disinflation process began in the advanced economies in the early 1980s. The emerging markets and developing countries suffered from even higher rates of inflation, although these finally began to fall in the 1990s.

	ANNUAL INFLATION RATE (%)				
	1980–1984	1985–1989	1990–1994	1995–1999	2000–2004
World	14.1%	15.5	30.4	8.4	3.9
Advanced economies	8.7	3.9	3.8	2.0	1.8
Emerging markets and developing countries	31.4	48.0	53.2	13.1	5.6

KEY POINTS

1. Purchasing power parity (PPP) implies that the exchange rate should equal the relative price level in the two countries, and the real exchange rate should equal 1.

KEY POINTS

2. Evidence for PPP is weak in the short run but more favorable in the long run. In the short run, deviations are common and changes in the real exchange rate do occur. The failure of PPP in the short run is primarily the result of market frictions, imperfections that limit arbitrage, and price stickiness.

KEY POINTS

3. A simple monetary model (the quantity theory) explains price levels in terms of money supply levels and real income levels. Because PPP can explain exchange rates in terms of price levels, the two together can be used to develop a monetary approach to the exchange rate.

KEY POINTS

4. If we can forecast money supply and income, we can use the monetary approach to forecast the level of the exchange rate at any time in the future. However, the monetary approach is valid only under the assumption that prices are flexible. This assumption is more likely to hold in the long run, so the monetary approach is not useful in the short run forecast. Evidence for PPP and the monetary approach is more favorable in the long run.

KEY POINTS

5. PPP theory, combined with uncovered interest parity, leads to the strong implications of the Fisher effect (interest differentials between countries should equal inflation differentials). The Fisher effect says that changes in local inflation rates pass through one for one into changes in local nominal interest rates. The result implies real interest parity (expected real interest rates should be equalized across countries). Because these results rest on PPP, they should be viewed only as long-run results, and the evidence is somewhat favorable.

KEY POINTS

6. We can augment the simple monetary model (quantity theory) to allow for the demand for real money balances to decrease as the nominal interest rate rises. This leads to the general monetary model. Its predictions are similar to those of the simple model, except that a one-time rise in money growth rates leads to a one-time rise in inflation, which leads to a one-time drop in real money demand, which in turn causes a one-time jump in the price level and the exchange rate.

KEY POINTS

7. The monetary approach to exchange rate determination in the long run has implications for economic policy. Policy makers and the public generally prefer a low-inflation environment. Various policies based on exchange rates, money growth, or interest rates have been proposed as nominal anchors. Recent decades have seen a worldwide decline in inflation thanks to the explicit recognition of the need for nominal anchors.

KEY TERMS

monetary approach to exchange rates

law of one price (LOOP)

purchasing power parity (PPP)

absolute PPP

real exchange rate

real depreciation

real appreciation

overvalued

undervalued

inflation

relative PPP

money

central bank

money supply

money demand

quantity theory of money

fundamental equation of the monetary model of the price level,

fundamental equation of the monetary approach to exchange rates

hyperinflation

real money demand function

Fisher effect

real interest rate

real interest parity

world real interest rate

nominal anchors

monetary regime

exchange rate target

money supply target

inflation target plus interest rate policy

central-bank independence