



# Exchange Rates and Macroeconomic Policy

## EC1101E Macro Lecture 6

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# Agenda

Introduction to currency markets and the exchange rate

Demand and supply in currency markets

Explaining exchange rate movements

Government intervention in currency markets

The exchange rate and the macroeconomy

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## Introduction to currency markets and the exchange rate

- Currency markets
- The exchange rate

## Demand and supply in currency markets

## Explaining exchange rate movements

## Government intervention in currency markets

## The exchange rate and the macroeconomy



# Currency Markets

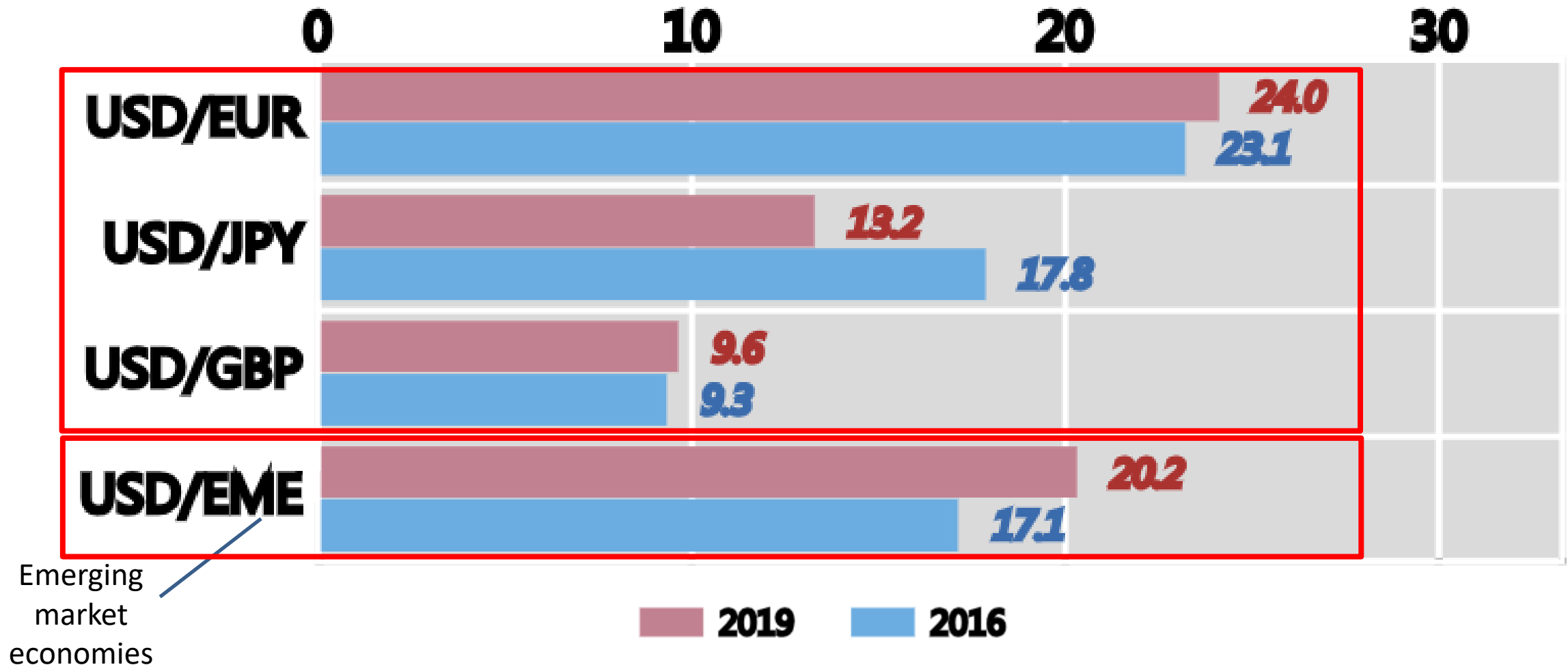
Visiting the local money changer = participating in the currency market

**Currency Market** = market where one currency is traded for another



# Currency Markets: % of daily turnover (I)

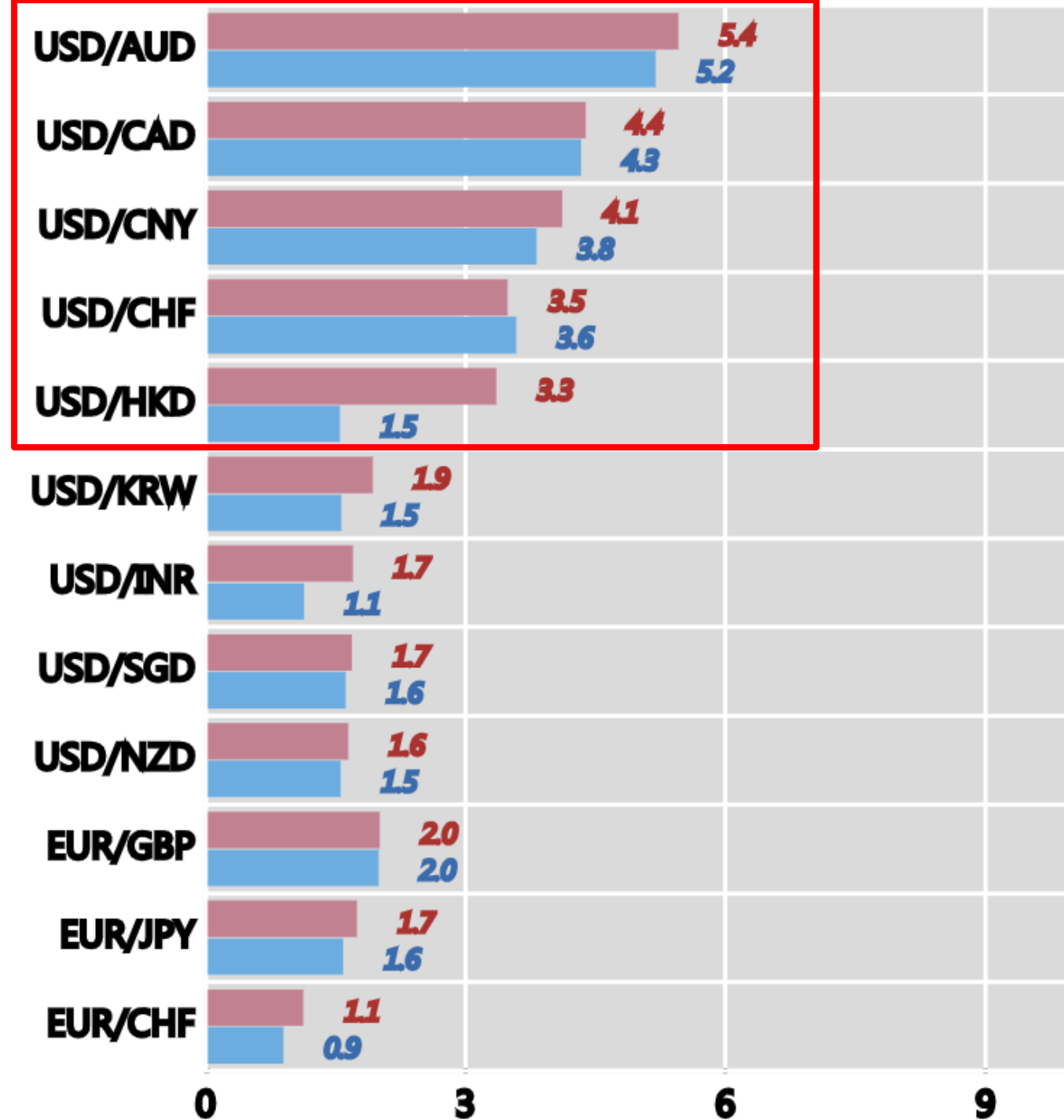
100% = USD6.5 trillion/day!



Source: Bank of International Settlements Triennial Central Bank Survey (2019)

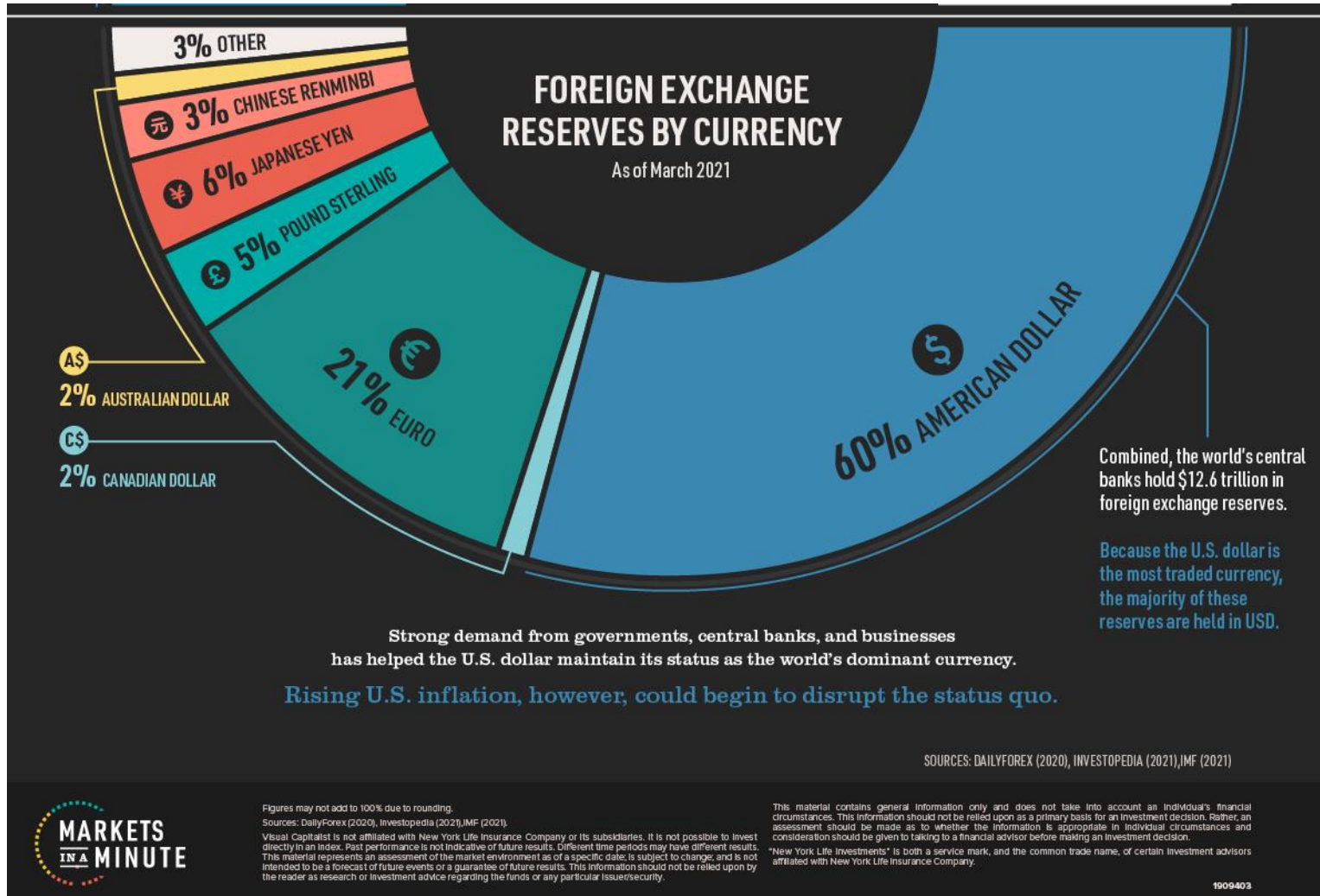
# Currency Markets: % daily turnover (II)

2019 2016



Source: Bank of International  
Settlements Triennial Central Bank  
Survey (2019)

# Share of foreign exchange reserves by currency



Foreign exchange reserves = foreign currency holdings of central banks

The 5 major reserve currencies are USD, Euro, GBP, JPY, CNY

# The exchange rate

The **Exchange rate** is the rate at which one currency is traded for another.

In \$-¥ market, there are two ways to quote the exchange rate:

1) Dollars per yen (**Dollar Price of Yen**)

0.009056\$ per ¥

2) Yen per dollar (**Yen Price of Dollar**)

110.424¥ per \$ (=  $1/0.009056$  \$ per ¥)



# Appreciation and Depreciation

Suppose the exchange rate rises from 110.424 Yen per dollar to 120.00 Yen per dollar

→ One dollar now trades for more yen than b4

We say that:

- The Dollar has **appreciated** (a.k.a. strengthened) against the Yen
- The Yen has **depreciated** (a.k.a. weakened) against the dollar

## Active Learning: Appreciation and Depreciation

Suppose the exchange rate falls from 0.009056 dollars per yen to 0.008333 dollars per yen

**Q: Has the dollar appreciated against the yen? Or depreciated?**

## Active Learning: Appreciation and Depreciation

Suppose the exchange rate falls from 0.009056 dollars per yen to 0.008333 dollars per yen

**Q: Has the dollar appreciated against the yen? Or depreciated?**

**Ans: Dollar has appreciated**

Note:  $1/0.009056 = 110.424$ , and  $1/0.008333 = 120.000$

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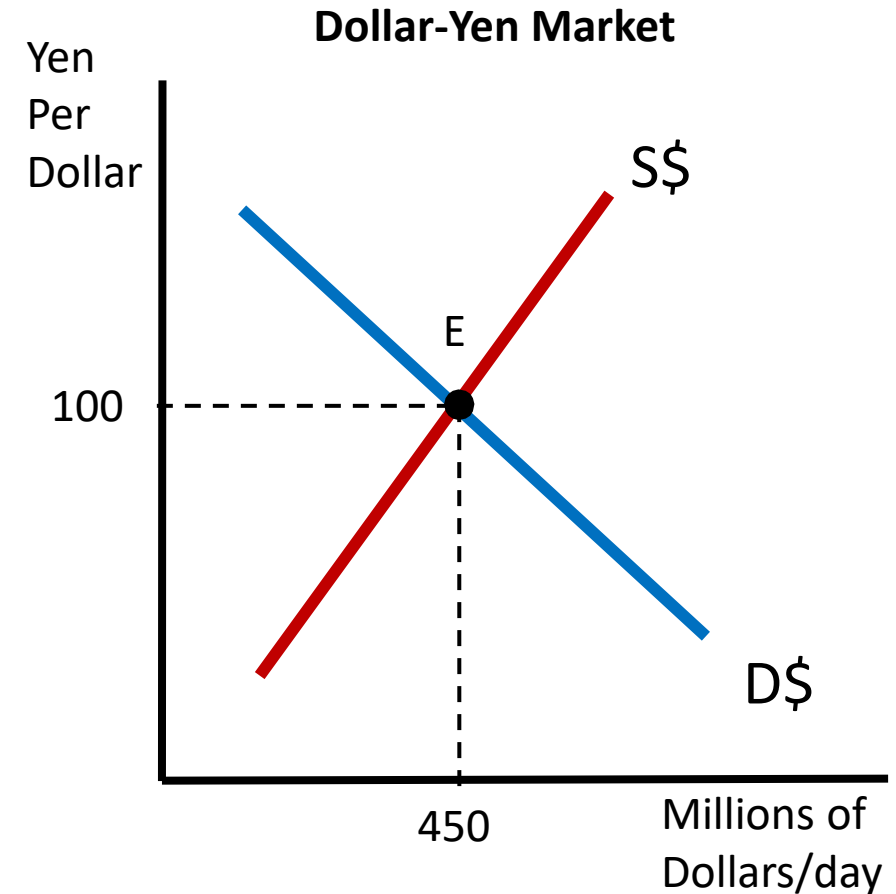
The exchange rate and the macroeconomy

# The Dollar-Yen Market

Apply demand-supply model to the dollar-yen market

**Price of dollar** (i.e. Yen per dollar) on vertical axis

**Quantity of dollars** traded on horizontal axis





# **Demand for dollars in \$-¥ market**

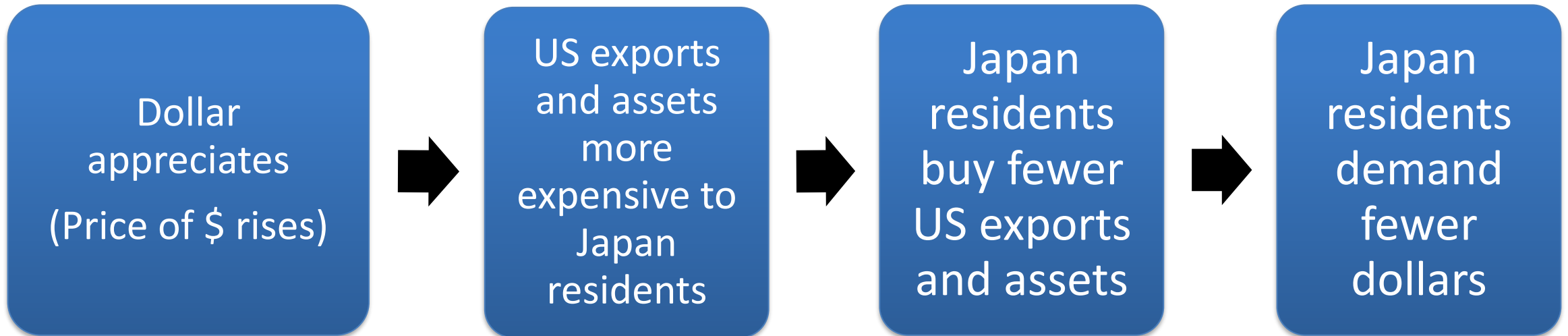
Assume for simplicity that residents in Japan are the only people who want to buy dollars with yen

Two purposes for Japan residents to buy dollars with yen:

1. To buy US goods (i.e. exports by US)
2. To buy US assets (i.e. capital inflow to US)

# Demand curve slopes down

Price of \$ rises → Quantity of \$ demanded falls

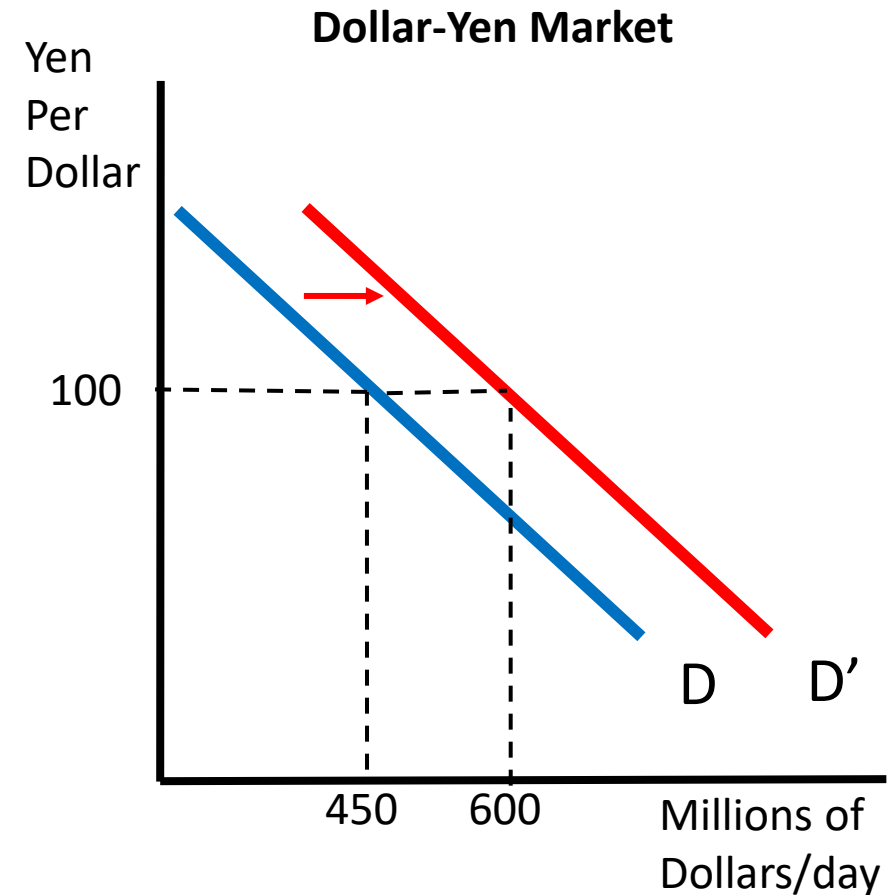


# Shift in the demand curve for dollars: example

Suppose Japan's real GDP rises

Then, Japan residents buy more US exports

Demand curve shifts right



# Shifts in the demand curve for dollars (US goods)

The demand curve shifts right when Japan residents demand more US goods for any given exchange rate:

- Japan's real GDP rises
- Japan residents increase their fondness for US goods
- Japan's price level rises, relative to US price level

# Shifts in the demand for dollars (US assets)

The demand curve shifts right when Japan residents demand more US assets for any given exchange rate

- Japan interest rate falls relative to US interest rate
- Japanese residents believe that the dollar will appreciate against the yen



## Active Learning: Shifts in the demand curve for \$

Shifts in the **Demand Curve for \$** in \$- ¥ market due to:

Event	Direction of shift in Demand for \$
Japan Real GDP rises	Left   Right
Japan residents gain taste for US goods	Left   Right
Japan price level rises relative to US price level	Left   Right
Japan interest rate rises relative to US interest rate	Left   Right
¥ expected to appreciate against \$	Left   Right

# Supply of dollars in \$-¥ market

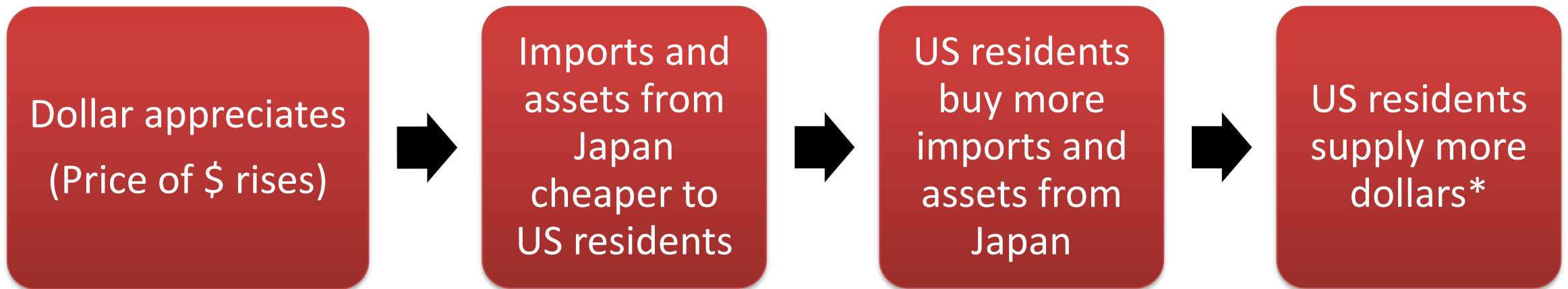
Assume for simplicity that residents in US are the only people who want to sell dollars for yen

Why do US residents want to sell dollars for yen?

1. To buy Japanese goods (i.e. imports by US)
2. To buy Japanese assets (capital outflow from US)

# Supply curve slopes up

Price of \$ rises → Quantity of \$ supplied rises



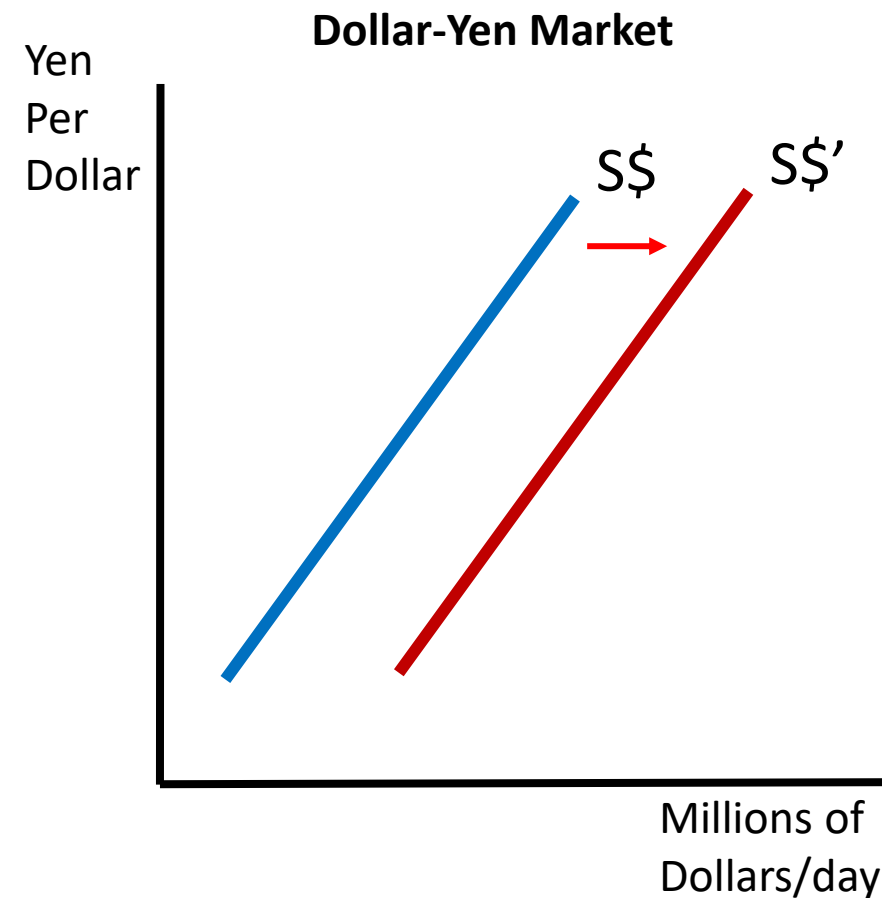
\*Assumption: rise in quantity of imports and asset purchases > fall in \$-prices

# Shifts in the supply of dollars

Suppose US real GDP rises

Then, US residents buy more imports from Japan

Supply curve shifts right



## Active Learning: Shifts in supply curve for \$

Shifts in the **Supply Curve for \$** in \$-¥ market due to

Event	Direction of shift in Supply of \$
US Real GDP rises	Left   <b>Right</b>
US residents gain taste for Japan goods	Left   Right
US price level rises relative to Japan price level	Left   Right
US interest rate rises relative to Japan interest rate	Left   Right
\$ expected to <b>appreciate</b> against ¥	Left   Right



# Simultaneous demand-supply shifts

Some factors affect both demand and supply

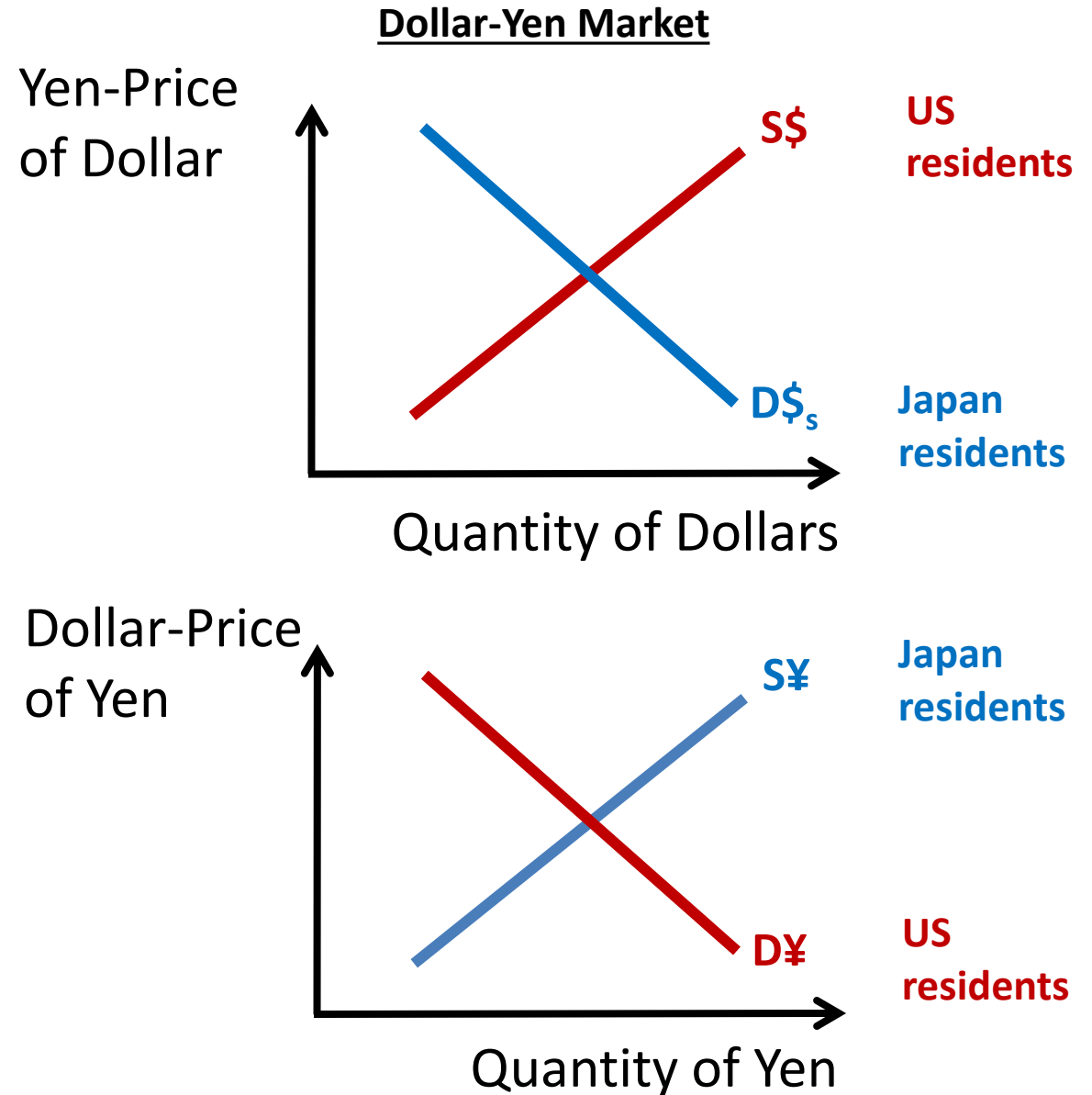
- Relative interest rates
- Relative price levels
- Expected future exchange rate

Q: do these simultaneous shifts lead the exchange rate to become more stable, or more volatile ...

# Two ways to depict the Dollar-Yen Market

Two ways to quote the exchange rate between the Dollar and the Yen

Two diagrams to represent the same Dollar-Yen currency market



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Demand and supply in currency markets

Explaining exchange rate movements

- Short Run: Economic Fluctuations
- Very Short Run: Hot Money
- Long Run: Purchasing Power Parity

Government intervention in currency markets

The exchange rate and the macroeconomy

Yen per US dollar

12H

1D

1W

1M

1Y

2Y

5Y

10Y



XE.com

Yen per US dollar

12H

1D

1W

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XE.com



Yen per US dollar

12H

1D

1W

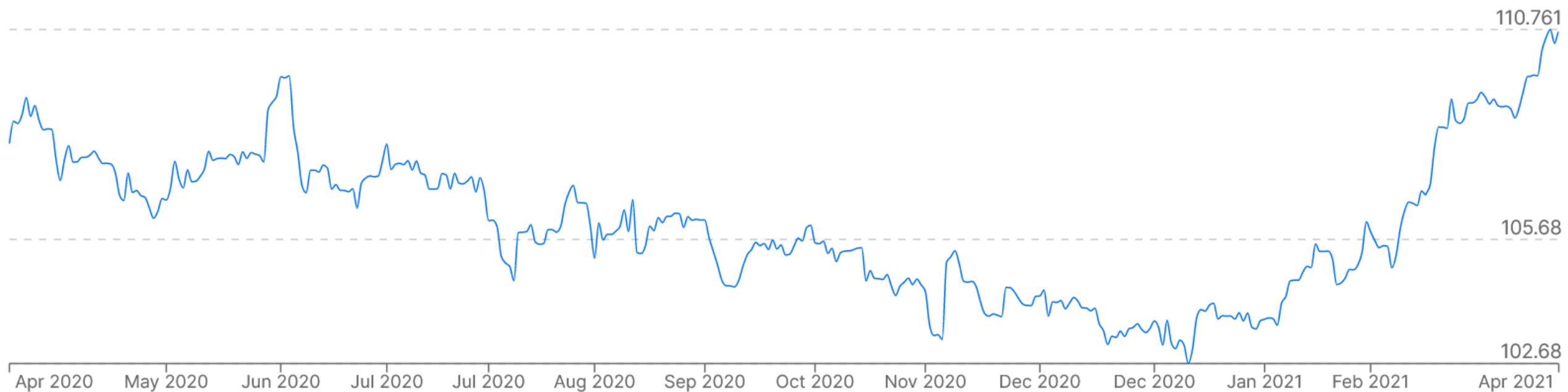
1M

1Y

2Y

5Y

10Y



XE.com

Yen per US dollar

12H

1D

1W

1M

1Y

2Y

5Y

10Y



XE.com

# Short Run: economic fluctuations

When US RGDP  $\uparrow$ , US imports of Japan goods  $\uparrow \rightarrow$  **Supply** of \$ shifts **right**  $\rightarrow$  USD **depreciates**

When Japan RGDP  $\uparrow$ , US exports to Japan  $\uparrow \rightarrow$  **Demand** for \$ shifts **right**  $\rightarrow$  USD **appreciates**

Note: common perception that “strong” economy is reflected in “strong” currency is not correct

# Very Short Run: Hot Money

**Hot money** = funds that can be moved from one type of asset to another at **very short notice**

Changes in **expectations** and **interest rates** are the major factors influencing hot money flows

Because hot money flows can be highly volatile, **exchange rates can be highly volatile**

# Suppose US interest rate ↓ relative to Japan interest rate ...

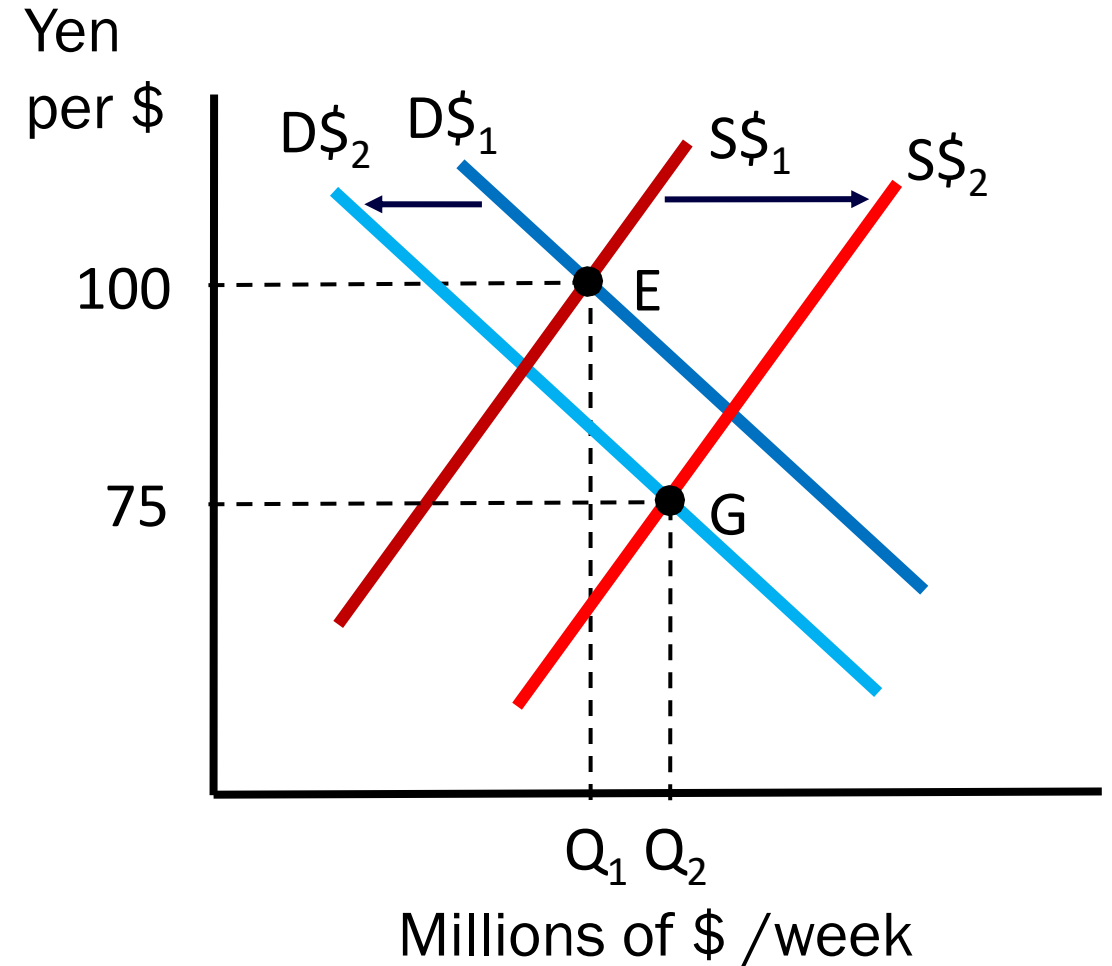
For Japan residents, US assets are now less attractive

→ Demand for \$ shifts **left**

For US residents, Japan assets are now more attractive

→ Supply of \$ shifts **right**

**Together, large ↓ in Price of \$!**



# Suppose currency traders expect \$ to depreciate ...

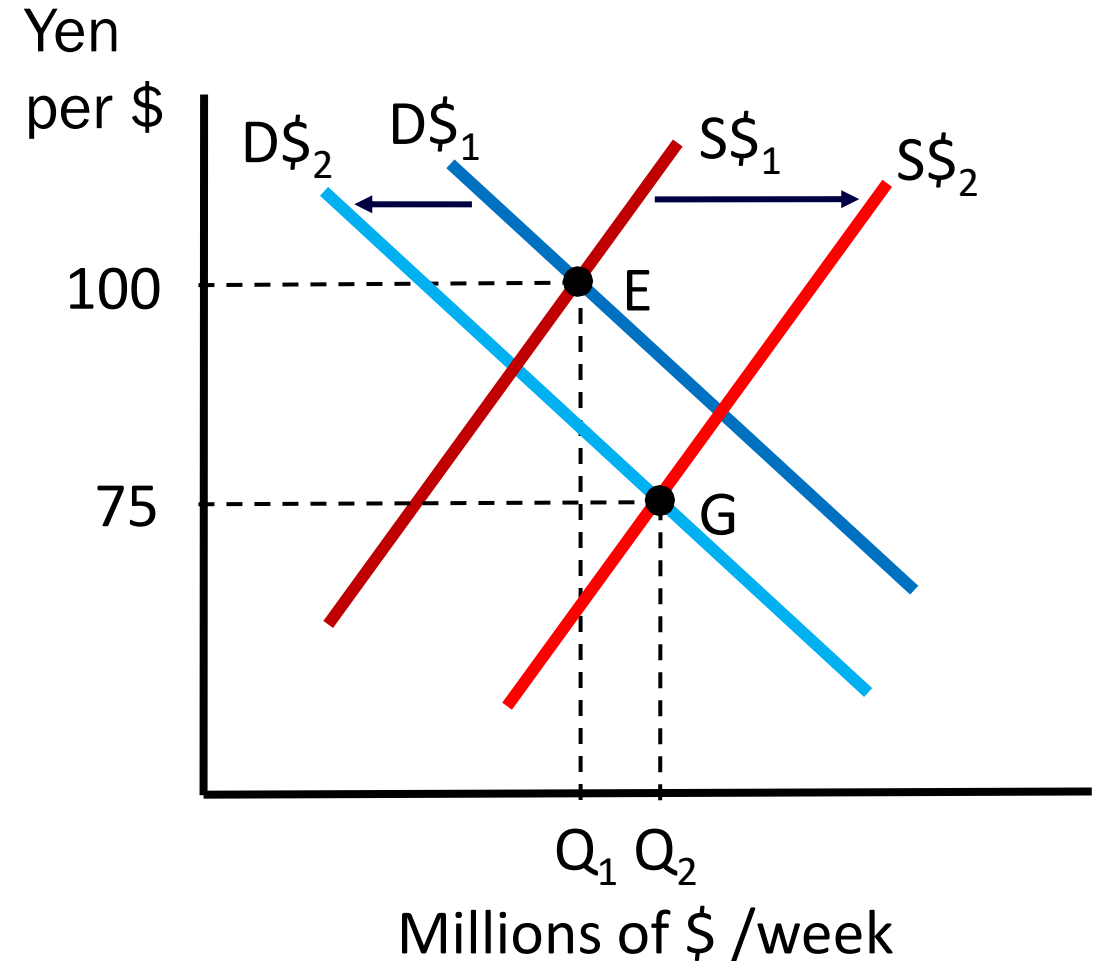
For Japan residents, US assets are now less attractive

→ Demand for \$ shifts **left**

For US residents, Japan assets are now more attractive

→ Supply of \$ shifts **right**

Together, **large ↓ in Price of \$ TODAY!**



# Arbitrage in currency markets

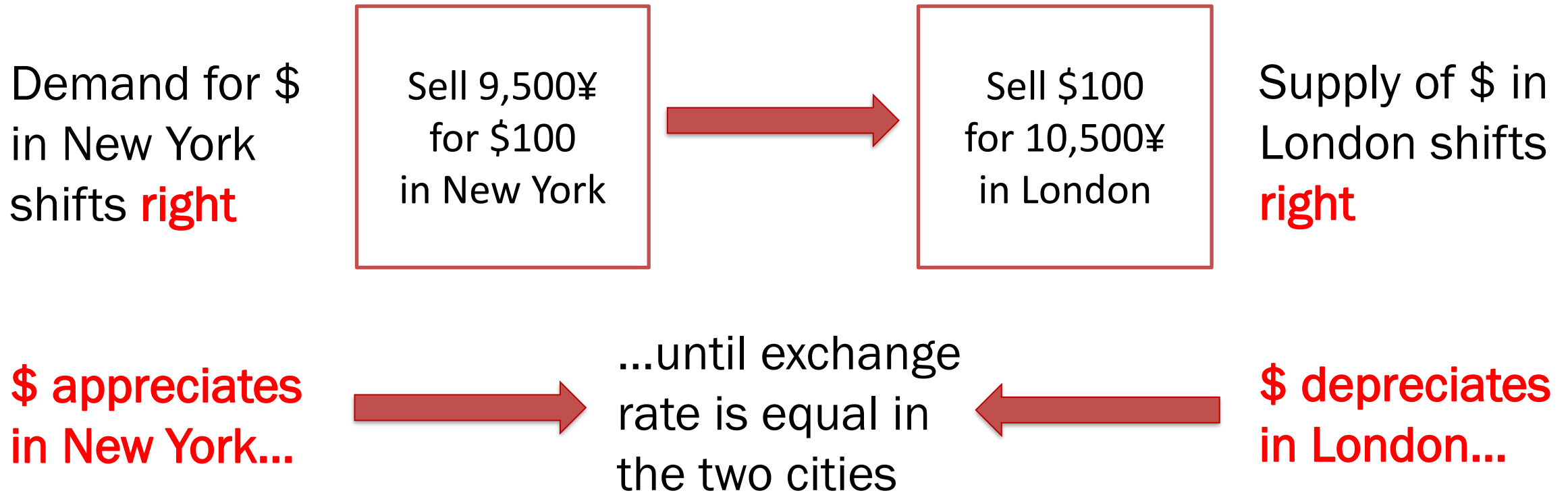
**Arbitrage:** buy an item in one market, sell it in another market for a **higher price**

Suppose the \$-¥ exchange rate is 95¥ per \$ in New York but 105¥ per \$ in London. A trader has 9,500¥. To make **riskless profit**, he can do the following trades:



# One \$-¥ exchange rate worldwide

Many traders will do the same arbitrage trade



**Arbitrage removes virtually all geographic differences in exchange rates**



## Active Learning: Arbitraging Big Macs

Price of Big Mac in Japan	385¥
Price of Big Mac in USA	\$5.50
Exchange Rate	105 ¥/\$



Starting with \$110, design an arbitrage trade to make profit (assuming shipping cost is zero). **Profit =**

Currency Market

Sell \_\_\_\_\_

Buy \_\_\_\_\_

Buy \_\_\_\_\_  
Big Macs

in \_\_\_\_\_

with \_\_\_\_\_

Shipping



Sell all the  
Big Macs

in \_\_\_\_\_

for \_\_\_\_\_

# Long run: Purchasing Power Parity

Traders will do arbitrage trades → supply of \$ shifts right  
Hence, \$ depreciates against ¥

\$ will stop depreciating when \$5.50 can be exchanged for 385¥, i.e. **when the exchange rate is 70¥ per \$.**

**Purchasing Power Parity** (PPP) Theory predicts that the \$ will eventually fall to **70 ¥ per \$**

# PPP exchange rate

In the Big Mac example,

$$\text{PPP Exchange rate} = \frac{\text{¥-Price of Big Mac in Japan}}{\text{\$-Price of Big Mac in US}} = 70\text{¥}/\$$$

$$100\% \left( \frac{70 - 105}{105} \right) = -33.3\% \rightarrow \text{¥ is } \mathbf{33.3\% \text{ undervalued}}$$

Generalizing to many goods,

$$\text{PPP Exchange rate} = \frac{\text{¥-Price level in Japan}}{\text{\$-Price level in US}}$$

# The Economist Magazine's Big Mac Index, Jan 2021

## Price of Big Mac

390¥ in Japan

\$5.66 in USA

## PPP exchange rate

$390\text{¥} / 5.66\$ = 68.90 \text{ ¥}/\$$

## Exchange rate

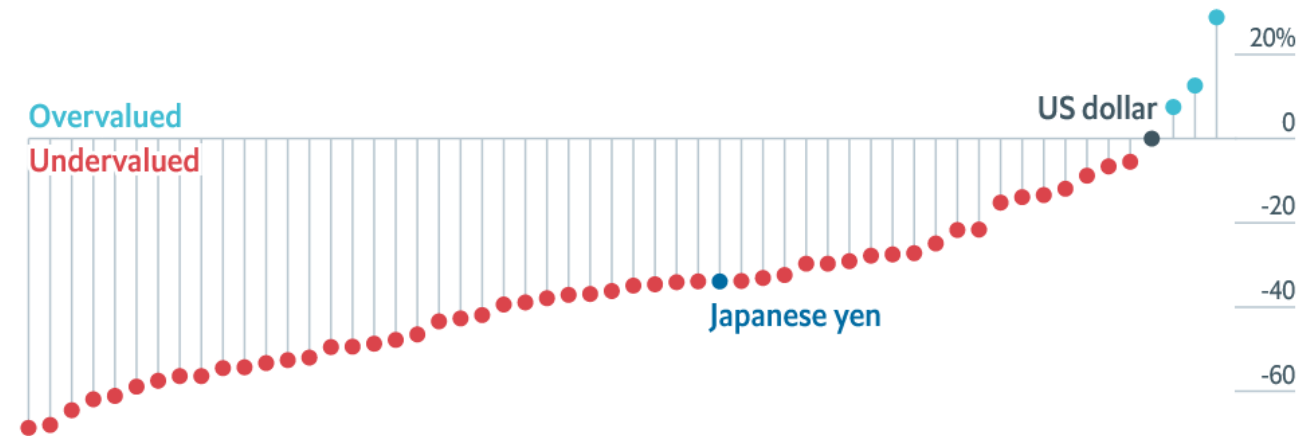
104.30 ¥/\$

$$100\% \left( \frac{68.90 - 104.30}{104.30} \right) = -33.9\%$$

¥ is **33.9% undervalued**

The Japanese yen is **34% undervalued** against the US dollar

January 2021



A Big Mac costs ¥390 in Japan and US\$5.66 in the United States. The implied exchange rate is 68.90. The difference between this and the actual exchange rate, 104.30, suggests the Japanese yen is **33.9% undervalued**

<https://www.economist.com/big-mac-index>

# Obstacles to PPP Theory

PPP Theory does not hold exactly, because

- Transportation costs are not zero
- Many goods and services (e.g. haircuts) are non-tradable
- Barriers to trade may be present
- Other determinants of exchange rate matter

Nonetheless, one implication of PPP Theory has held up well ...

# PPP Theory and inflation differentials

$$\text{PPP Exchange Rate} = \frac{\text{Price level in Japan (¥)}}{\text{Price level in US ($)}}$$

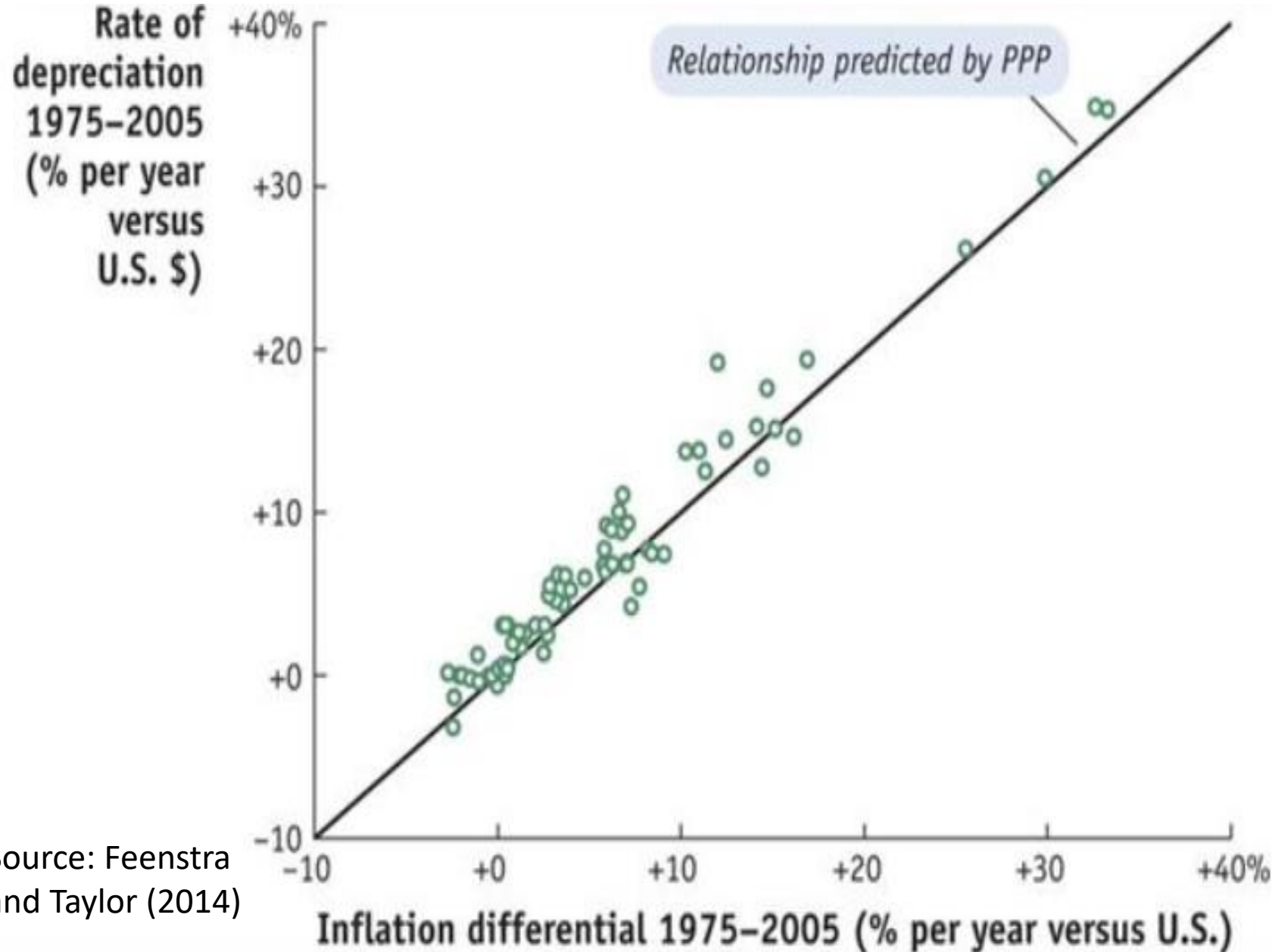
Recall growth rate approximation:  $g_{A/B} \approx g_A - g_B$

Thus,  $g_{\text{PPP Exchange Rate}} \approx \text{Japan inflation rate} - \text{US inflation rate}$

PPE Theory predicts that

- If Japan inflation rate > US inflation rate, \$ **appreciates** against ¥
- If Japan inflation rate < US inflation rate, \$ **depreciates** against ¥

# Inflation differential and currency depreciation 1975-2005



PPP Theory predicts that countries with inflation rates X% per year higher than US will see their currencies depreciate by X% per year against the US dollar

Source: Feenstra and Taylor (2014)

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- Floating, fixed and managed exchange rates
- 1997-8 Asian Currency Crisis

The exchange rate and the macroeconomy



# Flexible, Fixed and Managed Exchange Rates

When governments (mainly central banks) allow demand and supply to operate freely in the currency market, we say there is a **floating** a.k.a. **flexible** exchange rate

In the US Dollar-British Pound market, neither the Fed nor the Bank of England intervene in the currency market

- The \$-£ exchange rate is a floating exchange rate

# Fixed Exchange Rates

The Hong Kong Dollar-US Dollar market has a **fixed exchange rate** (a.k.a. **peg**) of HKD7.8/USD since 1983

The Hong Kong Monetary Authority (HKMA) **participates in the currency market** to ensure that the exchange rate stays within 0.05HKD of the **peg** (i.e. 7.75 to 7.85)

7 Nov 2009 00:00 UTC - 4 Nov 2019 08:58 UTC USD/HKD close:7.83717 low:7.74960 high:7.85661



# Managed Exchange Rates

7 Nov 2009 00:00 UTC - 4 Nov 2019 09:01 UTC USD/SGD close:1.35722 low:1.20074 high:1.45161



The Monetary Authority of Singapore also **participates in currency markets**

It manage the value of the Singapore dollar against currencies of its major trading partners, but without explicit commitments

The Singapore Dollar-US Dollar market has a **managed exchange rate**, a.k.a. **managed float**

# Why fix (or manage) the exchange rate?

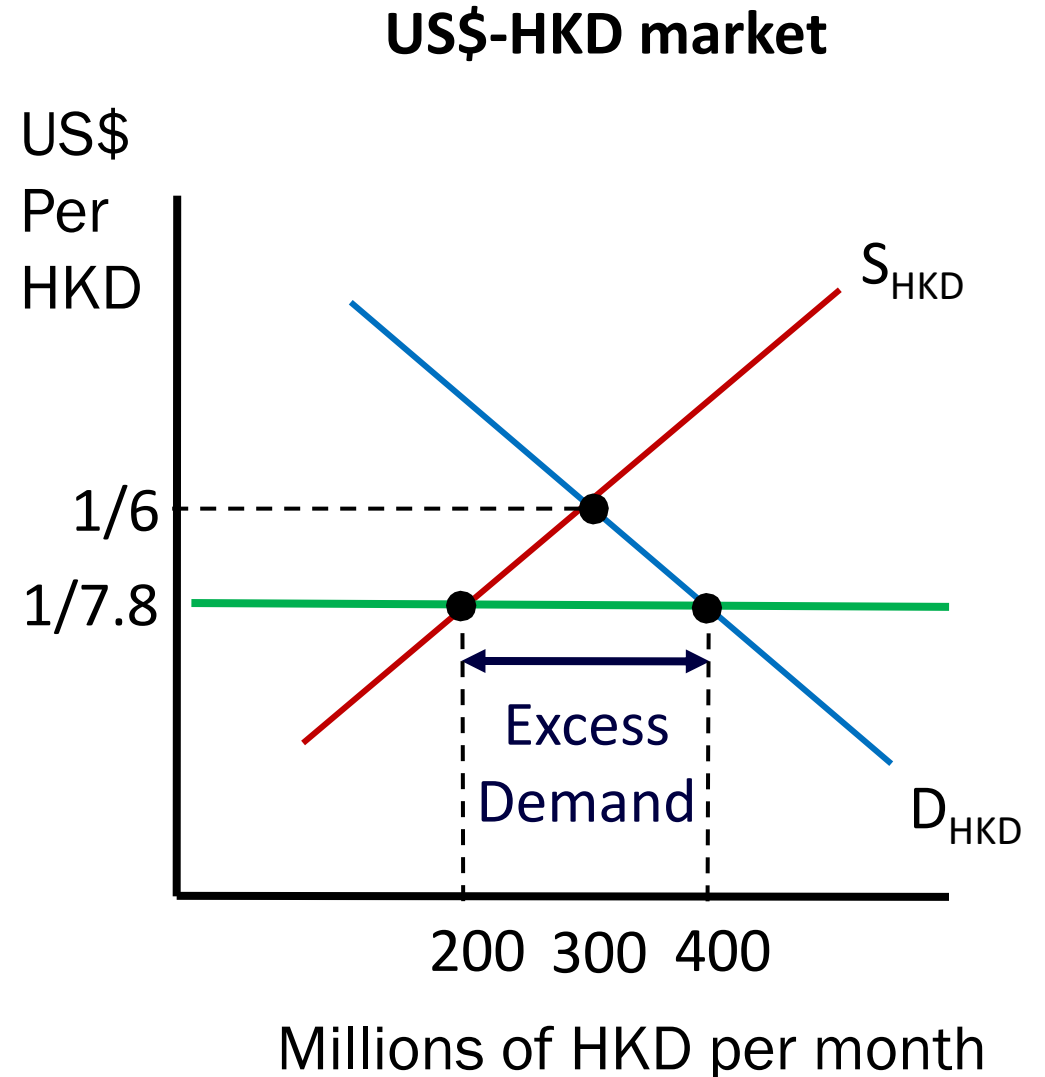
Different countries have different reasons

- **Preventing or slowing down appreciation** helps exporters and those competing against imports
- **Preventing or slowing down depreciation** helps import-using industries and consumers
- **Keeping the exchange rate stable** reduces the risk for doing international business transactions
- Pegging one's currency to USD **ties one's monetary policy** to that of the Fed, gaining credibility to fight inflation

# Preventing appreciation

Consider the HKD peg to USD

- There is **excess demand** for HKD
- To maintain the peg, HKMA must **sell 200 million HKD** each month at 1/7.8 US\$ per HKD
- This means HKMA **buys US\$ 25.6 million** each month
- The HKMA thus accumulates **foreign exchange reserves**



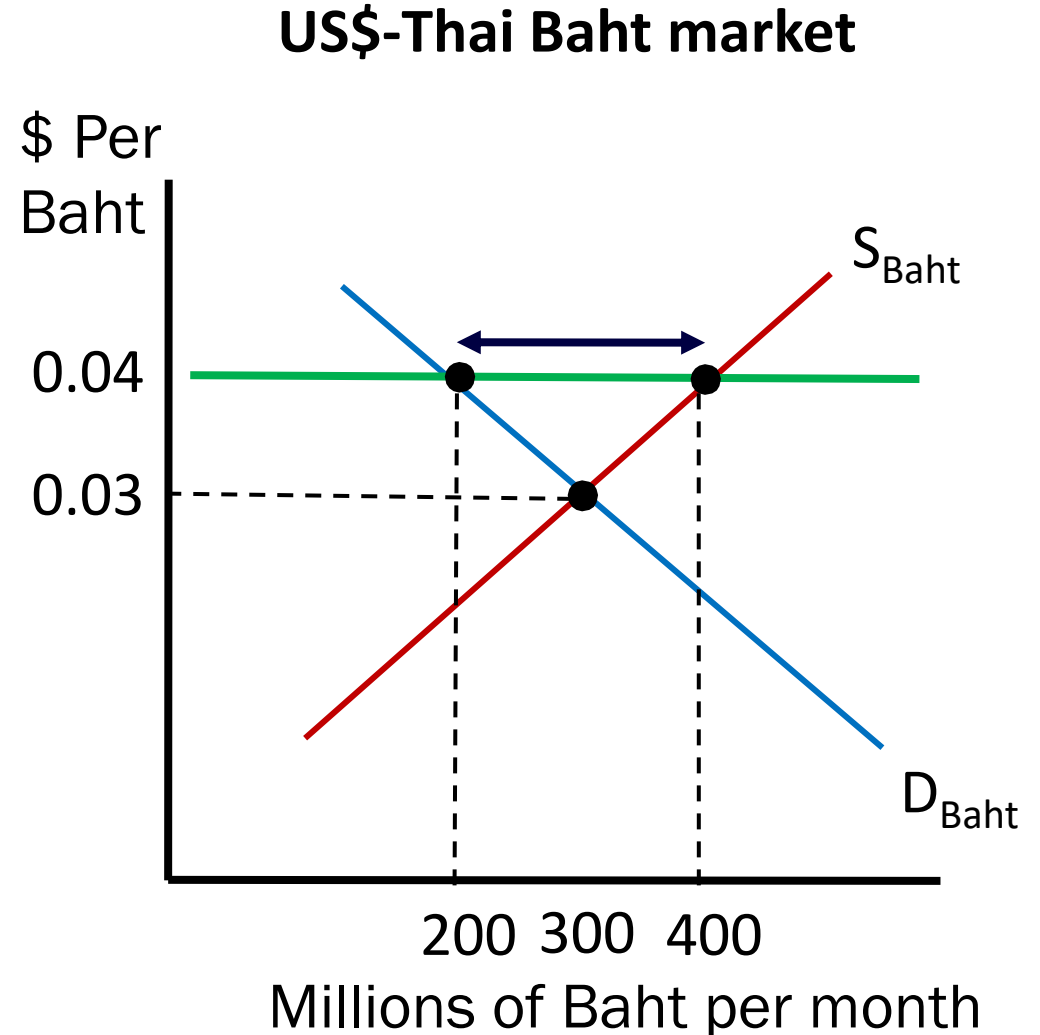
## Active Learning: Preventing Depreciation

### Fill in the blanks

The Baht is pegged at \$0.04/Baht. At this peg, there is **excess** \_\_\_\_\_

Bank of Thailand must \_\_\_\_\_  
200 million Baht each month  
at US\$ \_\_\_\_\_ per Baht

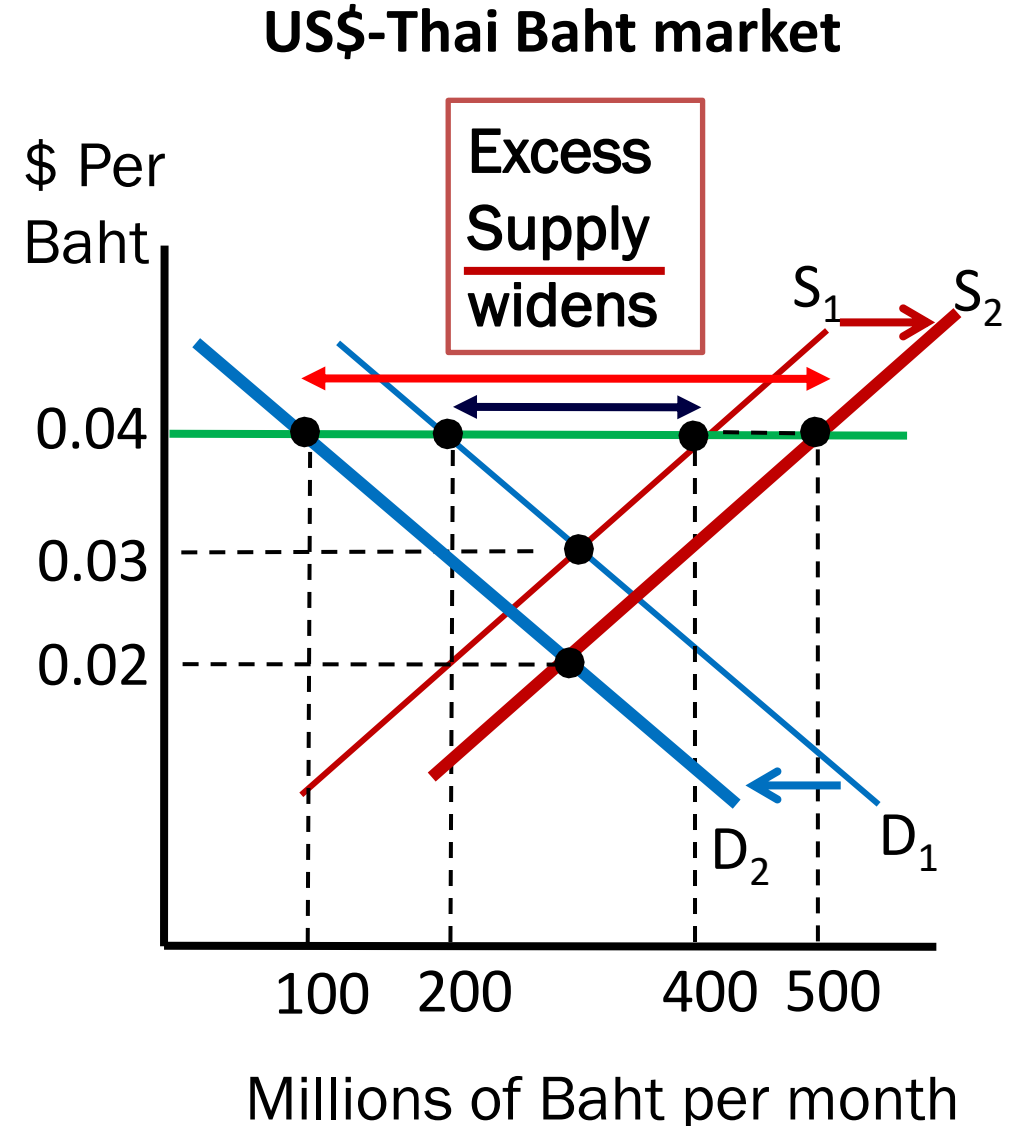
It depletes US\$ \_\_\_\_\_ of  
foreign exchange reserves  
every month



# Expectations of depreciation

If currency traders expect depreciation

- Supply of the Baht shifts **right**
- Demand for Baht shifts **left**
- Excess **supply** widens
- Even faster depletion of reserves!



# Preventing depreciation: if foreign exchange reserves run out...

Options for the Bank of Thailand:

**Allow the Baht to float**

Whereupon  
**the baht will depreciate**

**Devalue the Bhat**

**Lower the peg**  
to a  
sustainable  
level

**Impose capital controls**

Restrictions  
on inflows  
and/or  
outflows of  
funds

**Borrow from IMF**

**International Monetary Fund**  
(IMF) as lender  
of last resort!

IMF imposes  
stringent  
conditions!



# 1997-8 Asian Currency Crisis

Bank of Thailand **abandoned its peg in July 1997**

- Baht depreciated by nearly 20% but kept weakening
- Thai banks and businesses with US\$ debt are now in trouble
- Currency crisis became financial crisis and serious recession!
- By January 1998, the Baht had depreciated by over 50%

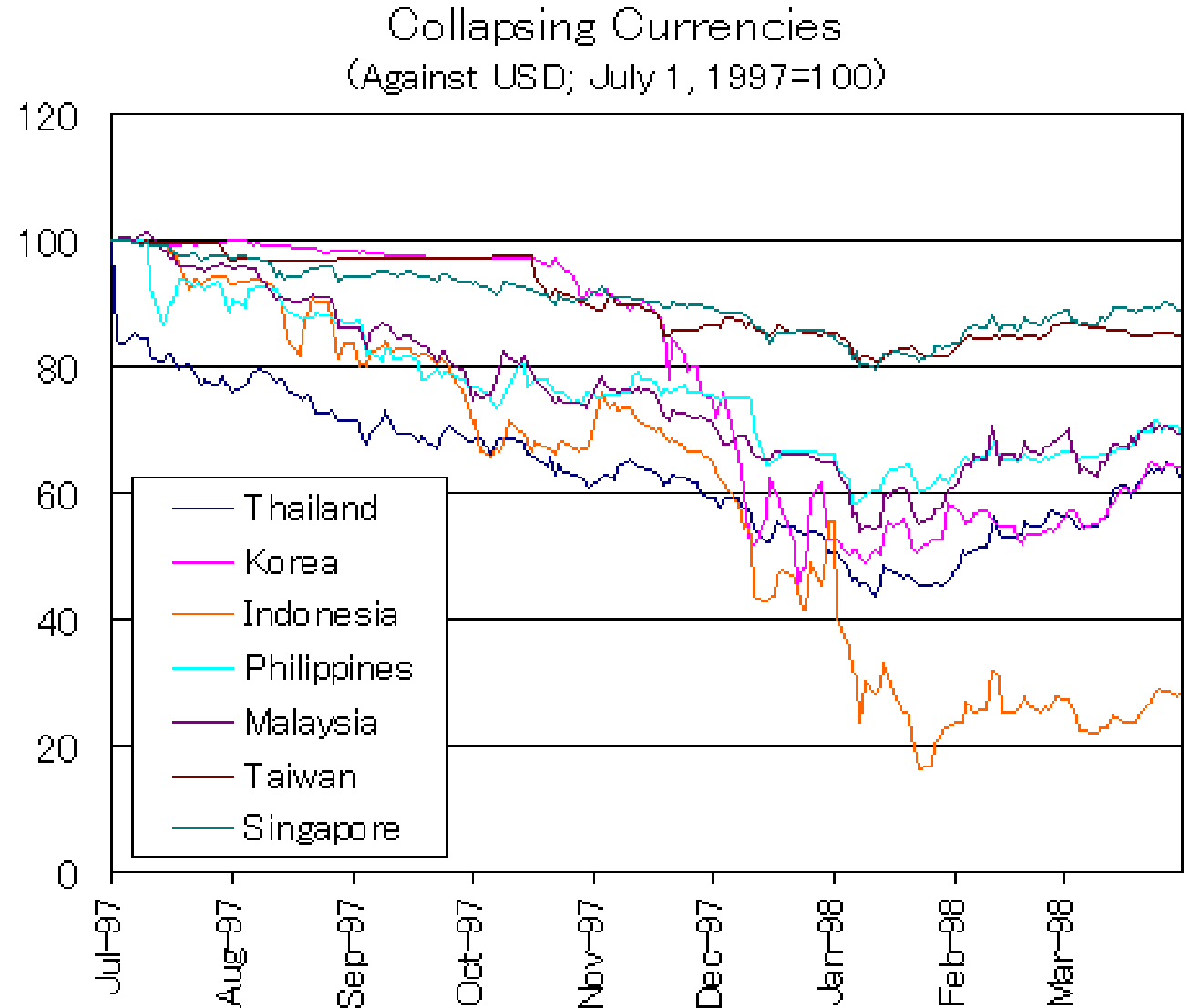
Thailand was forced to take emergency loans from the IMF

# ... but spread to other Asian currencies

Investors started to wonder if banks and companies in nearby countries were similarly vulnerable!

Currency crisis spread to rest of Asia

Like a bank **run** developing into a banking **panic** !





# Aftermath of 1997-8 Asian Currency Crisis

Thailand, Indonesia, South Korea received IMF loans to stabilize currencies, but had to cut budget deficits and raise interest rates during recessions

Malaysia imposed **capital controls** and devalued the MYR

Upon recovery and repayment of IMF loans, these and neighbouring countries learned lessons

- The need for ample foreign exchange reserves
- The need to monitor private sector borrowing in foreign currency



# Egypt devalues currency by 48% to meet IMF demands for \$12bn loan

The Egyptian pound will be allowed to float as government struggles with worst economic crisis in decades

Associated Press in Cairo

Thursday 3 November 2016 12.43 GMT



📷 An employee counts Egyptian pounds in a bank in Cairo. Photograph: Mohamed Abd El Ghany/Reuters

Egypt has devalued its currency by 48% and announced that it will be allowed to float - measures that meet a key demand by the International Monetary Fund in order to secure a \$12bn (£9.6bn) loan over three years to overhaul its ailing economy.

# UPDATE 2-Iraq devalues dinar as oil prices squeeze revenue

From

1,182 dinars/\$

To

1,460 dinars/\$

“The financial crisis which Iraq suffered due to the coronavirus pandemic caused a decline in oil prices that caused decreasing oil revenues, altogether have caused a large deficit in the federal budget,” the central bank said in a statement.

The devaluation decision came as a preemptive move to prevent “draining Iraq’s foreign reserves” and help government to secure public servants’ salaries, the bank said.

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- Exchange rate, spending and output
- Exchange rate and monetary policy
- Exchange rate and the trade balance

# Exchange rate, spending and output

We have already seen that rise in output can lead to currency depreciation

Causation also runs the other way:

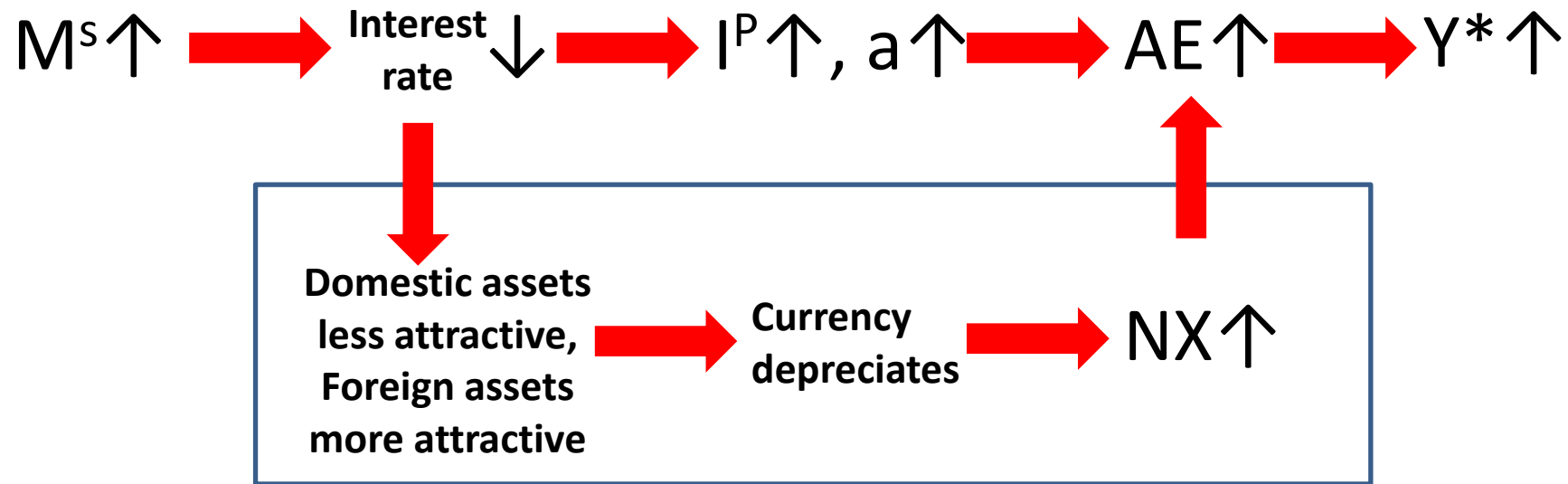
currency depreciation  $\rightarrow$  net exports  $\uparrow$   
 $\rightarrow$  AE  $\uparrow \rightarrow Y^* \uparrow$

**Exchange rate movements provide an additional source of demand shocks**



# Exchange rate and monetary policy

## Monetary policy affect the exchange rate



This **exchange rate channel** makes monetary policy's impact on output **more** powerful in an open economy than in a closed one

# Fixed exchange rate → loss of monetary autonomy

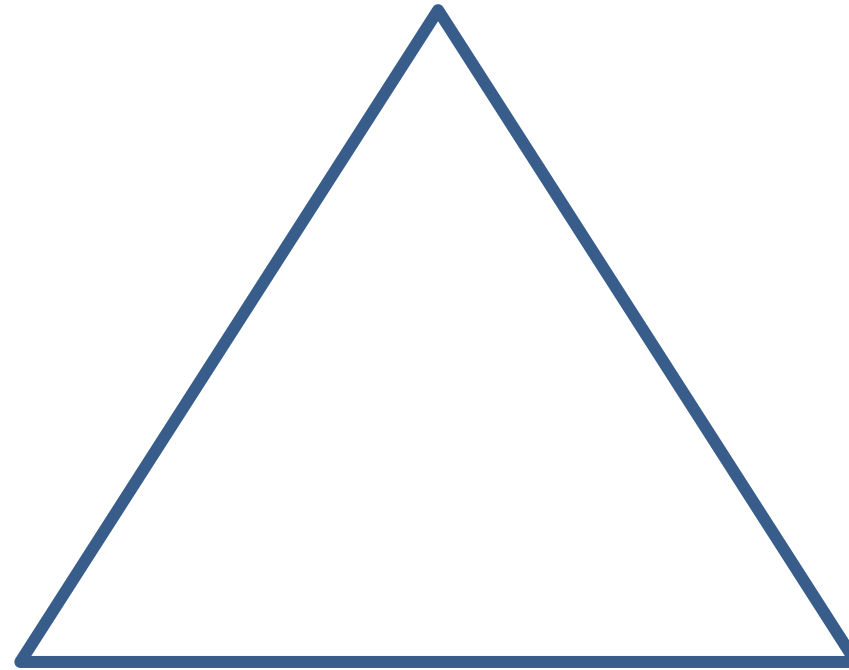
If a central bank pegs its currency to the USD, its interest rate must follow US interest rate! It cannot maintain its own monetary policy!

E.g. Suppose the interest rate in US and HK are initially the same

- If Fed ↑ US interest rate and HKMA does not follow suit, investors and traders will put **depreciation pressure on the HKD**
- HKMA cannot defend the peg forever
- As a centre of trade and finance, HK cannot afford to impose capital controls

# The Trilemma a.k.a. the Impossible Trinity

Free Capital Mobility



You can at most pick have  
2 out of 3 policy ideals

You cannot have all 3!

Exchange rate  
management

Monetary  
Autonomy

# Choices made by three central banks

Free Capital Mobility

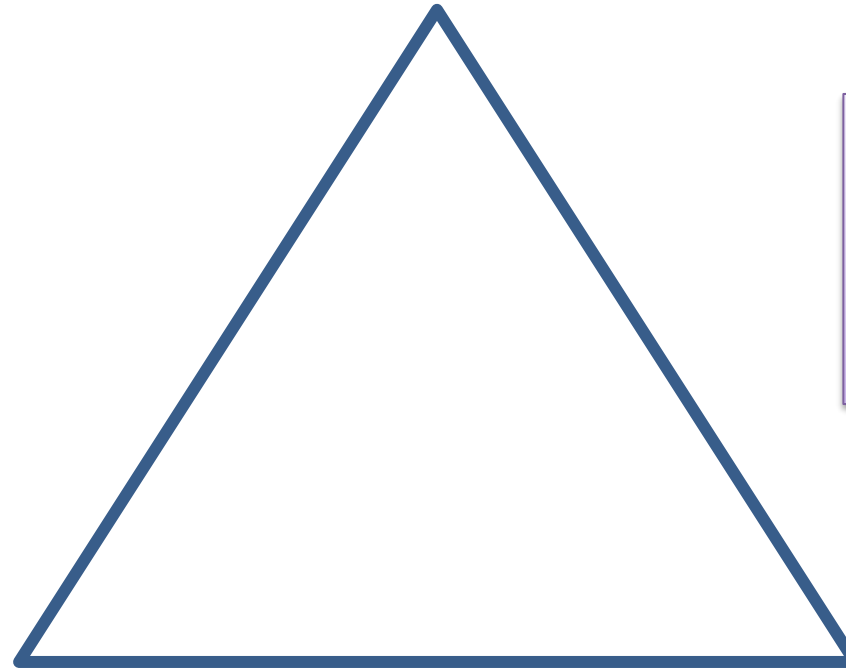
HKMA gives up  
monetary  
autonomy

European Central Bank  
gives up exchange rate  
management

Exchange rate  
management

Peoples Bank of China  
(PBOC) gives up free  
capital mobility

Monetary  
Autonomy



# Exchange rate and the trade balance

**Trade deficit** = Imports – Exports > 0

**Trade Surplus** = Exports – Imports > 0

**Bilateral trade balance** is measured against one other country

- Singapore has a **bilateral trade deficit** against the USA

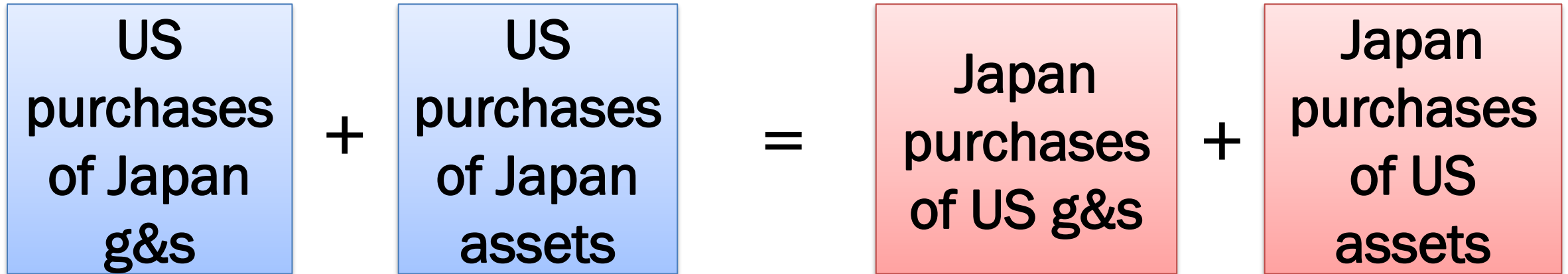
**Overall trade balance** is measured against the world

- Singapore has an **overall trade surplus**

# Currency market equilibrium

In the \$-¥ market ...

**Quantity of \$ supplied** = **Quantity of \$ demanded**



# Trade Deficit = Net Financial Inflow (I)

Rearranging the boxes ...

Suppose US buys more goods  
from Japan than Japan buys  
from US

Then, Japan buys more US assets  
than US buys Japan assets

$$\begin{array}{|c|} \hline \text{US} \\ \hline \text{purchases} \\ \hline \text{of Japan} \\ \hline \text{g\&s} \\ \hline \end{array} - \begin{array}{|c|} \hline \text{Japan} \\ \hline \text{purchases} \\ \hline \text{of US g\&s} \\ \hline \end{array} = \begin{array}{|c|} \hline \text{Japan} \\ \hline \text{purchases} \\ \hline \text{of US} \\ \hline \text{assets} \\ \hline \end{array} - \begin{array}{|c|} \hline \text{US} \\ \hline \text{purchases} \\ \hline \text{of Japan} \\ \hline \text{assets} \\ \hline \end{array}$$

# Trade Deficit = Net Financial Inflow (II)

US trade deficit with Japan = US net financial inflow\* from Japan

Japan trade surplus with US = Japan net financial outflow to US

$$\begin{array}{|c|} \hline \text{US} \\ \hline \text{purchases} \\ \hline \text{of Japan} \\ \hline \text{goods} \\ \hline \end{array} - \begin{array}{|c|} \hline \text{Japan} \\ \hline \text{purchases} \\ \hline \text{of US} \\ \hline \text{goods} \\ \hline \end{array} = \begin{array}{|c|} \hline \text{Japan} \\ \hline \text{purchases} \\ \hline \text{of US} \\ \hline \text{assets} \\ \hline \end{array} - \begin{array}{|c|} \hline \text{US} \\ \hline \text{purchases} \\ \hline \text{of Japan} \\ \hline \text{assets} \\ \hline \end{array}$$

\* Also called **net capital inflow**

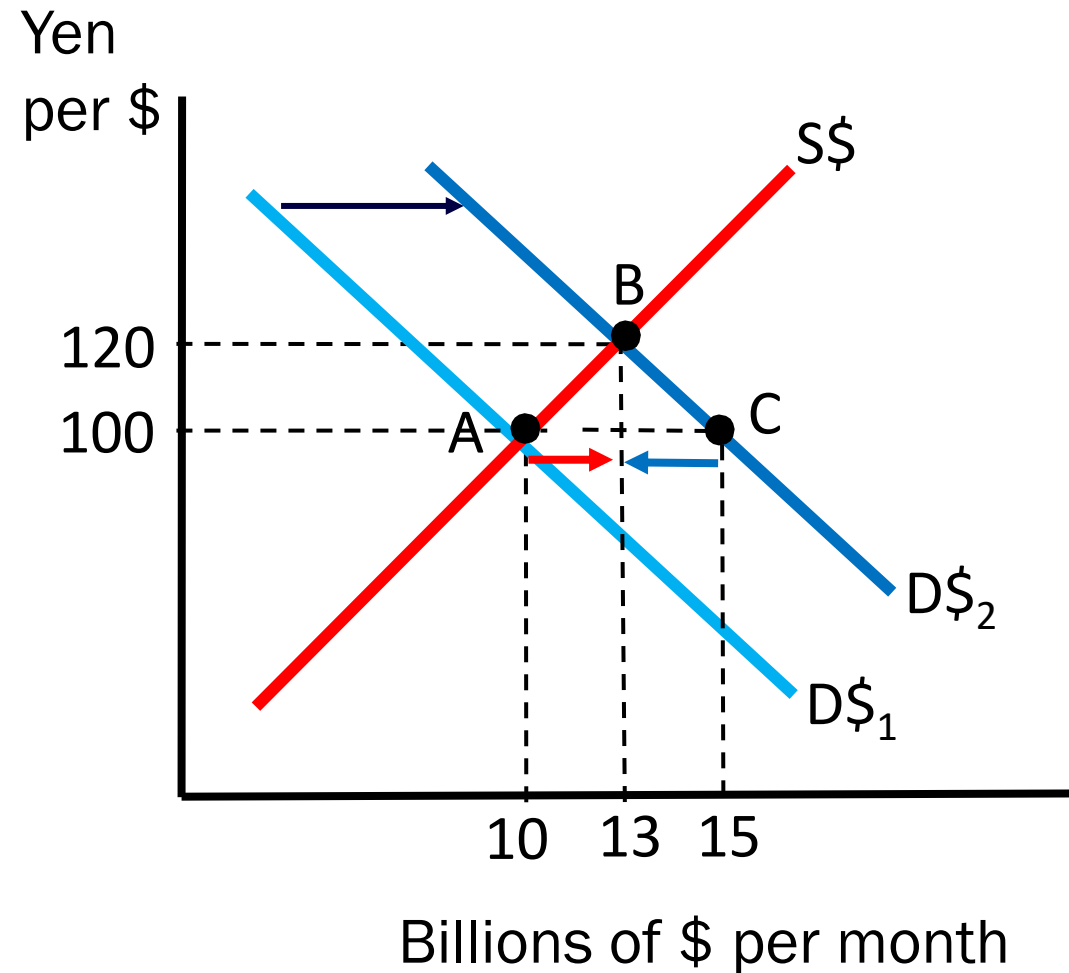


# Financial decisions of Japan residents affects US trade deficit

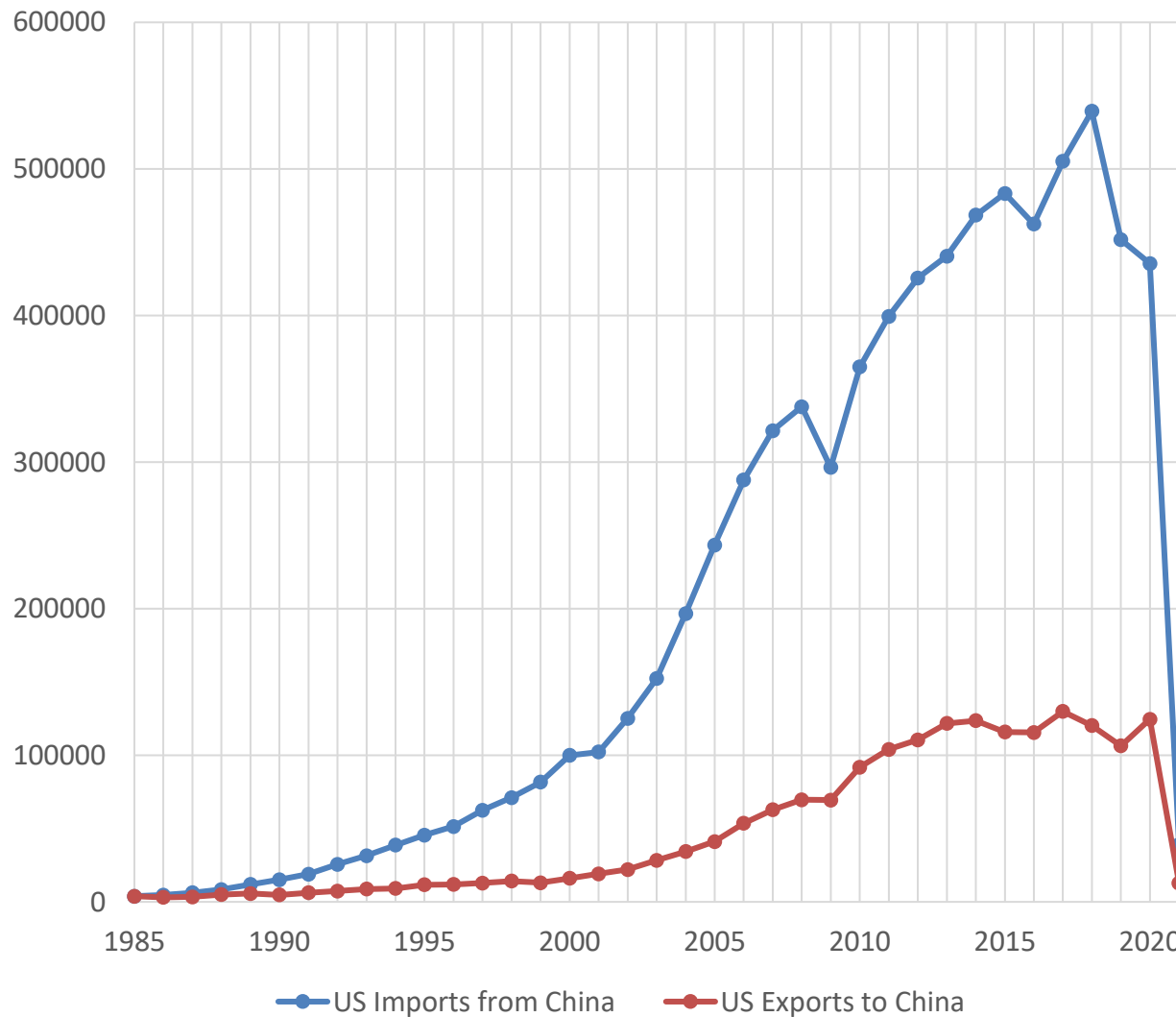
Start at A

Japan residents decide to buy \$5 billion of US assets

- Demand for \$ shifts **right**
- \$ **appreciates**
- US exports to Japan ↓ by \$2bn (movement along  $D\$_2$ )
- US imports from Japan ↑ by \$3bn (movement along  $S\$$ )
- US trade deficit rises by **\$5 billion!**



# The US merchandise trade deficit with China



Source: US Census Bureau

From 1985 to 2018, nominal US exports to China have grown at 10.6%/yr rate

But nominal US imports from China have grown at 15.6%/yr rate!

2018 US trade deficit was \$419bn

## PRESS RELEASES

# Treasury Designates China as a Currency Manipulator



August 5, 2019

**Washington** – The Omnibus Trade and Competitiveness Act of 1988 requires the Secretary of the Treasury to analyze the exchange rate policies of other countries. Under Section 3004 of the Act, the Secretary must "consider whether countries manipulate the rate of exchange between their currency and the United States dollar for purposes of preventing effective balance of payments adjustments or gaining unfair competitive advantage in international trade." Secretary Mnuchin, under the auspices of President Trump, has today determined that China is a Currency Manipulator.

<https://home.treasury.gov/news/press-releases/sm751>

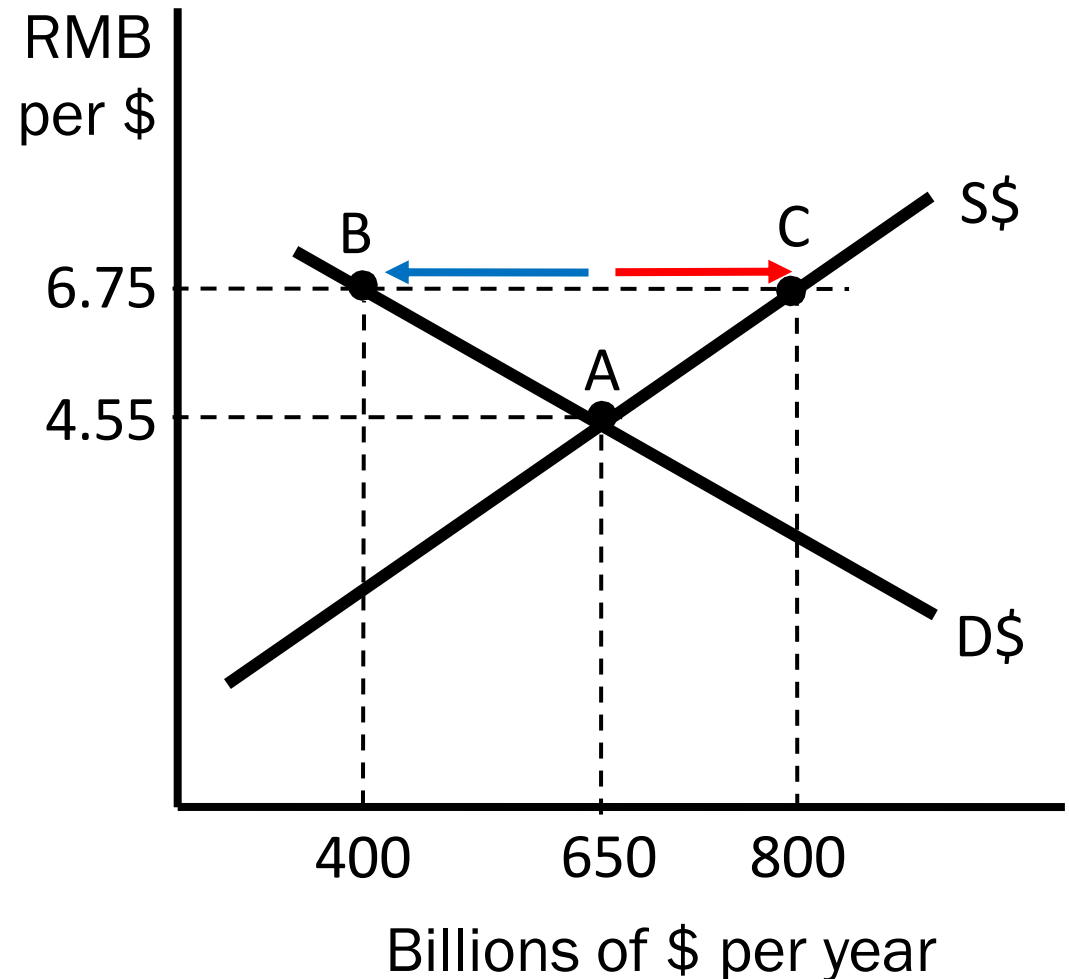
## Active learning: exchange rate policy and the trade deficit

Equilibrium price of \$ is 4.55RMB

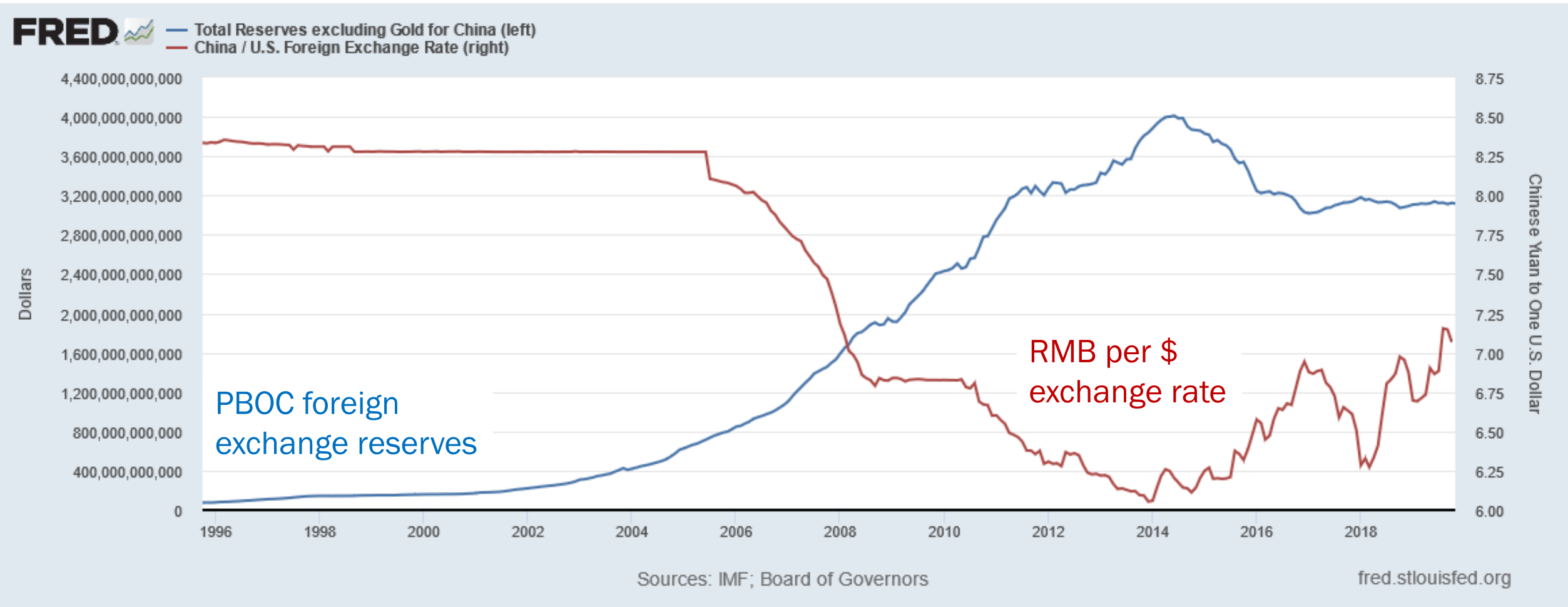
Suppose PBOC keeps price of \$ at 6.75RMB by \_\_\_\_\_

Effect of PBOC action on trade:

- US exports to China ↓ by \_\_\_\_\_ (movement along D\$)
- US imports from China ↑ by \_\_\_\_\_ (movement along S\$)



# RMB-\$ exchange rate and PBOC foreign exchange reserves



## Since mid-2014 ...

Recent large financial outflows by China's private sector from mid-2014 to early 2017

PBOC depleted ~\$1 trillion of **foreign exchange reserves** buying RMB to slow down RMB depreciation, and also tightened capital controls during the period

Since 2017 PBOC has vastly reduced its intervention in the currency market