Topic 2: Basics of exchange rates and FX markets

A (bilateral) exchange rate is the price of one currency in terms of another.

Example: on August 28 we had $1 = 0.855 €. This means the *price* of one US dollar was 0.855 €. Equivalently the price of one € was 1/0.855 = $1.170. (Question: On January 18 we had 1€ = $1.252. Which currency appreciated and which depreciated in that period?)

We ordinarily think of the *spot* exchange rate, or the price of one currency in terms of another if you exchanged them on the contemporaneous market (meaning no consideration of time is involved). Examples:

- A US tourist makes an ATM withdrawal of €500 or £1000.
- Or pays C$170 for a hotel room with a credit card.
- A US bank lends Yen 5 million to a California company to import Japanese machine tools.
- A US pension fund exchanges $1 million for CHF 975,000 in Swiss bonds.
- A British bank lends £50 million to a bank in South Korea in the overnight market.
- All of these would likely occur at slightly different rates but we refer to “the” spot rate.

Basics of exchange rates and FX markets

Convention in the text: the exchange rate is the price of a unit of foreign currency in terms of domestic currency.

$E_{1/2}$ = number of units of country 1 currency per unit of country 2 currency. (1 is home and 2 is foreign.)

$E_{\$/¥}$ is the dollar price of a Japanese yen. But then $E_{¥/\$} = 1/ E_{\$/¥}$ is the yen price of a dollar.

Let's suppose $E_{\$/¥} = 0.009$. It takes 0.9 cents to buy 1¥ (or \$0.9 to buy 100¥). This is sometimes called the *American terms*, or the price of a yen that an American pays.

But then $E_{¥/\$} = 1/0.009 = 111.1$ is the yen price of a dollar, the *Japanese terms*.

These are bilateral rates but there are many currencies, generating cross-currency rates.

Table of cross-currency FX rates (8/28/2018; 5:30 pm EST, from ratesFX.com)

	AUD	CAD	CHF	CNY	EUR	GBP	JPY	SGD	USD
AUD		0.954957	0.720001	4.999663	0.629548	0.569448	81.392110	1.000484	0.732998
CAD	1.047167		0.753962	5.235483	0.659242	0.596307	85.231154	1.047674	0.767572
CHF	1.388886	1.326327		6.943963	0.874370	0.790898	113.044390	1.389558	1.018051
CNY	0.200013	0.191004	0.144010		0.125918	0.113897	16.279520	0.200110	0.146610
EUR	1.588442	1.516894	1.143680	7.941672		0.904535	129.286607	1.589210	1.164325
GBP	1.756087	1.676988	1.264385	8.779842	1.105541		142.931617	1.756936	1.287208
JPY	0.012286	0.011733	0.008846	0.061427	0.007735	0.006996		0.012292	0.009006
SGD	0.999516	0.954496	0.719653	4.997245	0.629243	0.569173	81.352753		0.732644
USD	1.364260	1.302810	0.982269	6.820840	0.858867	0.776875	111.040000	1.364920	

Read these as the price of the row currency in terms of each column currency. Are these consistent? Consider 1$ = 0.776875 GBP. But 1/0.776875 = 1.287208 so yes. https://www.ratesfx.com/rates/crossrates.html

Exchange-rate changes

Since these are prices they go up and down.

If the price of a currency is rising, we call it an appreciating currency.

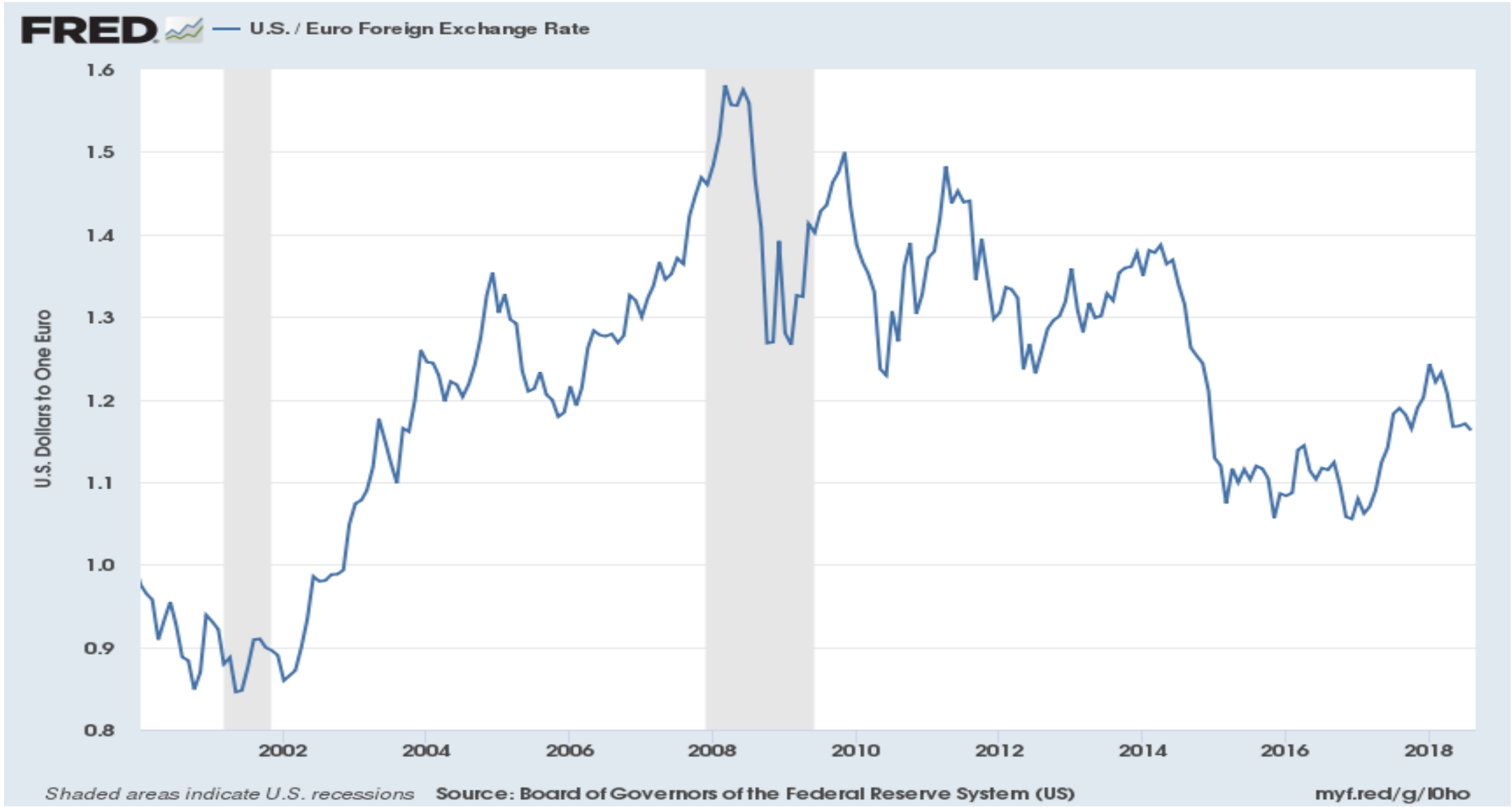
If the price of a currency is falling we call it a depreciating currency.

Don't get confused by this. If the yen is appreciating ($E_{\$/¥}$ ↑) it means there are more dollars per yen. So the dollar depreciates at the same time.

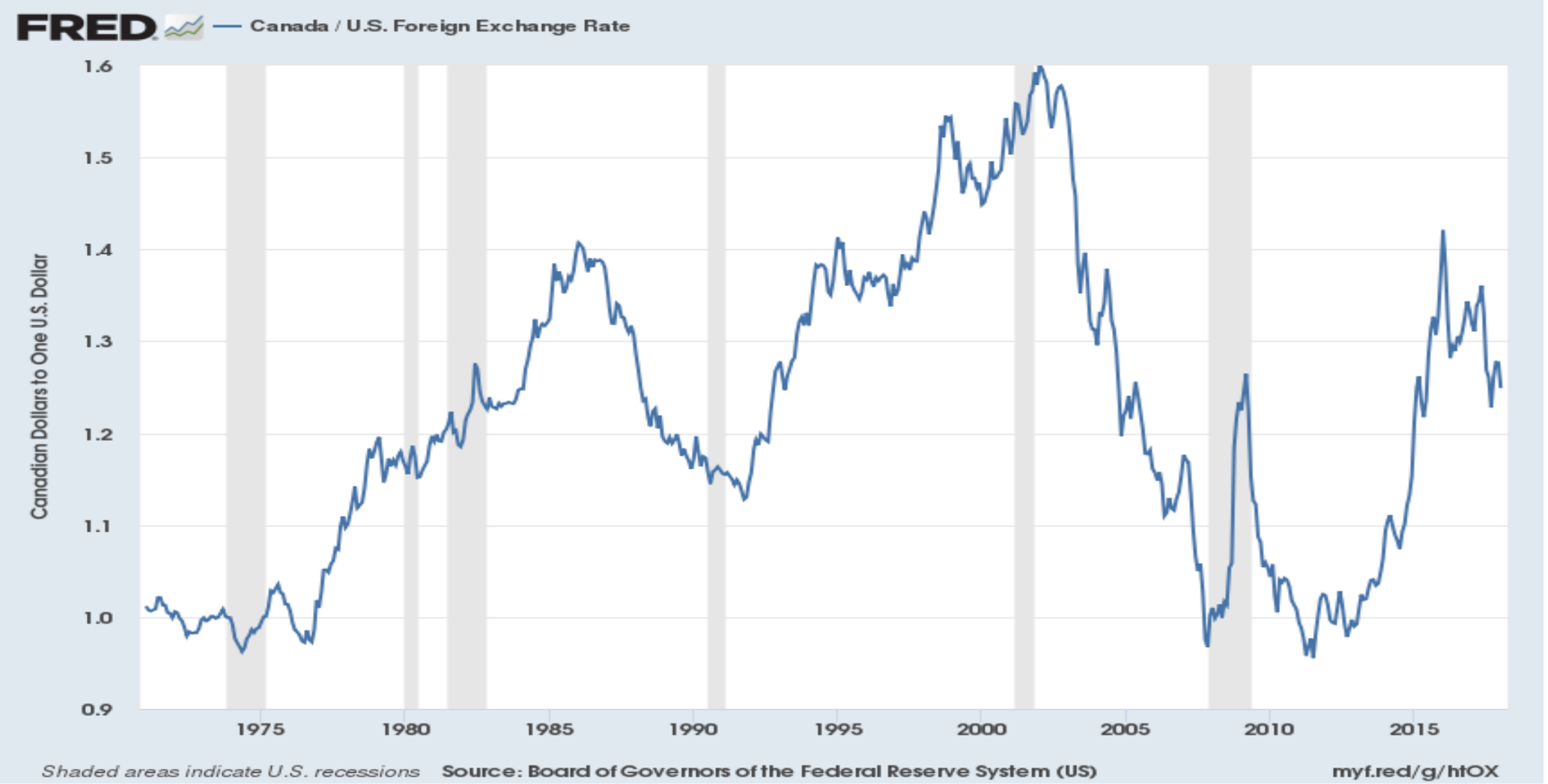
Exchange rates can vary considerably over time. In the chart below is the price of the euro in dollars (an increase means the euro is appreciating and dollar is depreciating). Do you suppose the large depreciation of the dollar prior to the crisis in 2008 had anything to do with the crisis?

Note in 2016 $E_{\$/€} = 1.1$; in early 2018 $E_{\$/€} = 1.25$. So the euro appreciated by (1.25-1.1)/1.1 = .136 (13.6%) in that period. It took 13.6% more dollars to buy a euro, so the $ depreciated.

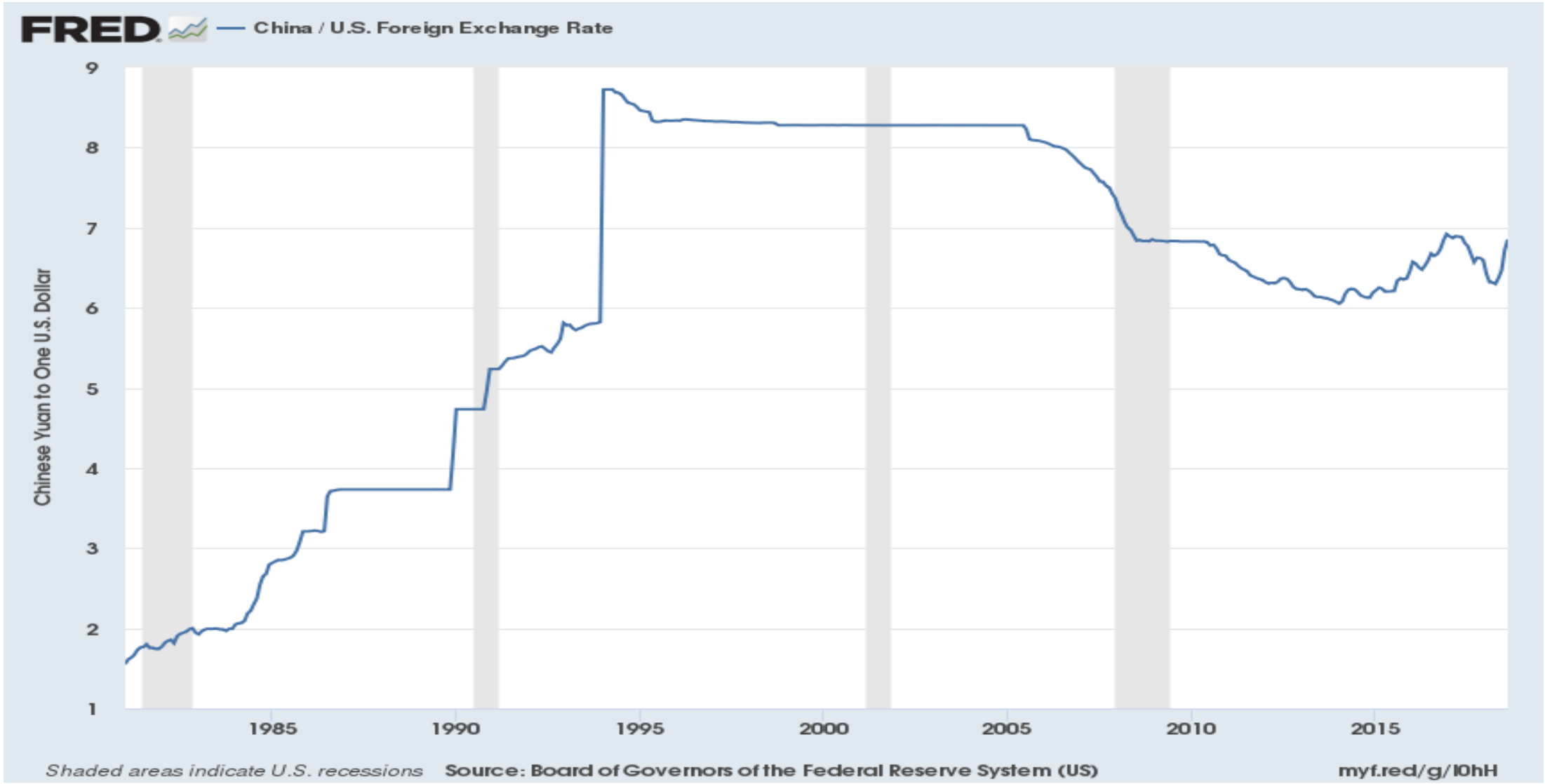
(In fact, the dollar depreciated in euro terms by (0.80-.91)/.91 = -.121 (-12.1%).)


FRED
U.S. / Euro Foreign Exchange Rate
U.S. Dollars to One Euro
1.6
1.5
1.4
1.3
1.2
1.1
1.0
0.9
0.8
2002
2004
2006
2008
2010
2012
2014
2016
2018
Shaded areas indicate U.S. recessions
Source: Board of Governors of the Federal Reserve System (US)
myf.red/g/l0ho

These rates can vary for currencies we generally think are pretty stable.
Here is the price of the US$ in terms of Canadian dollars over 45 years.



And they can be fixed or managed, as opposed to flexible. Here is the Chinese Yuan (or RMB) per dollar rate, which was fixed at about 8.2 for 10 years in the 1990s and early 2000s.



Multilateral exchange rates

A change in one bilateral rate may be interesting but it is misleading in terms of the overall direction of a country's exchange rates.

So we often compute *effective exchange rates,* which are weighted averages of bilateral rates (or changes in bilateral rates). These can be nominal (NEER) or expressed as real (inflation-adjusted) effective exchange rates (REER).

Since we are talking about one country's (home) NEER, we need to standardize by using the units of home currency for each partner currency. Let $E_1 = E_{H/1}$, $E_2 = E_{H/2}$, … $E_N = E_{H/N}$ for N countries.

CRITICAL CONVENTION: because a percentage rise (fall) in E_j means a depreciation (appreciation) of the home currency it enters home's NEER as a positive (negative) percentage change.

What would be appropriate figures to use as weights? Typically use trade weights across the N countries. Could be total trade (X+M) or X or M. Also might be goods or goods and services. And we could consider financial trade as the weights.

Multilateral exchange rates

- The **nominal effective exchange rate (NEER)** is the sum of the trade shares multiplied by the exchange rate for each country. For the US as home:
  - The dollar weight of each currency in the basket (in a base year) is given by the share of that country in U.S. trade.
  - Changes in the dollar price of this basket tell us how the value of the dollar has changed "on average" against the entire basket of currencies. Because these are dollar prices of foreign currencies an increase (decrease) is an effective dollar depreciation (appreciation).

$$\frac{\Delta E_{\text{effective}}}{E_{\text{effective}}} = \underbrace{\frac{\text{Trade}_1}{\text{Trade}}\frac{\Delta E_1}{E_1} + \frac{\text{Trade}_2}{\text{Trade}}\frac{\Delta E_2}{E_2} + \ldots + \frac{\text{Trade}_N}{\text{Trade}}\frac{\Delta E_N}{E_N}}_{\text{trade-weighted average of bilateral nominal exchange rate changes}}$$

Clicker question

Suppose we want to calculate the nominal effective exchange rate (NEER) for Australia and we have the following information. Australia trades with 4 countries (New Zealand, China, Japan and the US). Currencies for these countries are A$, NZ$, CN¥, ¥, and $. The NEER uses Australia's total trade by country, as a share of total Australian trade, as weights.

(X+M) NZ = 100; (X+M) China = 250; (X+M) Japan = 50; (X+M) US = 500.

Australia's NEER is then:

A. (100+250+50+500)*($E_{A\$/NZ\$} + E_{A\$/CN¥} + E_{A\$/¥} + E_{A\$/\$}$)

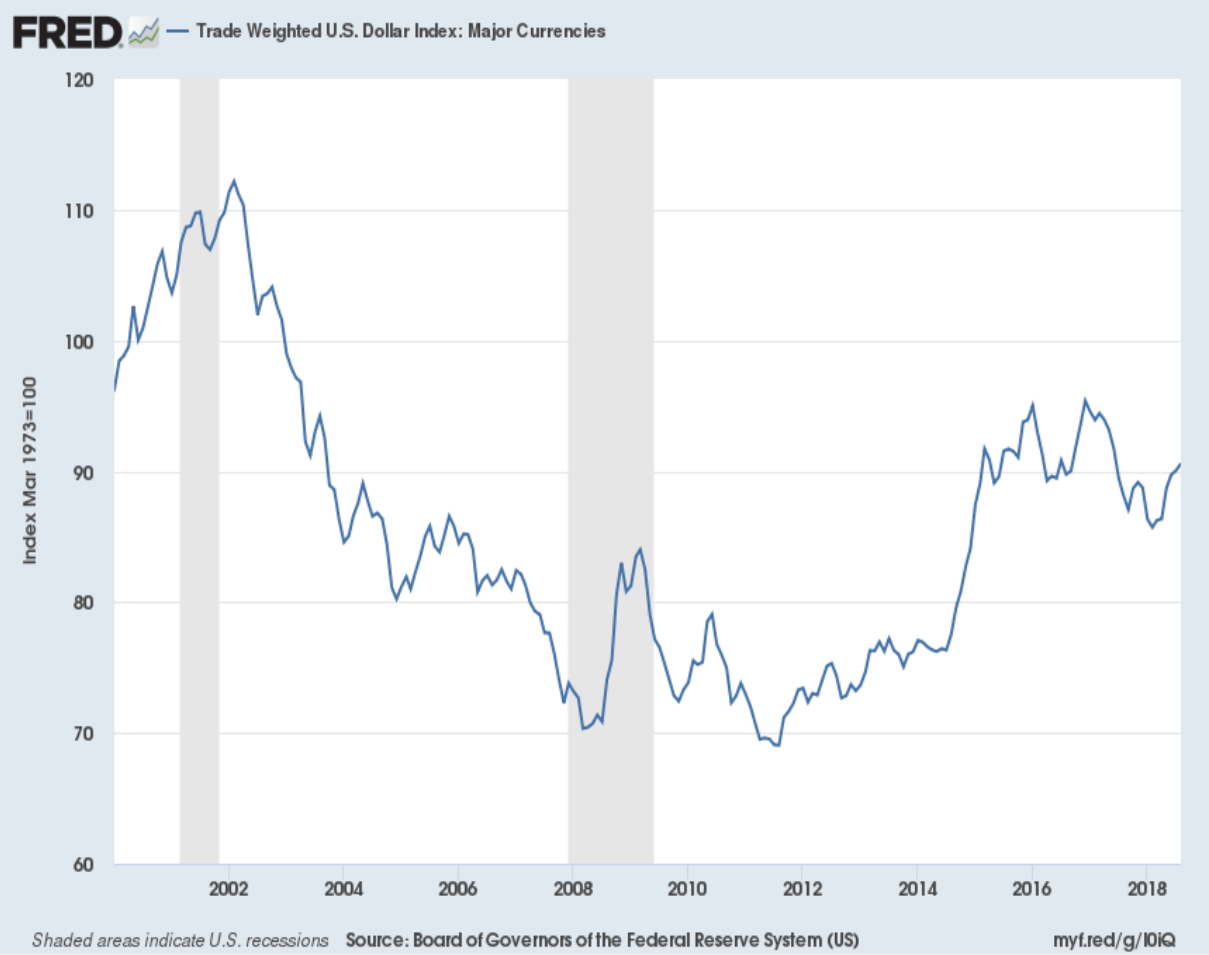
B. (100*$E_{A\$/NZ\$} + 250 * E_{A\$/CN¥} + 50 * E_{A\$/¥} + 500 * E_{A\$/\$}$)

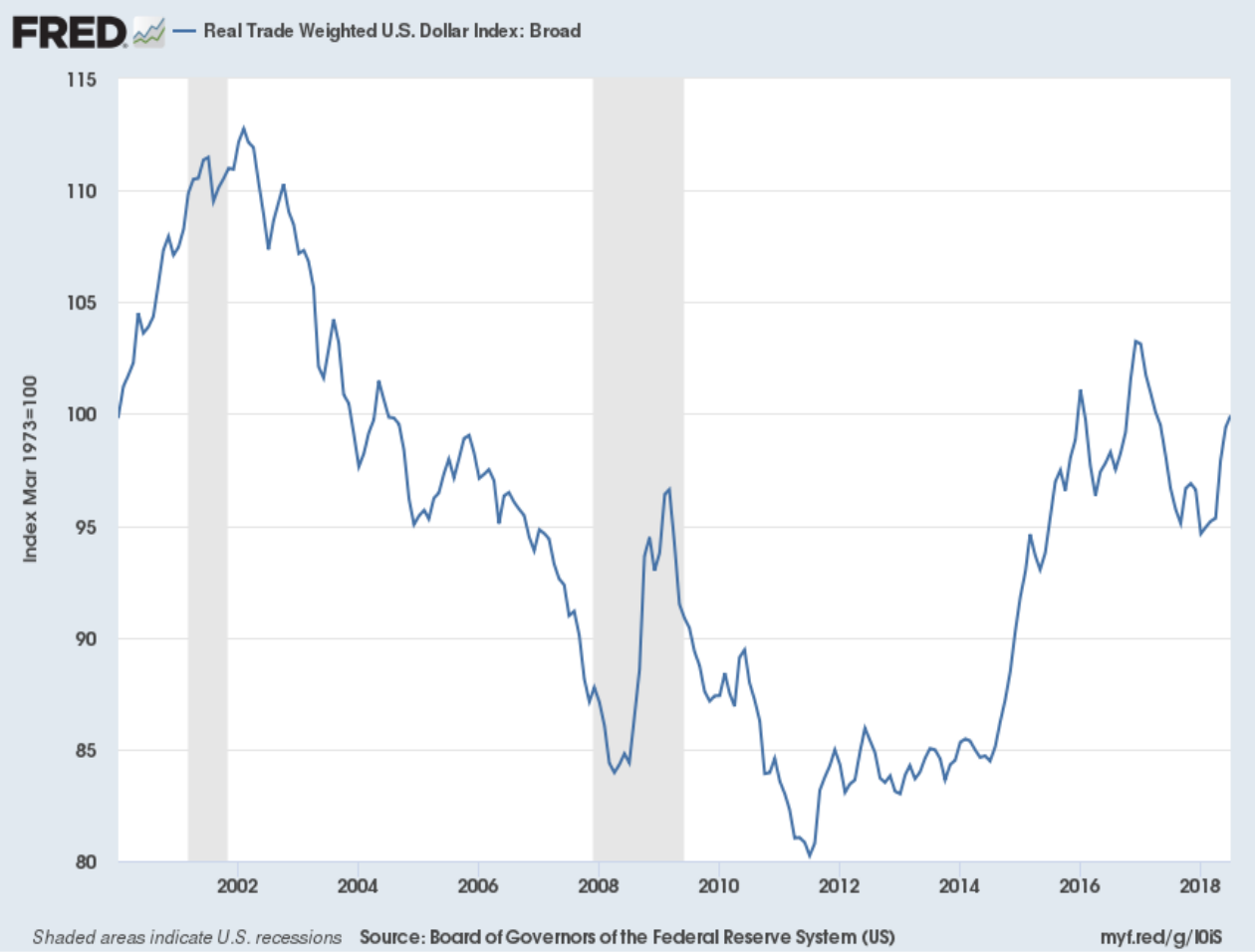
C. [($\frac{100}{900}$) * $E_{A\$/NZ\$}$ +($\frac{250}{900}$) * $E_{A\$/CN¥}$+ $\left(\frac{50}{900}\right)$ * $E_{A\$/¥}$ + $\left(\frac{500}{900}\right)$ * $E_{A\$/\$}$)]

D. [($\frac{100}{900}$) * $E_{NZ\$/A\$}$ +($\frac{250}{900}$) * $E_{CN¥/A\$¥}$+ $\left(\frac{50}{900}\right)$ * $E_{¥/A\$}$ + $\left(\frac{500}{900}\right)$ * $E_{\$/A\$}$)]

E. Cannot be computed from this information.

Often (as in the textbook) we depict the *reciprocal* of NEER as the effective price of the dollar (26 countries), as in this chart. A decline means a falling dollar. 2d graph is the REER; note they move together closely.





Prices in a common currency

- Exchange rates translate foreign currency prices into a common currency, and facilitate price comparisons.
  - Suppose you wish to compare the prices of a good sold in two locations.
    - It sells in Beijing for P_{CN} expressed in CN¥.
    - It sells in the US for P_{US} expressed in $.
    - The currency units differ.
  - The only meaningful way to compare the prices in different countries is to convert prices into a common currency.
  - The Beijing price in dollar terms is $E_{\$/CN¥} * P_{CN.}$
    - Here: $/CN¥ times price in CN¥ = price in $.

Example

Let $E_{\$/CN¥} = 0.15$ and $E_{€/CN¥} = 0.13$ and $E_{\$/€} = 1.15$ (implicitly $E_{\$/€} = 0.15/0.13 = 1.15$)

Price of a shirt in Beijing = CN¥135; in Denver = $25; in Berlin = € 20.

What are the dollar prices? Denver = $25; Berlin = 1.15*20 = $23; Beijing = 0.15*135 = $20.25.

Euro prices? Denver = (1/1.15)*25 = €21.74; Berlin = €20, Beijing = 0.13*135 = €17.55.

Looks like everyone would buy shirts in Beijing. Should cause some convergence in the shirt prices. (What might prevent it?)

But the main point is that exchange rate changes affect common-currency prices. If the yuan appreciates we might get $E_{\$/CN¥} = 0.185$ and $E_{€/CN¥} = 0.16$ and $E_{\$/€} = 1.15$ is the same.

Then the dollar prices become Denver = $25; Berlin = 1.15*20 = $23; Beijing = 0.185*135 = $24.98.

Euro prices? Denver = €21.74; Berlin = €20; Beijing = 0.16*135 = €21.60.

Example

Price of a shirt rose in Beijing in both $ and euro terms.

But that means price of a US shirt and a German shirt are lower in Chinese yuan. (Show that.)

You can play with these kinds of figures and see the tuxedo/James Bond example in the text. We'll use these kinds of relationships as the course proceeds.

The general point:

Changes in the exchange rate affect the relative prices of goods across countries:

- *Appreciation in the home currency leads to an increase in the relative price of its exports to foreigners and a decrease in the relative price of imports from abroad.*
- *A depreciation in the home currency leads to a decrease in the relative price of its exports to foreigners and an increase in the relative price of imports from abroad.*

Basics of exchange-rate systems

Countries have several choices in selecting how they will manage (or not) the international value of their currencies.

We will study this in detail later; here are some basics.

1. *Fixed* exchange rate or an ER *peg*. This means fixing ("pegging") the value of your currency in terms of some benchmark, most often the dollar or the euro (or a composite basket). They sometimes are reset to new pegs ("revalued" upward or "devalued" downward).

- How are rates fixed? The central bank commits to buying and selling the home currency for the benchmark currency at the posted rate. This has implications for the size of the domestic money supply.
- Are the rates literally fixed? No, typically they would operate within some *narrow band* or *wide band*, depending on the policy. This limits the amount of intervention needed.
- Historical examples:
  - Classical gold standard in 19th and first part of 20th centuries.
  - The Bretton Woods gold-exchange then dollar standard of the mid-20th century.

Basics of exchange-rate systems

2. A set of countries chooses a single currency in a *currency union* or *monetary union*. This essentially means centralizing the regional monetary policy and having a common payments or even banking system.

- Eurozone: 19 of 28 EU countries; currency is the euro; floats against other currencies.
- CFA franc zone: 14 countries in Western and Central Africa; former French (12), Portuguese (1) and Spanish (1) colonies. Currency is the CFA Franc, which has a fixed exchange rate with the euro: €1 = 656 CFA Francs.
- CFP franc zone: 3 French territories in the Pacific. Currency is the CFP Franc, which has a fixed exchange rate with the euro: CFPF 10,000 = €83.80. (€1 = 119 CFPF).
- Eastern Caribbean Currency Union: 6 countries in the Caribbean. Currency is the East Caribbean dollar, fixed to the US dollar: $1 = EC$2.70.

3. Countries adopt another country's currency and completely give up monetary sovereignty. Most frequent is "dollarization": In East Timor, Ecuador, El Salvador, Marshall Islands, Micronesia, Palau, Panama, and Zimbabwe the US$ is in circulation as legal tender. Example: Ecuador in 2000 exchanged $1 for 25,000 Sucres then phased out the Sucre. The central bank now only issues Ecuadorian centavo coins.

Basics of exchange-rate systems

4. A *currency board* is a rigorous peg to another currency; the only role of the CB is to make sure the ER does not change. The HK$ has a fixed rate to the US$ in a currency board. ECCU is in effect a currency board.

4. *Managed pegs* are systems where the ER is permitted to move up or down according to an announced set of targets. The central bank manages this intended movement through currency operations. Sometimes called a “crawling peg” within an announced band.

5. *Managed floating* exchange rates are largely flexible but CB often intervenes to affect fluctuations.

6. *Flexible* exchange rates are permitted to float freely and the CB chooses not to intervene except in unusual circumstances.

Most developed country currencies are in group 5 or 6. Note this means the country sustains its own monetary policy and may target inflation, nominal GNP, etc.

Basics of exchange-rate systems

The IMF publishes the *Annual Report on Exchange Arrangements and Exchange Restrictions.* Data for 2016:

- No separate currency (14); All are small and most are quite poor.
- Currency board (11); Also small and poor except Hong Kong.
- Conventional peg (44); mostly small and poor with trade concentrated with one major country (also includes Middle Eastern and other major oil exporters).
- Stabilized peg (wide bands) (18); mix of poor and middle-income economies.
- Crawling pegs (13); middle-income countries with concentrated trade.
- Other managed arrangements (21); mix of poor and middle-income, including China.
- Managed floating with occasional CB intervention (40); mostly upper middle-income and a few developed countries.
- Flexible (31, including 19 in Eurozone); advanced OECD countries plus Mexico and Chile.