

Econ 340

Lecture 13 Exchange Rates

Outline: Exchange Rates

- In What Forms Are Exchange Rates Reported?
 - Bilateral Nominal Rates
 - Multilateral (Trade-Weighted) Rates
 - Real Rates
 - Forward Rates
- What Determines Exchange Rates?
 - Markets
 - Governments/Central Banks
- Theories of Exchange Rates
 - Purchasing Power Parity
 - Asset Theory
 - Supply and Demand Model

Forms of Exchange Rates

- What Is an Exchange Rate?

- The price of one currency in terms of another
- Examples
 - Recent rates for the US \$ vs the € (euro) and ¥ (yen) were

	Oct 22, 2019	Oct 23, 2018
\$/ €	1. 1150	1.1471
€/ \$	0.8969	0. 8718
\$/ ¥	0.00921	0.00889
¥/ \$	108.60	112.44

Forms of Exchange Rates

- What Is an Exchange Rate?
 - Rates are reported both ways, which can be confusing:
 - i.e., “The Japanese yen rose today from 95 to 90”
 - Makes sense because the numbers are understood to be ¥/\$, not \$/¥, so the change from 95 to 90 is in fact a rise in the value of the yen

Forms of Exchange Rates

- Sources of Exchange Rates
 - Wall Street Journal
 - Each day includes a table with rates for yesterday and the day before for a few dozen currencies
 - Also used to report forward rates and trade-weighted indexes for major currencies (see later)
 - IMF, online and in various publications
 - x-rates.com flexible tool for rates in various forms

Forms of Exchange Rates

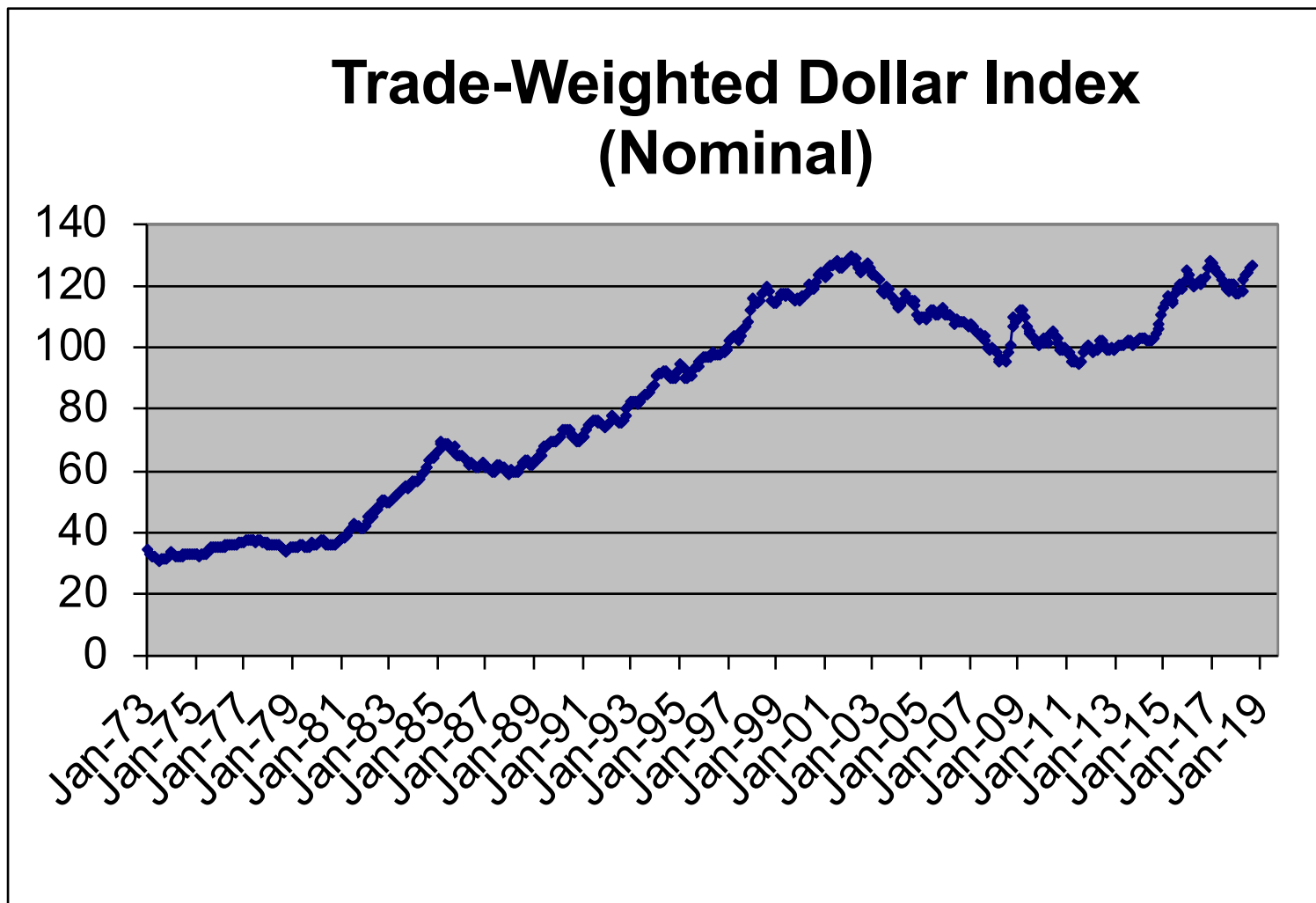
- Bilateral Nominal Exchange Rates
 - These are what we normally see: the actual rate between a pair of currencies
 - Don't need to say “bilateral” or “nominal” except when comparing to something other than these.
 - Note that the size of an exchange rate means very little
 - Whether euro is worth more, or less, than a dollar is not important
 - That the yen is worth about one US cent means nothing
 - But see reading on “Currency Envy”. People do care!

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Forms of Exchange Rates

- Multilateral Exchange Rates
 - Bilateral rates only tell value of a currency relative to a single other currency
 - If you want the overall value of a currency, you need an index relative to many others
 - An index requires weighting by the importance of the other currencies
 - Typically, multilateral exchange rates are “trade weighted” (weighted by bilateral exports and/or imports between the countries)



Source: Federal Reserve, “Broad Index” based on a large group of currencies, monthly data

Forms of Exchange Rates

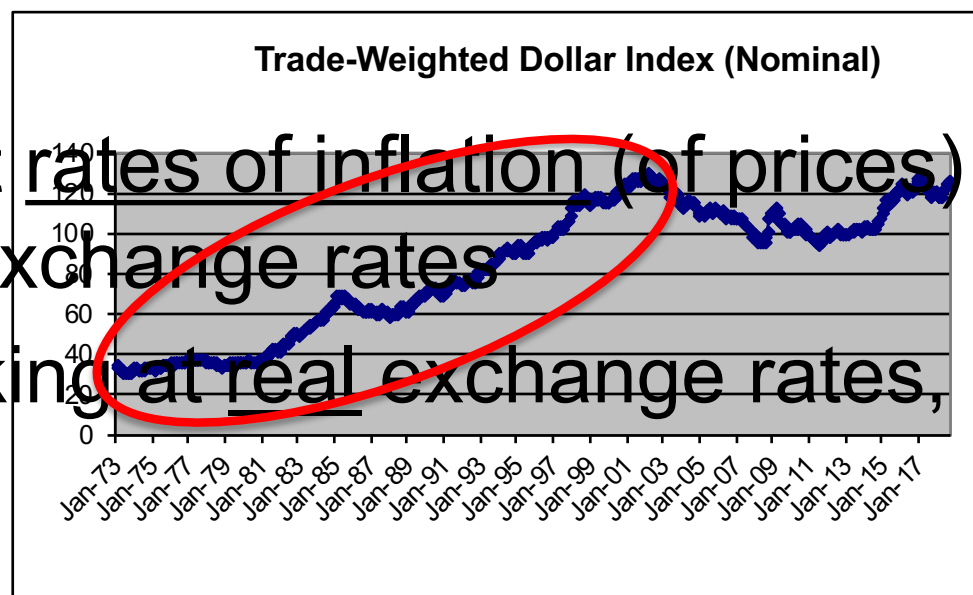
- Interpretation

- From the graph, until 2002 the dollar rose relative to other currencies

- By 2002 it was 4 times higher than in 1973

- Why?

- We'll see later that rates of inflation (of prices) are important for exchange rates
 - This suggests looking at real exchange rates, as well as nominal



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Forms of Exchange Rates

- Real Exchange Rates
 - Like real wages or real incomes, a real exchange rate is simply
 - Corrected for inflation, or equivalently
 - Deflated by (i.e., divided by) a price index
 - But an exchange rate involves two currencies: Whose prices do you use?
 - Answer: Both!

Forms of Exchange Rates

- Real Exchange Rates

- Let

- $E = \text{€}/\text{\$}$ be the euro/dollar nominal exchange rate
 - P^e = price level (index) in Europe (€ per EU-good)
 - P^u = price level (index) in US (\$ per US-good)

- Then Real Exchange rate is

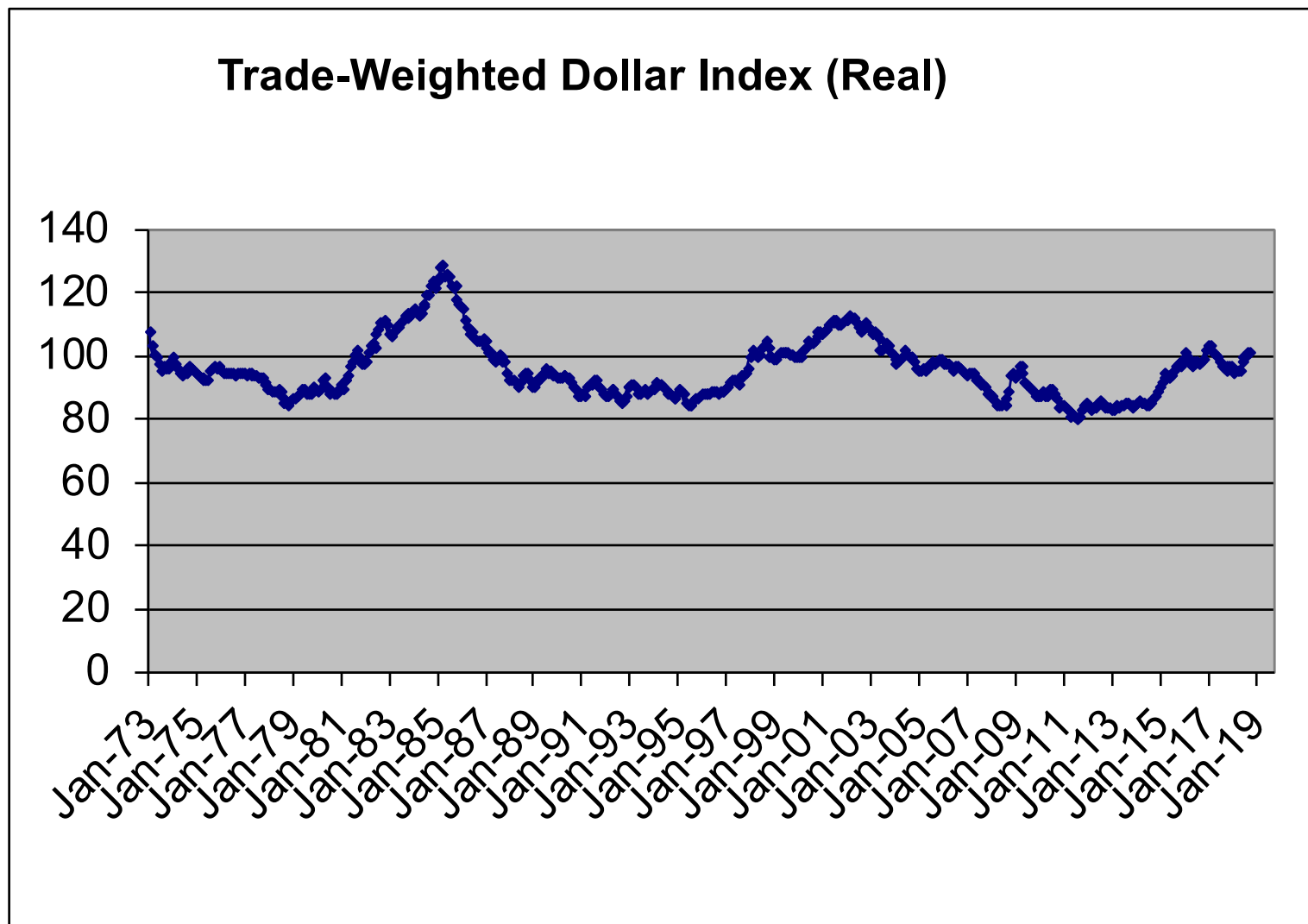
$$R = EP^u/P^e$$



$$\begin{aligned} &= (\cancel{\text{€}/\text{\$}}) (\cancel{\text{\$/US-good}}) / (\cancel{\text{€}/\text{EU-good}}) \\ &= (\text{EU-good}/\text{US-good}) \end{aligned}$$

- Note that this divides each currency by its own price level:

$$R = (\text{€}/\text{\$})(P^u/P^e) = (\text{€}/P^e) / (\text{\$/}P^u)$$



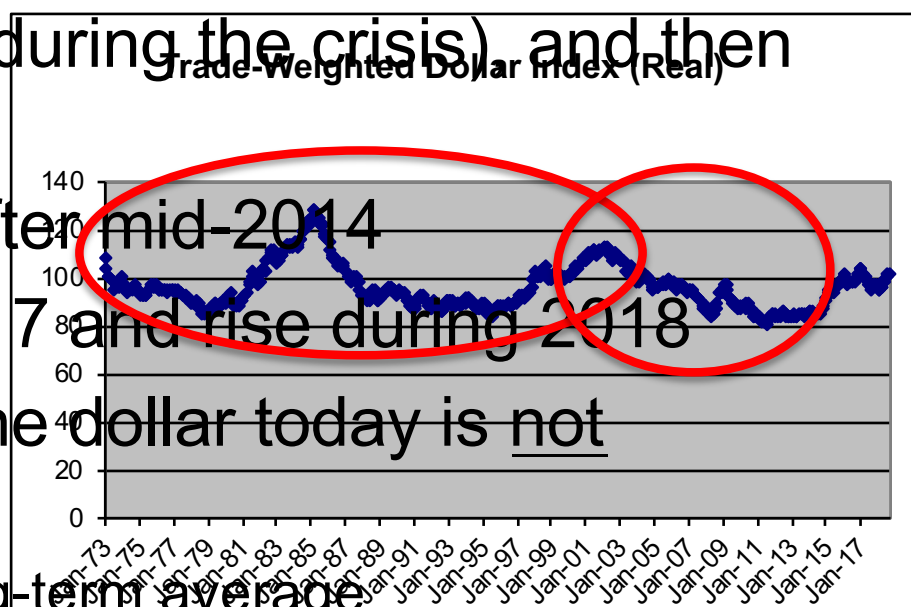
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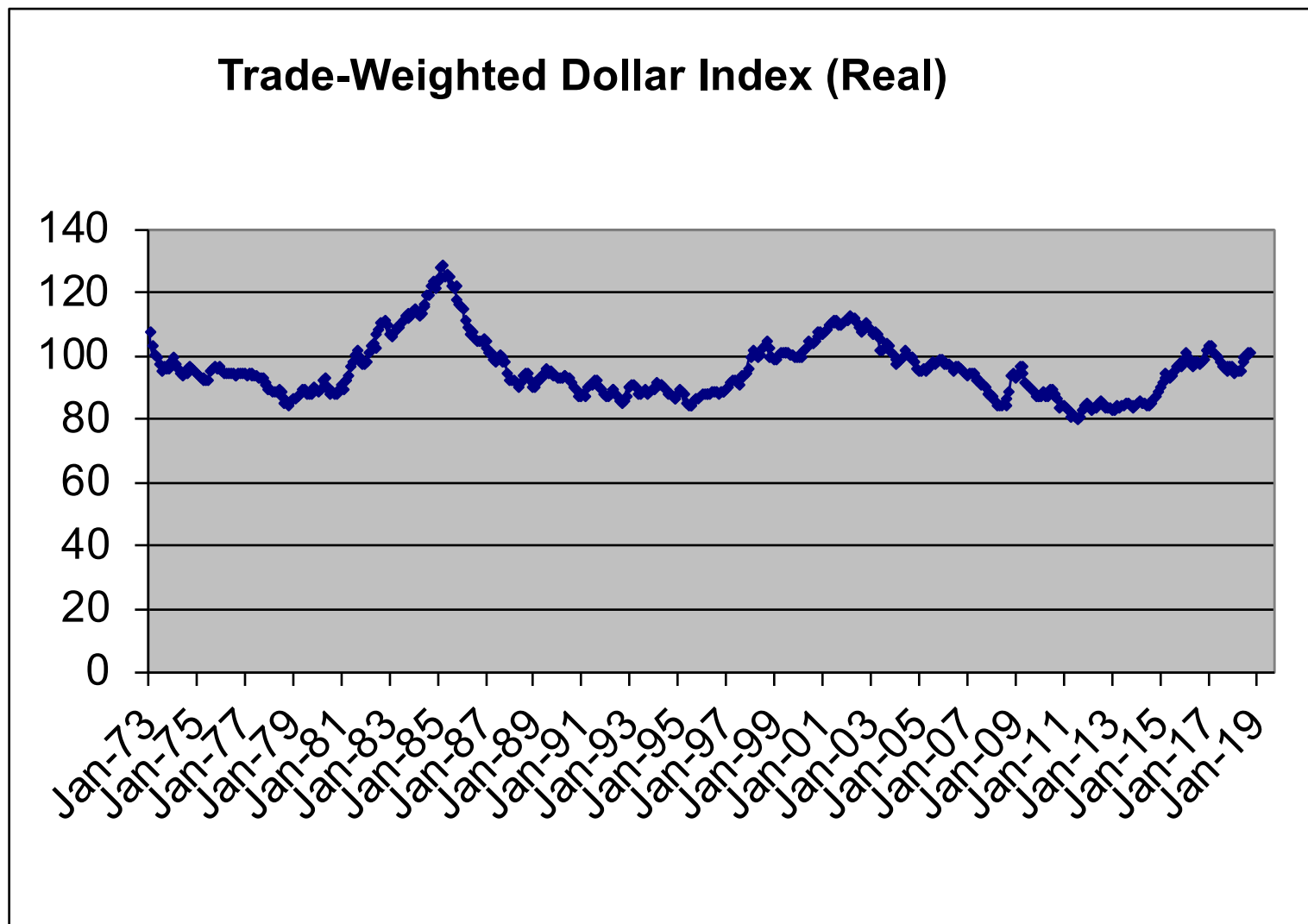
Forms of Exchange Rates

- Real Exchange Rates

- From the graph, note that

- The rise in the dollar 1973-2002 was not real
 - Decline of the dollar after 2002 was real
 - So was the brief rise (during the crisis) and then fall
 - And so was the rise after mid-2014
 - And the fall during 2017 and rise during 2018
 - But the real value of the dollar today is not unusually low or high
 - It is basically at its long-term average





Source: Federal Reserve, “Broad Index” based on a large group of currencies, monthly data

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Forms of Exchange Rates

- Forward Exchange Rates
 - These are rates of exchange for later, not today
 - (Rates for exchange today are called “spot rates.” That’s what we’ve been looking at so far.)
 - In a forward market, no money changes hands today; a forward exchange is a contract, for both buyer and seller to transact
 - 1 month from now
 - 3 months from now
 - 6 months from now

Most common forward contracts; rates used to be reported in WSJ

Forms of Exchange Rates

- Forward Exchange Rates
 - Example (from WSJ) for 3/3/14:

	US\$/A\$	US\$/Sfr
Spot	0.8937	1.1323
1 Month Forward	0.8917	1.1326
3 Month Forward	0.8882	1.1332
6 Month Forward	0.8828	1.1342

Here, the Australian \$ costs (today) less for future delivery than for spot delivery. That is, it is selling at a “**forward discount**”.

The Swiss franc costs more for future delivery than spot, and so is at a “**forward premium**.”

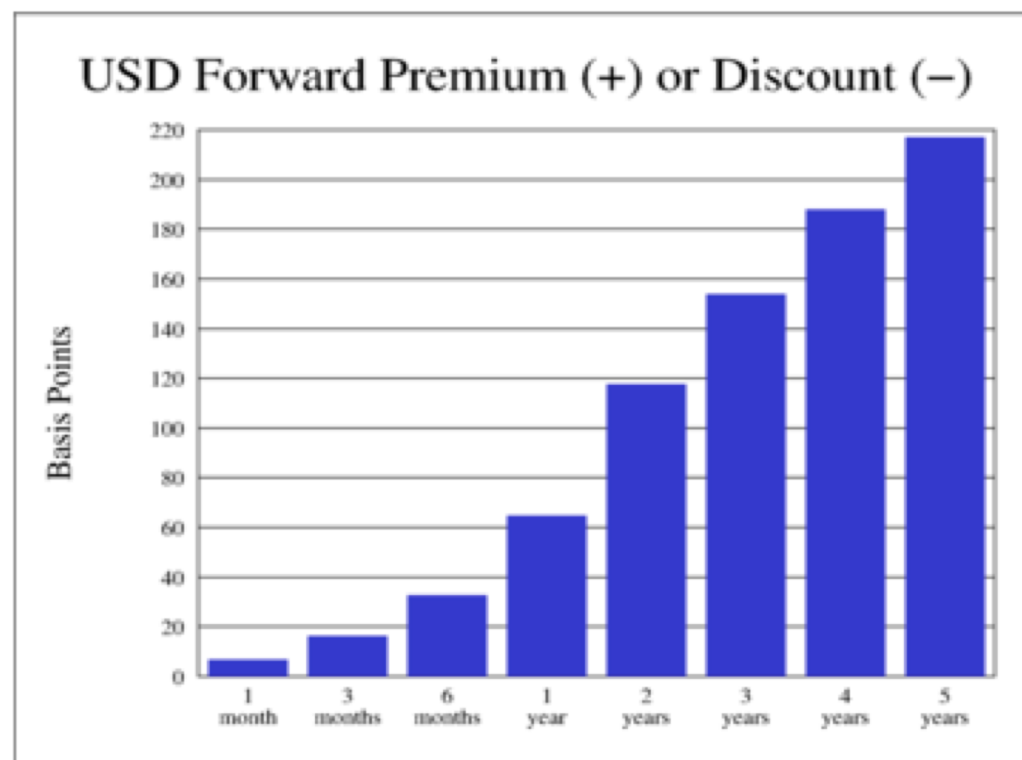
- Each maturity is a separate market.

Canadian Dollar Forward Rates

The chart on the right shows the U.S. Dollar Forward Premium (+) or Forward Discount relative to the Canadian Dollar. The bid-ask midpoint rates shown apply to large-volume transactions in the interbank market around noon time (Eastern) on **Monday, March 18, 2019**. The precise forward rates, in U.S. Dollars per 1 Canadian Dollar, appear in the table on the left. Also reported are the implied forward premium or discount, and the implied foreign interest rate differential at an annualized rate $FIRD=100[(f/s)^{(1/d)}-1]$, where f and s are the forward and spot rate, and d is the forward time in years. If the Canadian Dollar is trading at a USD forward premium, the Canadian Dollar is expected to appreciate. The reverse is true for a forward discount. However, forward rates are poor predictors of the corresponding future spot rates.

	Rate	Premium	FIRD
Spot	0.7500		
1 month	0.7507	+7	1.09%
3 months	0.7517	+16	0.87%
6 months	0.7533	+33	0.88%
1 year	0.7565	+65	0.86%
2 years	0.7618	+118	0.78%
3 years	0.7654	+154	0.68%
4 years	0.7688	+188	0.62%
5 years	0.7717	+217	0.57%

The exchange rates are in U.S. Dollars per 1 Canadian Dollar. The forward premia (+) or discounts (-) are expressed in basis points (100-th of a US cent). The FIRD is expressed in percents per annum.



Source: Werner Antweiler, Sauder School of Business, University of British Columbia

Forms of Exchange Rates

- Forward Exchange Rates
 - Who uses the forward market, and why?
 - Traders, who wish to “hedge” (i.e., avoid risk)
 - Speculators, who wish to bet that the spot rate will change (i.e., they take on risk)
 - There are also specialists who make a profit from discrepancies involving the forward rate, the spot rate, and interest rates in the two countries; this is called “covered interest arbitrage”

Clicker Question

The statement “the yen rose today from 121 to 117” makes sense because

- a) These numbers are indexes, defined relative to a base of 100
- b) The yen is a reserve currency
- c) The U.S. gains when Japan loses
- ✓ d) These numbers measure yen per dollar, not dollars per yen
- e) These numbers refer to time of day that the change took place

Clicker Question

A “multilateral exchange rate” is

- a) The average exchange rate of a group of countries with different currencies
- b) The average exchange rate of a group of countries that share a single currency, such as the euro
- ✓ c) An index of the value of a country's currency relative to several other currencies
- d) A measure of how much a country's currency value has changed, on average, over multiple years
- e) An exchange rate agreed upon between a country and an institution such as the IMF

Clicker Question

If you were to buy Japanese yen using US dollars on the 90-day forward market, you would

- a) Pay dollars now but receive yen in 90 days
- b) Receive yen now but pay dollars in 90 days
- c) Pay dollars now and receive yen now
- ✓ d) Pay dollars in 90 days and receive yen in 90 days
- e) Be breaking the law of international finance

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What Determines Exchange Rates?

- Two things determine exchange rates:
 - Markets; i.e., supply and demand
 - Like any other price
 - We'll look at the markets later today
 - Governments and/or Central Banks
 - This is true IF they intervene in the markets, which they often do
 - We'll look at such intervention in the next lecture

What Determines Exchange Rates?

- We'll look at 3 theories of exchange rates:
 - PPP = Purchasing Power Parity
 - Very useful, but mostly wrong
 - Works best, if ever, only in the very long run
 - Asset Theory (not in textbook)
 - Always right! But useless
 - Supply and Demand Model
 - Best for understanding what has happened
 - Not much help in predicting the future
- (Nothing is much help in predicting! We'll see why.)

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Purchasing Power Parity

- The PPP Theory:

Exchange rate reflects relative purchasing powers of two currencies

- If one country's prices are rising faster than another's, then the currency of the first should depreciate:
- As a country's goods get more expensive, its currency should get less expensive
 - Thus keeping it competitive

Purchasing Power Parity

- The Prediction of PPP:
 - For the bilateral exchange rate between currencies of two countries, A and B

$$\begin{aligned} & \text{A's rate of currency } \underline{\text{depreciation}} \\ &= \text{A's rate of price inflation} \\ & \quad \text{minus} \\ & \quad \text{B's rate of price inflation} \end{aligned}$$

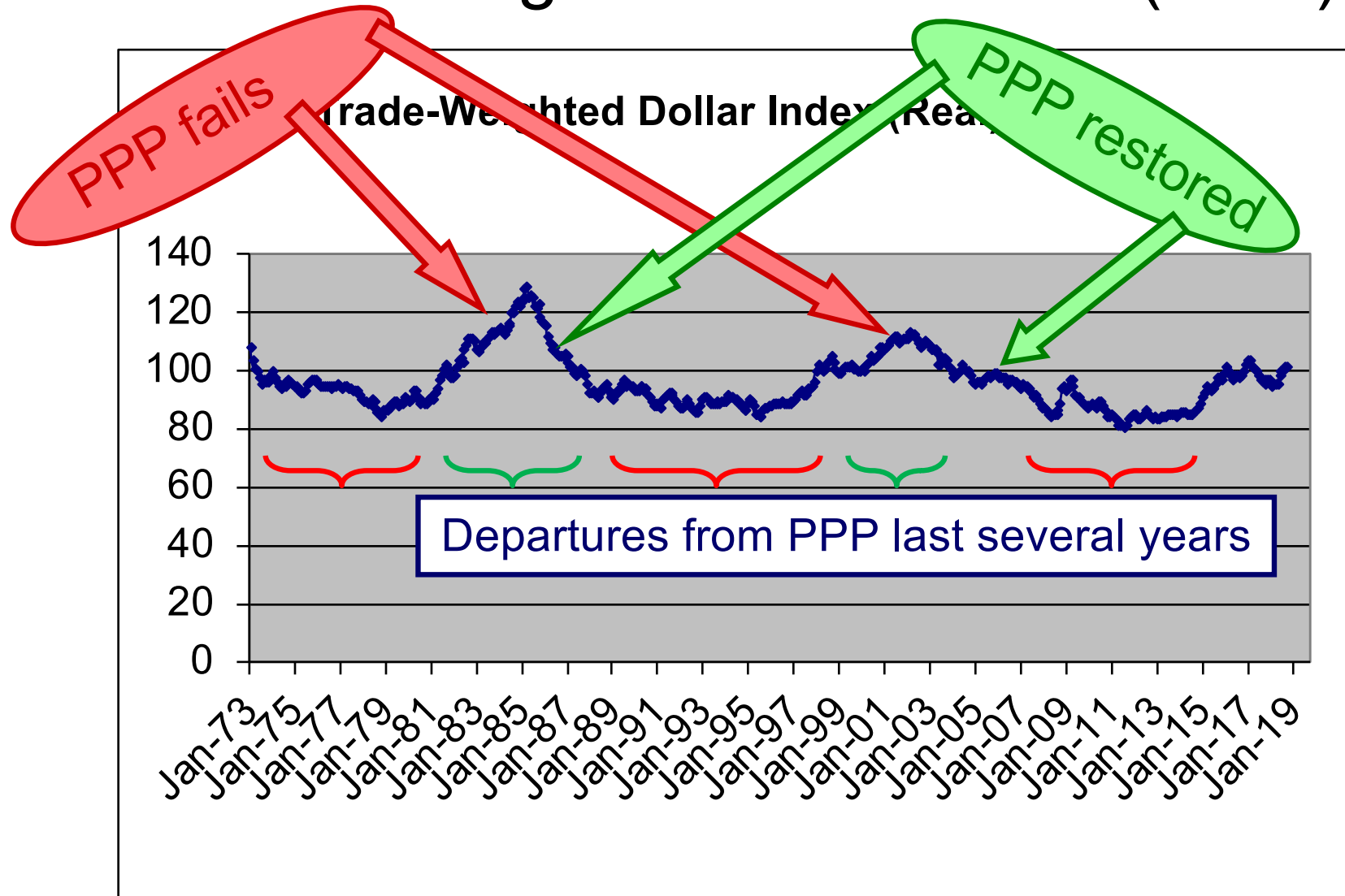
Purchasing Power Parity

- PPP is used to guess whether a currency is
“Overvalued” (i.e., worth more than it “should be”)
or
“Undervalued” (worth less than it “should be”)
- E.g., if a currency has not depreciated in spite of the country having higher inflation than others, we say that its currency is now overvalued

Purchasing Power Parity

- Implication of PPP: The Real Exchange Rate should be constant
- Recall: $R = EP^u/P^e$ where $E = \text{€}/\text{\$}$
- If E falls at the same rate that the rise in P^u exceeds the rise in P^e , then R is constant
- Does it work? Look again at graph of real value of the dollar...

Trade-Weighted Dollar Index (Real)



Source: Federal Reserve, "Broad Index" based on a large group of currencies, monthly data

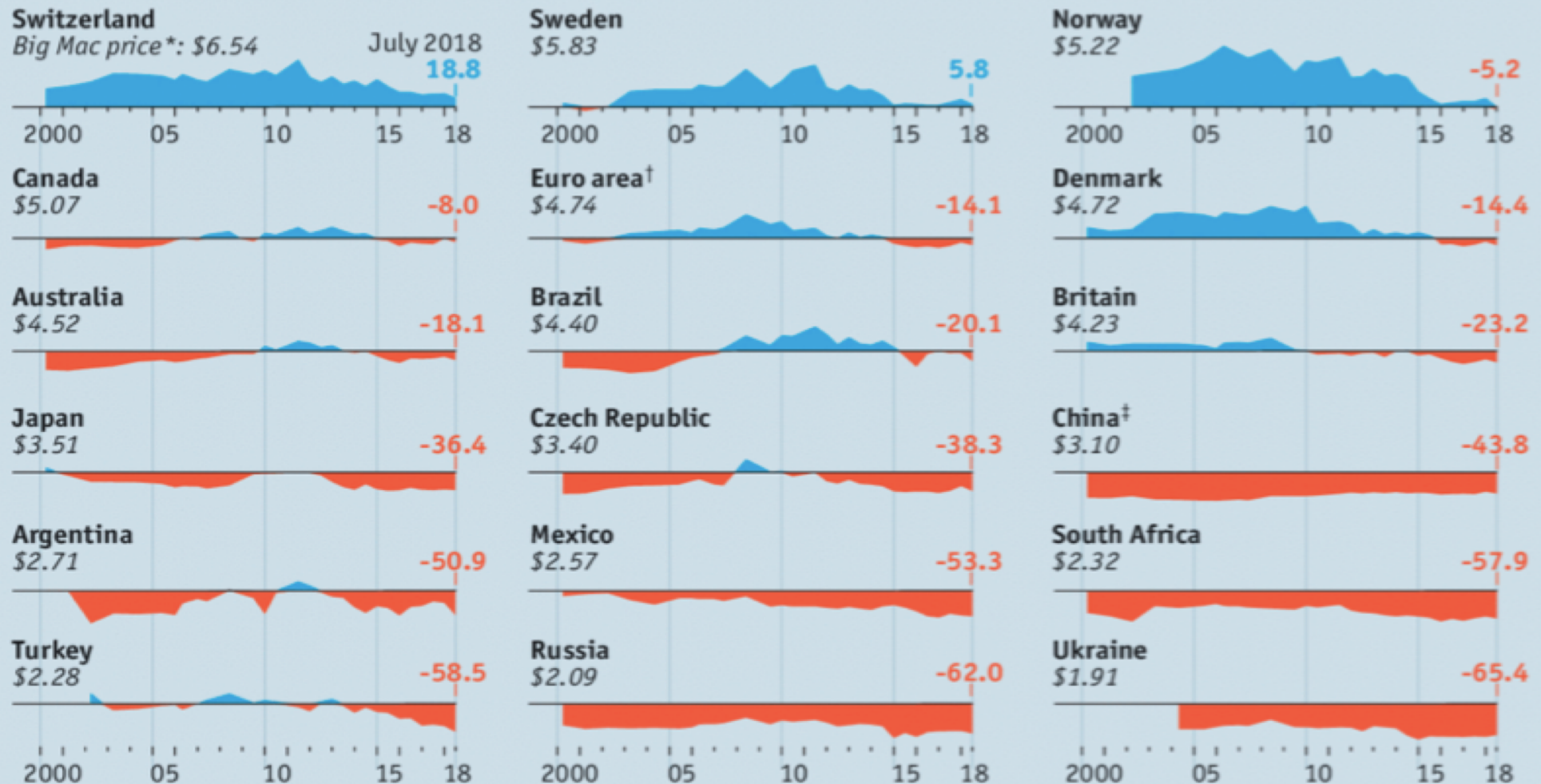
Purchasing Power Parity

- Which Prices Should One Use for PPP?
 - Most would say to use the CPI = Consumer Price Index
 - *The Economist* (for fun) uses the price of the MacDonald's Big Mac hamburger
 - See reading: "The Big Mac Index" July 2019
 - The message here: price of the Big Mac can be an indicator of whether a currency is over- or under-valued.
 - The Big Mac costs more than in the US in only a few countries, which suggests that the US dollar is over-valued.
 - In an earlier report, they noted that, measured in burgers, US GDP was 3,682 billion and China's GDP was 3,931 billion. Thus China's economy was already larger than the US, measured in burgers, because the burger was cheaper there.

Currencies from Big Mac Index July 2018 (similar to 2019, but easier to display)

Movers and milkshakers

The Big Mac index, local-currency valuation against the dollar, %



Sources: McDonald's; *The Economist*

*At market ex-rates (July 10th 2018)

†Weighted average of members

‡Average of five cities

Purchasing Power Parity

- Another message also from an earlier report of the Big Mac Index:
 - Exchange rates of poor countries tend to be low, compared to PPP, while those of rich countries tend to be high.
 - Reason: prices of some goods, including hamburgers, depend heavily on local inputs (rents, wages) that tend to be lower in poor countries.
 - Therefore it is best to only compare countries with similar incomes.
 - You can get a sense of that from several above.
 - Also, see the following graph from July 2011:



Clicker Question

Based on the graphs of US exchange rates in this lecture, when has the US dollar been most over-valued relative to Purchasing Power Parity?

- a) 1973
- ✓ b) 1985
- c) 2001
- d) 2011
- e) 2017

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Asset Theory of the Exchange Rate

- The Asset Theory:

Exchange rate adjusts to eliminate the motive to shift assets between currencies

- Reason: Attempts to move assets quickly would swamp the market

Asset Theory of the Exchange Rate

- The Asset Theory:

- Implication

Exchange rate must already be
whatever people think it is about to be

- Reason: If it were not, then

- Huge amounts of money would try to flow toward the currency that is expected to appreciate
 - Market would be in disequilibrium ($D > S$)
 - Exchange rate would instantly appreciate until it equaled what people expected

Asset Theory of the Exchange Rate

- The Asset Theory:
 - Implications:
 - Rates change whenever expectations of rates change
 - Rates are very volatile
 - Rates do respond to normal economic forces (like shifts in supply and demand below),
 - but they respond as soon as those forces are expected,
 - they don't wait for the shifts themselves.
 - Rates also respond to “investor psychology,” which may be irrational (e.g., herd behavior)

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Supply and Demand Model of the Market for Foreign Exchange

- Market is for two currencies, so it is arbitrary which currency we consider as
 - the one that is being traded, and
 - the one that is being used to pay for it

Supply and Demand Model of the Market for Foreign Exchange

- To fix these, we will consider the market from the perspective of a domestic country
 - Trading a foreign currency
 - Paid for with its own currency
 - Hence it really is the market for foreign exchange

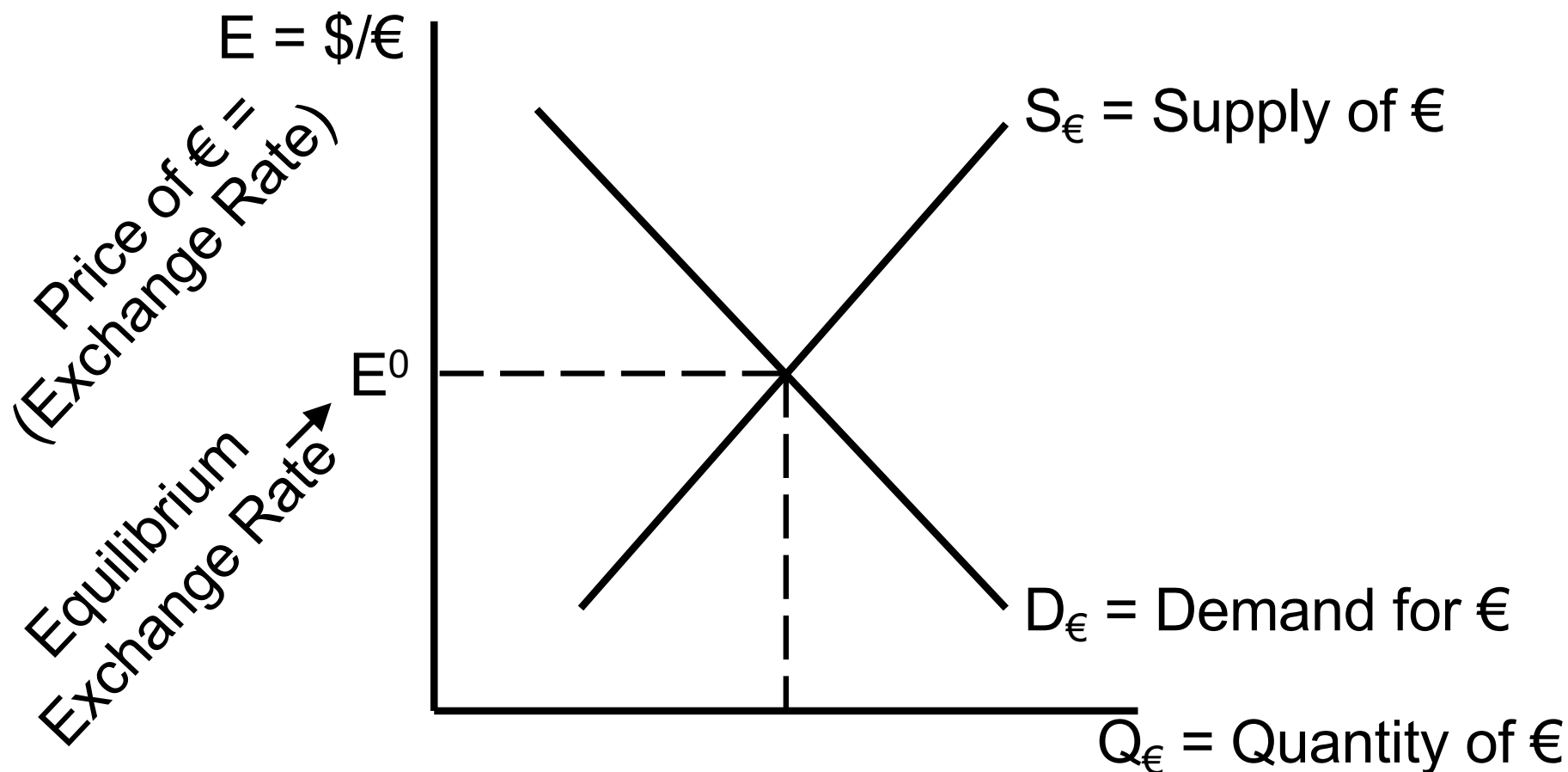
Supply and Demand Model of the Market for Foreign Exchange

- We say foreign “exchange” rather than foreign “currency”
 - This is not the market for holding currency, such as you studied in Econ 102 (e.g., the Money Market)
 - It is the market for exchanging one currency for another,
 - usually with the intention of using the acquired currency to buy goods or other assets, not to hold it.

Supply and Demand Model of the Market for Foreign Exchange

- In graphs below,
 - own currency is \$ and
 - foreign currency is €
 - Thus it is the market for (foreign currency) € in terms of (home currency) \$
- But
 - you should be able to do this with any two currencies
 - Including having the dollar as another country's foreign currency

Supply and Demand Model of the Market for Foreign Exchange



Supply and Demand Model of the Market for Foreign Exchange

- Sources of Supply of €
 - US Exports (i.e., Europe's imports)
 - US Capital Inflows (i.e., Europe's outflows)
 - Other
 - US investment income receipts
 - Transfers into US
 - Etc.
 - (Thus, all credits in the Balance of Payments)

Supply and Demand Model of the Market for Foreign Exchange

- Sources of Demand for €
 - US Imports (i.e., Europe's exports)
 - US Capital Outflows (i.e., Europe's inflows)
 - Other
 - US investment income payments
 - Transfers out
 - Etc.
 - (Thus all debits in the Balance of Payments)

Supply and Demand Model of the Market for Foreign Exchange

- Use of the model
 - Figure out how an event will change one or more of these sources of supply and demand
 - Shift the curve or curves accordingly
 - Read from the diagram what happens to the exchange rate

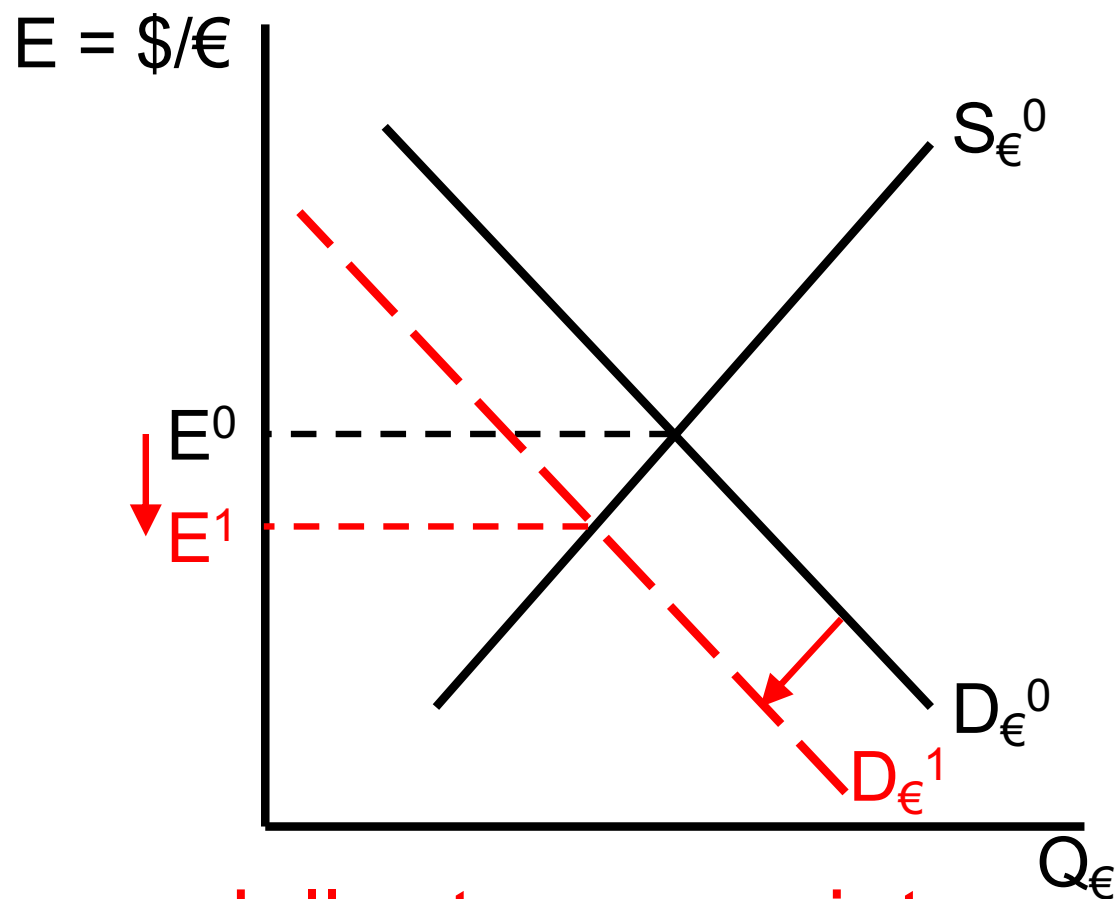
Supply and Demand Model of the Market for Foreign Exchange

- Use of the model
 - Note that the price in the diagram, $E = \$/\text{€}$, is the price of foreign currency, not the dollar
 - Thus
 - if E rises, that is a dollar depreciation
 - if E falls, that's a dollar appreciation
 - This can be confusing. Remember, this is the market for, and E is the price of, foreign exchange

Supply and Demand Model of the Market for Foreign Exchange

- Implications of the Model
 - US Tariff Increase on lots of goods
(e.g., Nixon's 10% surcharge on imports in 1971
or a broad tariff increase now to add jobs)
 - Reduces demand for imports
 - Reduces demand for €
 - Shifts $D_{\text{€}}$ left

- US Tariff Increase



- Causes dollar to appreciate
 - (which hurts exports)

Supply and Demand Model of the Market for Foreign Exchange

- Implications of the Model
 - Could apply to Trump's tariffs, especially on China.
 - Model says dollar should appreciate.
 - It did over the last two years:

Renminbi per dollar:



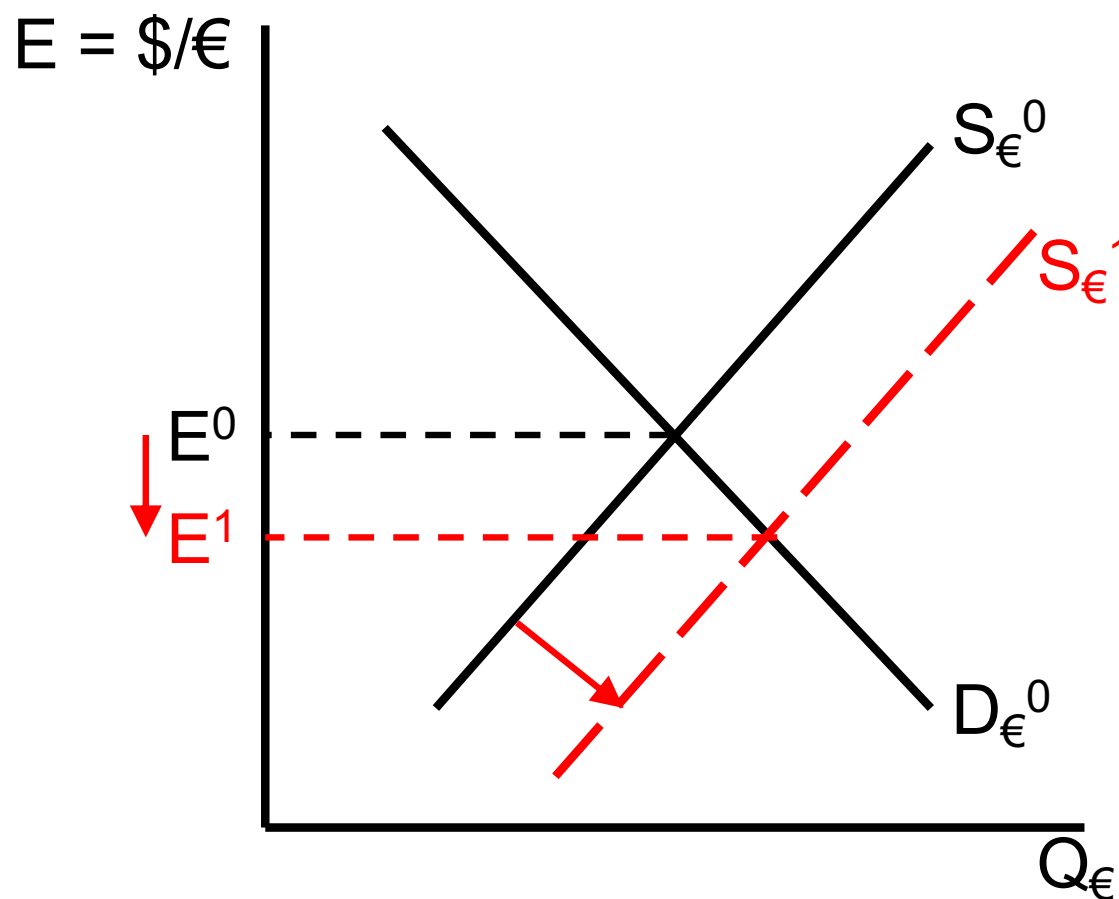
Source: X-Rates.com

Econ 340, Deardorff, Lecture 13:
Exchange Rates

Supply and Demand Model of the Market for Foreign Exchange

- Implications of the Model
 - US Interest Rate Increase
 - Makes US bonds more attractive
 - Causes increased capital inflow to US
 - Increases demand for \$ and thus supply of €
 - Shifts $S_{\text{€}}$ right
 - This also causes the \$ to appreciate
 - As it has done recently, with the Fed raising interest rates
 - Though just lately (today?) it has reduced them

- US Interest Rate Increase



- Causes dollar to appreciate

Supply and Demand Model of the Market for Foreign Exchange

- Implications of the Model
 - Other examples of changes that will also cause the US dollar to appreciate (you should be able to argue and demonstrate these also):
 - Increase in demand for US exports
 - Fall in foreign interest rates
 - Increase in perceived riskiness of foreign assets
 - Fall in US transfer payments to foreigners
 - Opposites of all these will cause dollar to depreciate

Clicker Question

Which of the following would cause the Mexican peso to depreciate?

- a) A US tariff on Mexican exports
- b) A decrease in remittances from US to Mexico by immigrants from Mexico
- c) A rise in the US interest rate
- ✓ d) All of the above
- e) None of the above

Clicker Question

Suppose that Canada were to experience a burst of inflation, prices there suddenly rising faster than in the US. Which of the exchange-rate theories would predict that the Canadian dollar would fall in value relative to the US dollar?

- a) Purchasing Power Parity
- b) Asset Theory
- c) Supply and demand
- ✓ d) All of the above
- e) None of the above

PPP predicts it most directly, but the rise in Canadian prices will reduce demand for Canadian exports and thus demand for its currency. And asset holders will understand this too, and expect depreciation. So all three predict the same.

Next Time

- Pegging the Exchange Rate
 - How it's done
 - Who does it
 - Effects of pegging