

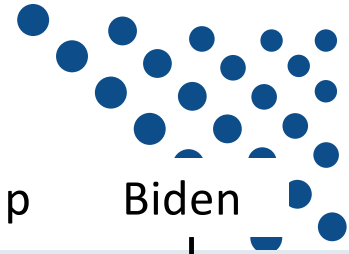
# Trade Deficits and Exchange Rates

Presentation to Arizona State University  
Jun 22, 2023

Alan Deardorff  
*University of Michigan*



# US Trade Balance = Exports minus Imports



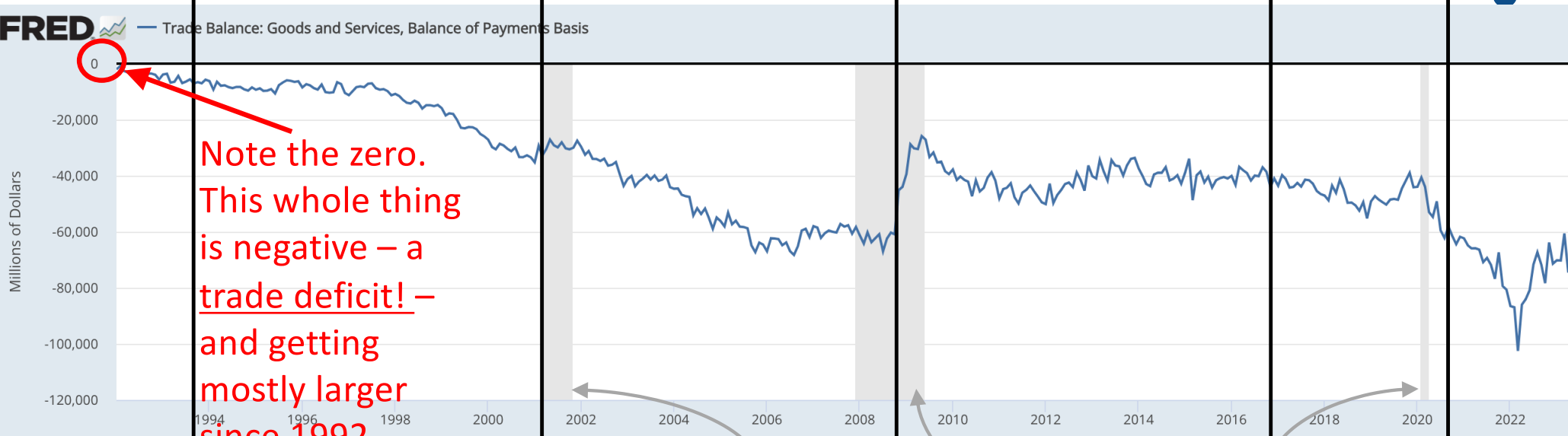
Clinton

Bush

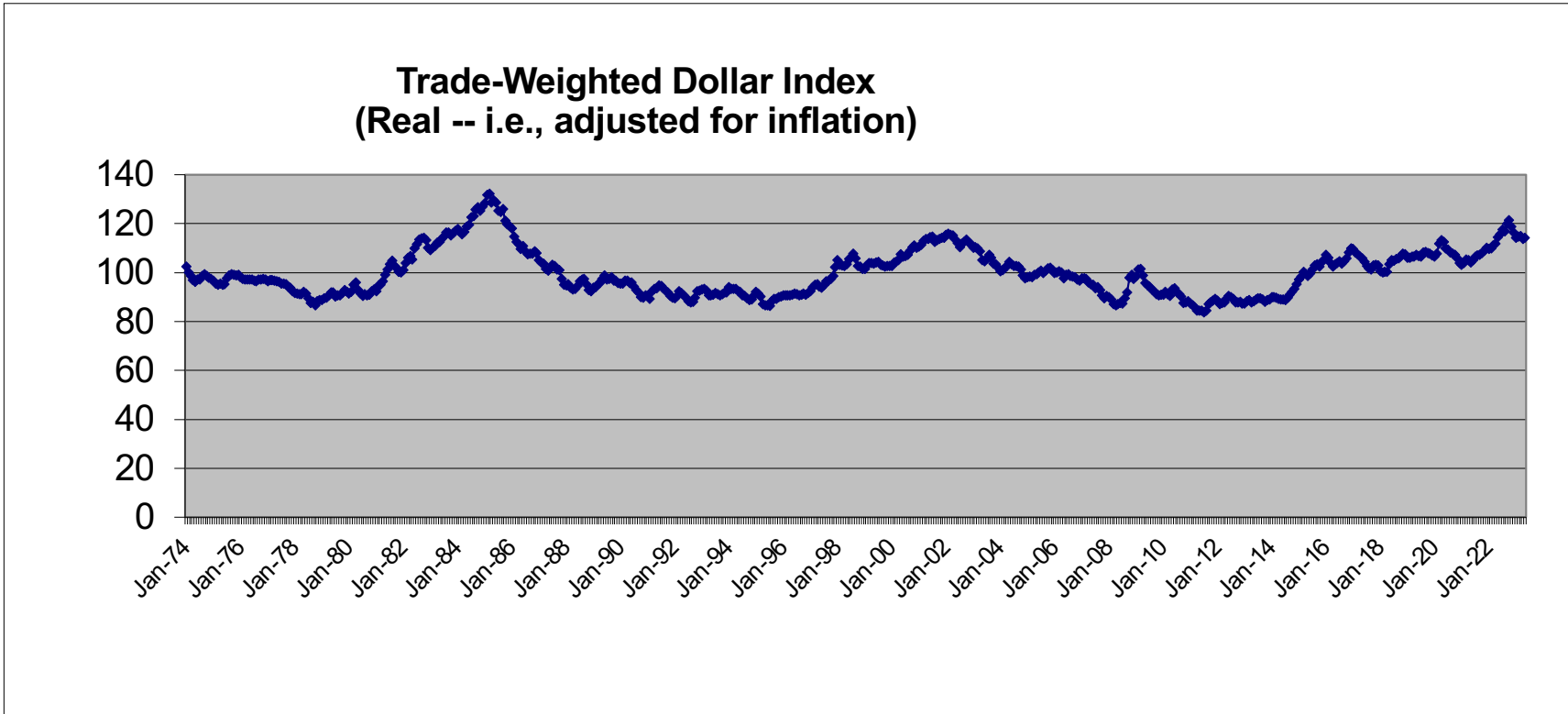
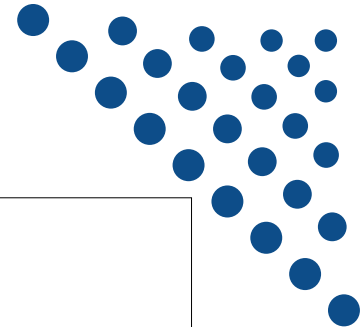
Obama

Trump

Biden



# US Exchange Rate



Source:  
Federal  
Reserve

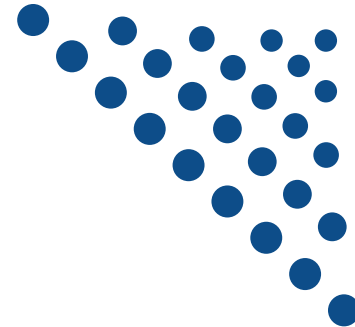
# Outline

- **The trade deficit**

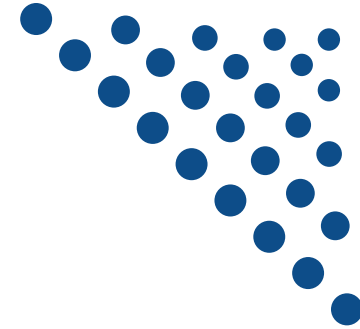
- How it's defined
- How it has changed over time, US and other
- What it means and does not mean

- **Exchange rates**

- What they are
- How they are determined
- How they have changed over time, US and other
- How they matter
- Currency manipulation (if time allows)



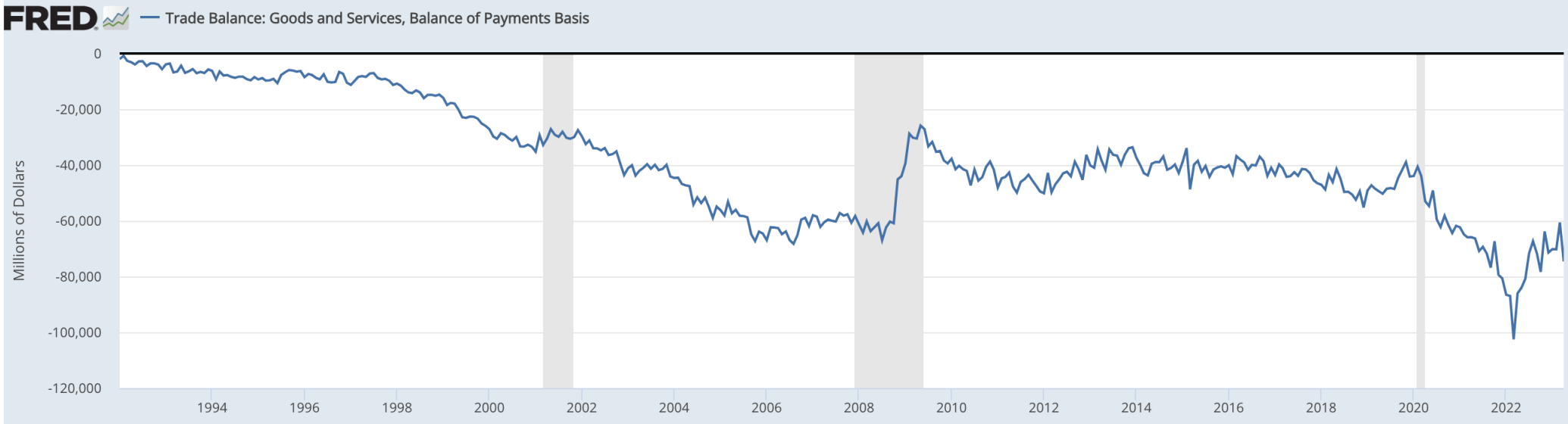
# Trade Deficit



- **The trade balance**
  - Defined as Exports minus Imports,  $X-M$
  - May be reported for goods only, or for goods and services
- **When trade balance is negative, that's a trade deficit**
  - Thus trade deficit is Imports minus Exports,  $M-X$
- **The US:**
  - Has had a deficit for many decades
  - It has grown substantially in recent years
  - Has had a surplus for trade in services
- **Another measure: “The Current Account Balance”**
  - This is the trade balance plus:
    - International income flows (interest, dividends, profits, wages)
    - International transfer payments (e.g., remittances, aid)
  - Not very different from the trade balance



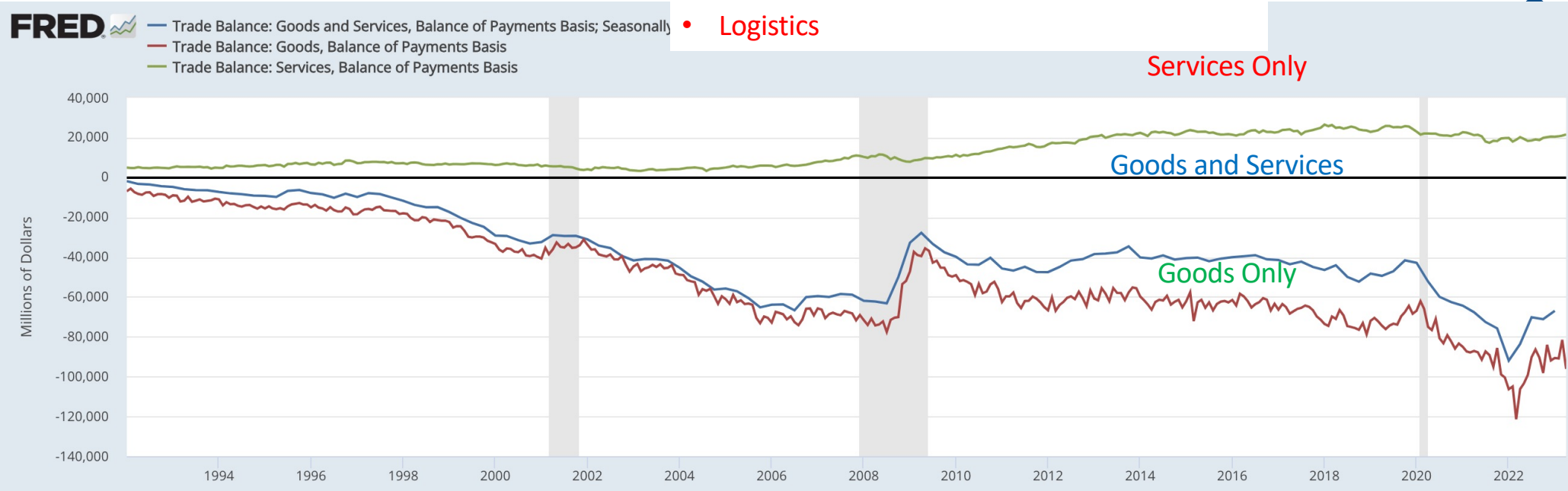
# US Trade Balance: Goods and Services



# US Trade Balances

## Examples of services trade:

- Professional (legal, engineering, accounting)
- Banking
- Computer
- Construction
- Logistics

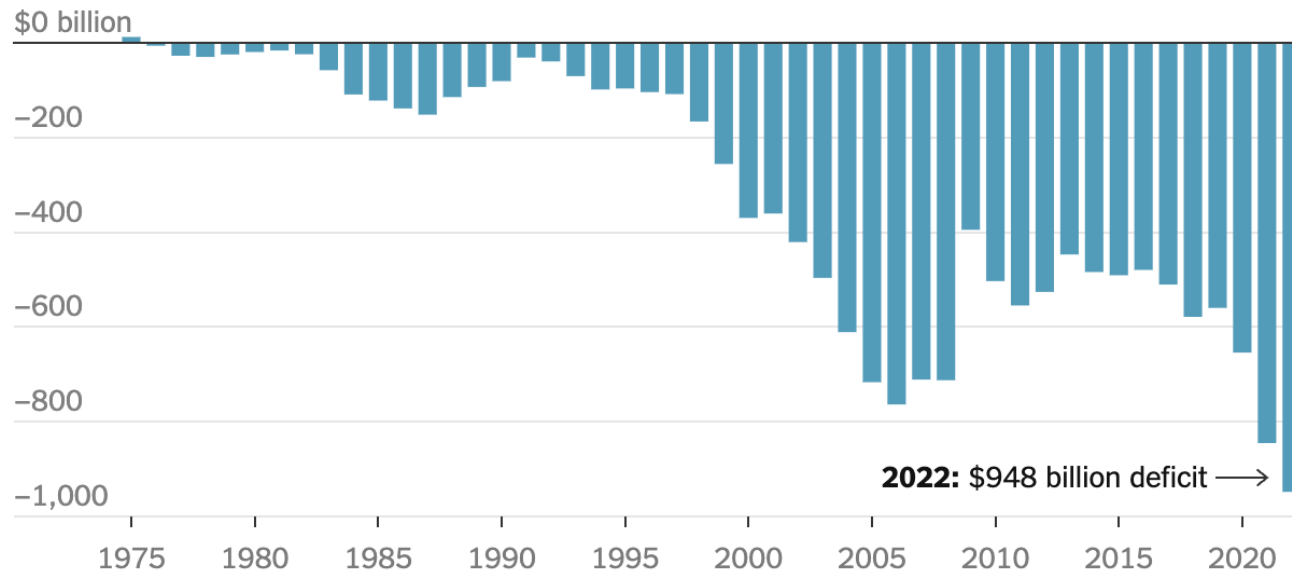




# America's Trade Deficit Surged in 2022, Nearing \$1 Trillion



Annual U.S. trade balance

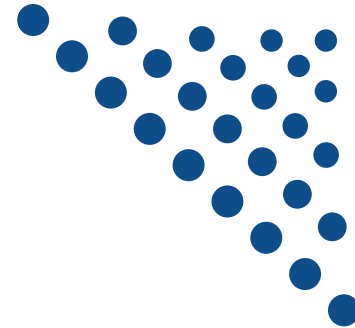


Source:  
NYT, Feb 8, 2023

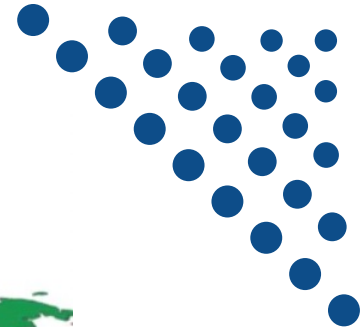
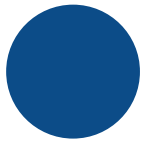
Goods and services, seasonally adjusted, not adjusted for inflation



# Trade Deficit

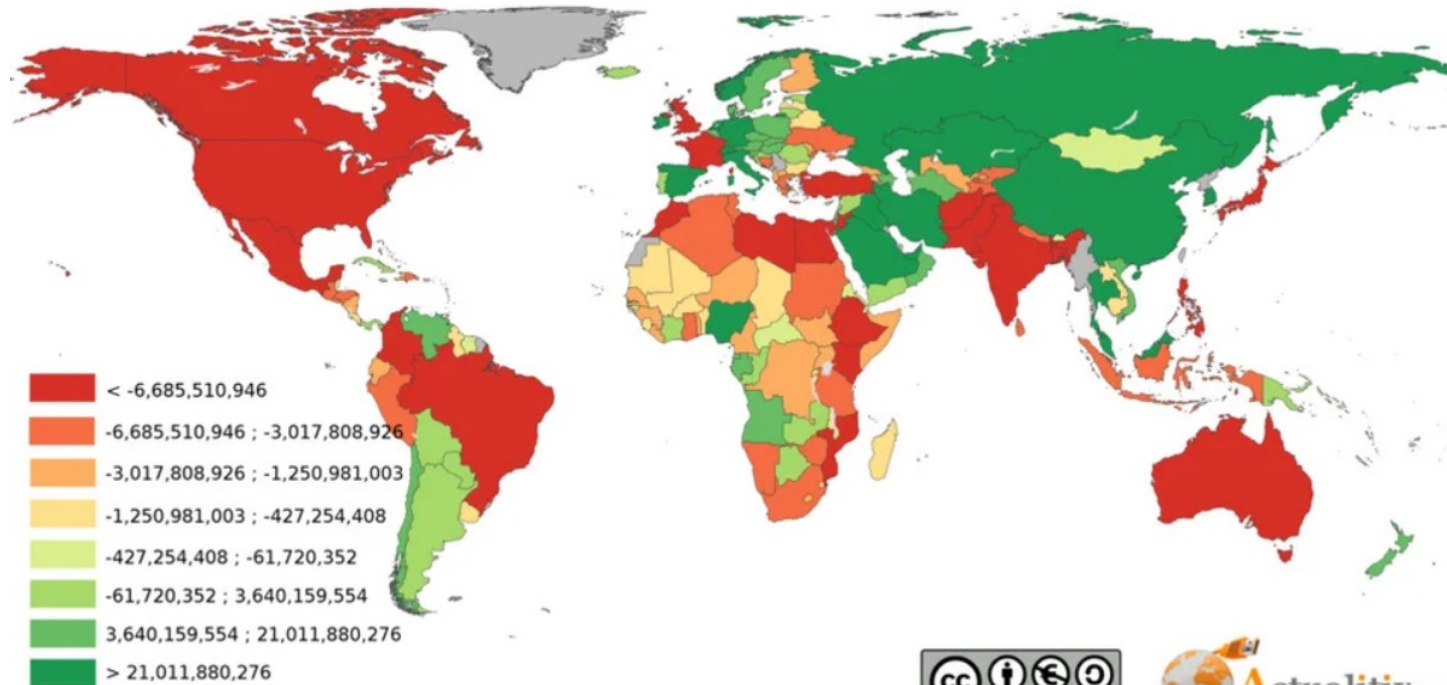


- **For the World as a Whole**
  - Since one country's imports are another's exports
    - ↳ The sum of all deficits and surpluses must be zero
- **Therefore US deficit implies rest of world has surplus**
- **But many countries have deficits**



## World Map: Balance of trade (US Dollars)

Balance of trade (US Dollars)

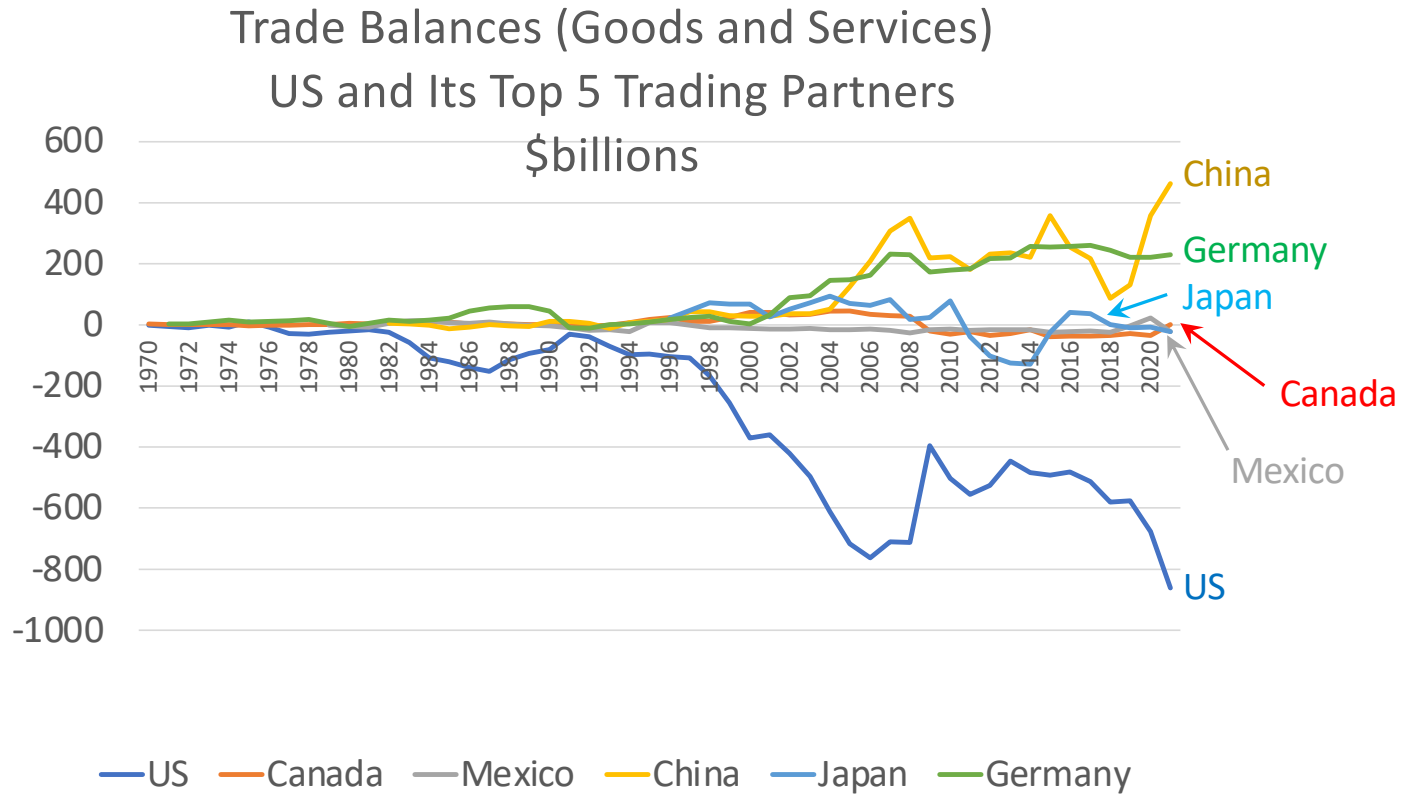
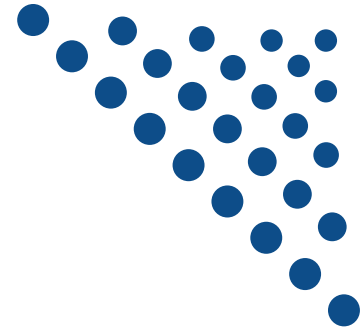


Source:  
Reddit

Source : The World Bank - 2014  
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# Trade Balances Over Time



Source:  
IMF  
*International  
Financial  
Statistics*



# Trade Deficit

- **What a trade deficit means**

- Imports > Exports
- The gap must be paid for somehow. By
  - Capital inflows (borrowing, sale of stocks & bonds)
  - Sale of property (real estate, companies)
  - Gifts from foreigners (not relevant for US)
  - Others willing to hold more of our currency (very relevant for US)
- What explains the gap? Look at GDP (Gross Domestic Product), which measures both production and income in a country:

$$\text{GDP} = C + I + G + X - M$$

# What a Trade Deficit Means

Production (=Income)

$$\text{GDP} = C + I + G + X - M$$

Consumption  
= Household  
spending

Investment  
= Business  
spending on  
equipment  
and  
inventories  
(not inputs)

Government  
= Purchases by  
government at  
all levels

Exports

Imports  
(Subtracted  
because C, I,  
and G all  
include  
imports)

# What a Trade Deficit Means

$$\begin{array}{ccc} \text{Income} & \text{Expenditure} & \text{Trade Balance} \\ \underbrace{\text{GDP}} & = \underbrace{\text{C} + \text{I} + \text{G}} & + \underbrace{\text{X} - \text{M}} \end{array}$$

OR:

$$\begin{array}{ccc} \text{Trade Balance} & \text{Income} & \text{Expenditure} \\ \underbrace{\text{X} - \text{M}} & = \underbrace{\text{GDP}} & - \underbrace{(\text{C} + \text{I} + \text{G})} \end{array}$$

- **Therefore**

- Trade Surplus = Income minus Expenditure
- Trade Deficit = Expenditure minus Income

- **Running a trade deficit means we are spending more than our income**



# What a Trade Deficit Means

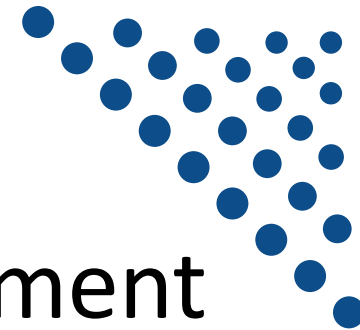
- For another interpretation, subtract net taxes from both sides

$T = \text{Net Taxes} = \text{Taxes} - \text{Transfers}$

$$\begin{aligned} \text{GDP} - T + T &= C + I + G + X - M \\ \underbrace{(\text{GDP} - T - C)}_{\text{Private Saving}} + \underbrace{(T - G)}_{\text{Gov't Saving}} - \underbrace{I}_{\text{Investment}} &= \underbrace{(X - M)}_{\text{Trade Balance}} \\ \underbrace{\hspace{10em}}_{\text{Total Saving}} & \end{aligned}$$

**Trade Balance = Saving minus Investment**

# What a Trade Deficit Means



Trade Balance = Saving minus Investment

- **Therefore**
  - If a country is saving more than needed to finance domestic investment, it will, by definition, run a trade surplus
  - If a country is saving less than needed to finance domestic investment, it will, by definition, run a trade deficit
- **That gap is also, as before, the difference between total income and total expenditure**
- **It therefore also appears as**
  - Net borrowing and lending
  - Plus net acquisition or sales of assets



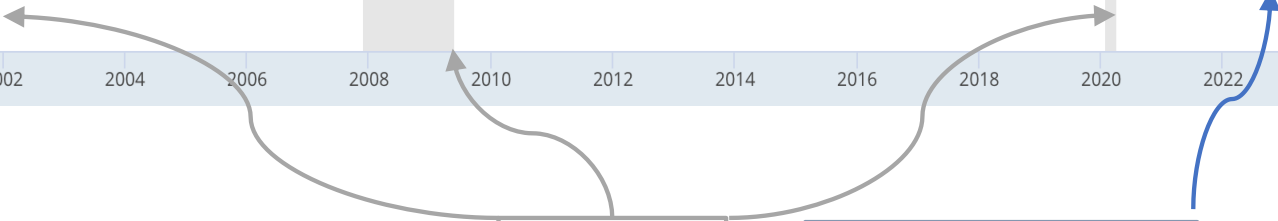
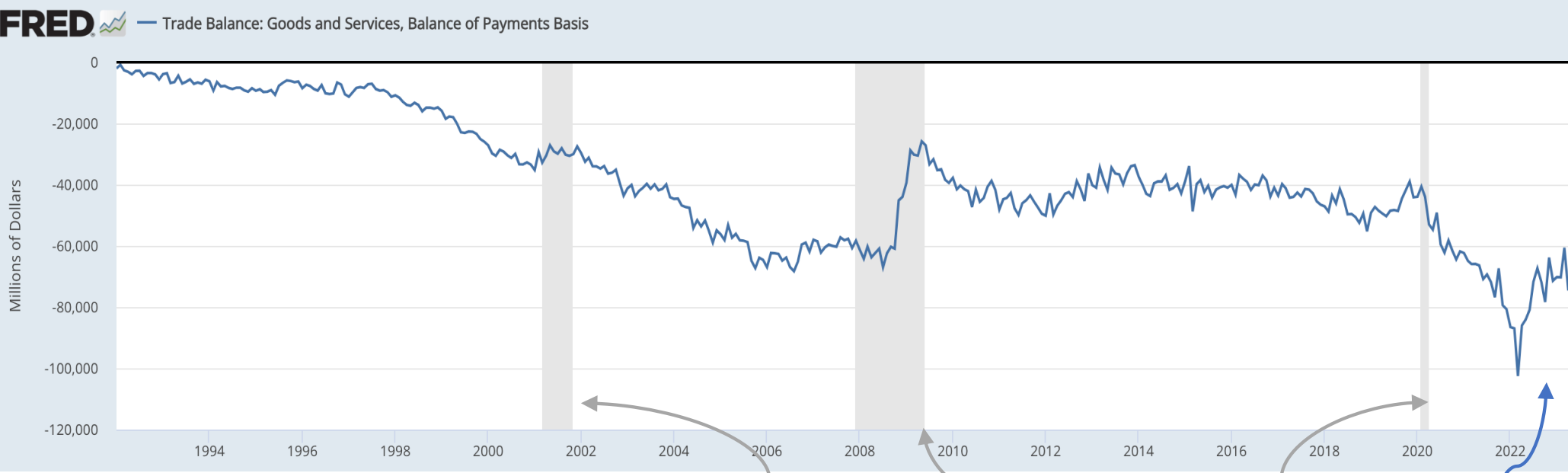
# What a Trade Deficit Does NOT Mean



- **There are several very popular interpretations of trade deficits that are simply NOT valid, even though many politicians believe them:**
  - That foreign trade barriers are hurting our exports
  - That other countries are engaged in unfair trade
  - That our firms are not competitive
  - That we are losing jobs to other countries
  - That we need to restrict trade
- **To understand why these are wrong, think about whether they could change**
  - Expenditure relative to income, or
  - Saving relative to investment
- **Possible exception: If we are in recession and these may change income**
  - But note that the trade deficit typically falls during recession, due to recession reducing expenditure



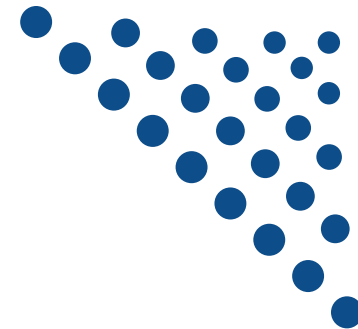
# US Trade Balance: Goods and Services



Recessions

Note that we are not in a recession now.

# US Trade Deficit



- **The US trade deficit means that the US is spending more than its income. How much?**
  - \$861 billion in 2021, according to the IMF
  - How does that compare to US GDP? GDP was \$23 trillion.
  - So US trade deficit was about 3.7% of US GDP
  - Collectively, we and our government are spending almost 4% above our income.
  - How does that compare to other countries?

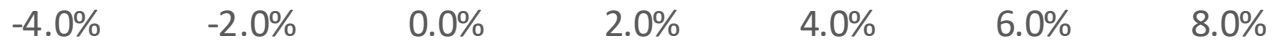


# Trade Balance / GDP of US and It's Top Ten Trading Partners, 2019

Country	Trade w US (\$ billions)	Trade Balance / GDP (%)
US	Trade w US	= 2.7% (grew to 3.7% in 2021)
Canada	619.0	-1.5%
Mexico	617.7	-0.5%
China	579.1	1.0%
Japan	221.6	-0.5%
Germany	189.7	5.8%
S. Korea	136.8	3.5%
UK	133.2	-1.0%
France	97.2	-1.0%
India	94.3	-2.5%
Italy	82.5	3.5%

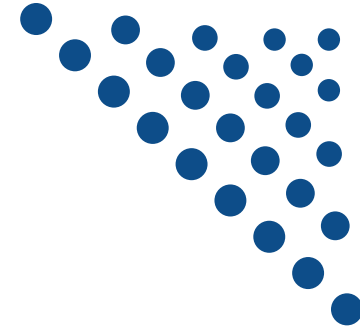
Source:  
IMF  
*International  
Financial  
Statistics*

Trade balance  
includes  
goods and  
services





## Trade Balance / GDP Sample countries, 2019

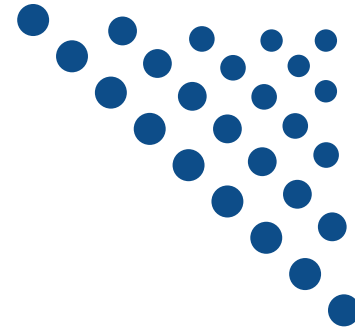


Singapore	36.9 %
Ireland	12.4%
Switzerland	9.8%
Germany	5.7%
China	0.9%
Japan	-0.2%
US	-2.7%
Romania	-4.1%
Ukraine	-8.1%
Philippines	-9.6%
Haiti	-24.5%
Guyana	-62.2%

Source:  
IMF  
*International  
Financial  
Statistics*

Trade balance  
includes  
goods and  
services

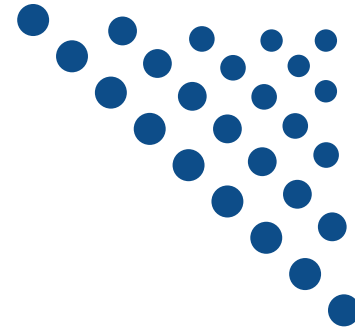
# US Trade Deficit



- **Is it a problem?**

- Yes, if others are unwilling to lend to us or to hold our assets (& our money)
- But US, at least for now, has both a strong currency and a strong economy
  - Others trust assets in the US more than others
  - They also rely on US dollars for transactions and reserves
  - We have an “Exorbitant Privilege” because of the US dollar’s role in the world economy (said by Valery Giscard d'Estaing in the 1960s) when most currencies were pegged to dollars, but still valid today)

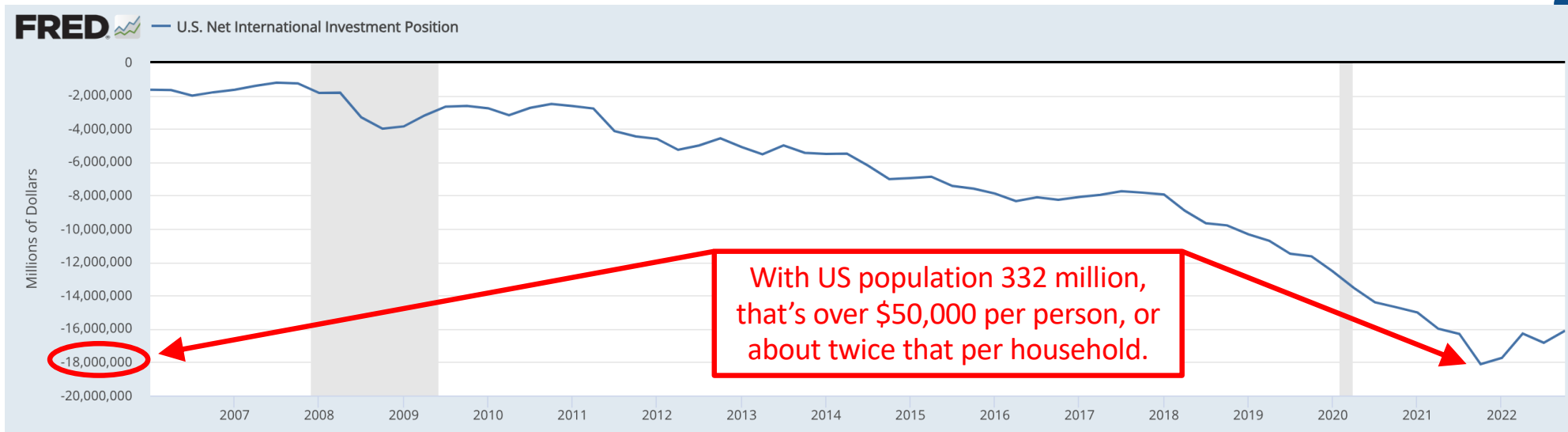
# US Trade Deficit



- **Is it a problem?**

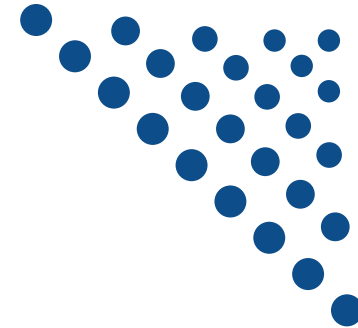
- It does mean that US net debt to foreigners grows every year.
- What if other countries decide to dump their dollar assets? Their value would plummet and they would lose. (But runs on currencies, like runs on banks, do happen.)
- US net international investment position recently reached  $-\$18$  trillion!

# US Net International Investment Position





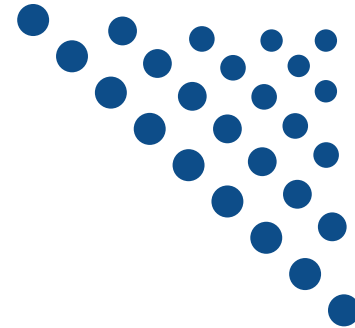
# US Trade Deficit



- **Is it a problem?**

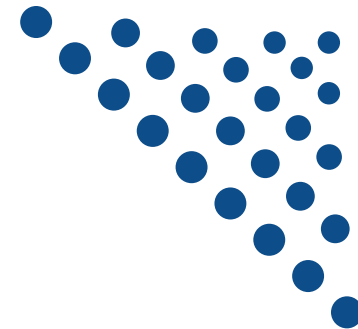
- Yes, in my view, but not because it might hurt us. Because it takes advantage of others.
- The US, one of the richest countries in the world, is
  - Spending more than its income
  - Being funded, in part, by much poorer countries
- We are enjoying
  - More goods and services than we produce
  - Produced by often lower-wage and poorer workers abroad
  - Without, at least in the foreseeable future, paying for them
- That just feels wrong to me,
  - Especially if others are financing us not by choice but because they have no other option.

# US Trade Deficit



- **Could an increase in the trade deficit ever hurt us?**
  - Yes, if we are in a recession.
  - Then by demanding foreign goods and services instead of our own, we support jobs abroad instead of at home
  - That is when using trade policy and/or exchange-rate policy to promote demand and higher employment at home seems to make sense.
    - But it helps us only at the expense of others, if they are also in recession
    - And it is likely to cause retaliation, cancelling all or more than any benefit

# Trade Deficits and Exchange Rates

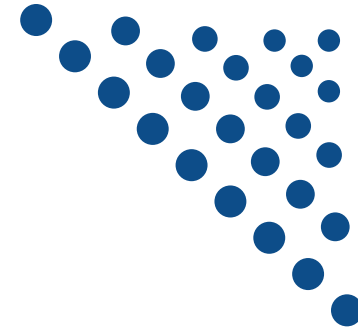


- **Do exchange rates matter for trade deficits?**
  - Yes.
  - If your currency rises in value, it makes
    - Exports more expensive
    - Imports cheaper
    - Raises real income and therefore expenditure
    - Result: Trade balance “worsens”
      - Deficit grows, or
      - Surplus shrinks
  - Example of dollar appreciation: Volker policy in 1980-81
    - Raised US interest rates (to fight inflation)
      - ↳ Attracted capital from abroad
      - ↳ Caused the US dollar to rise in value by about 50%
      - ↳ Hurt US exports, helped imports, and increased the US trade deficit

# Pause

- **Pause for**
  - Questions
  - 5-Minute Break
- **Next: Exchange Rates**

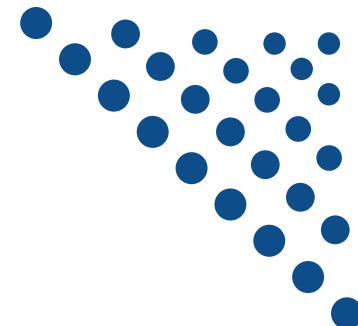
# Exchange Rates



- **What they are**

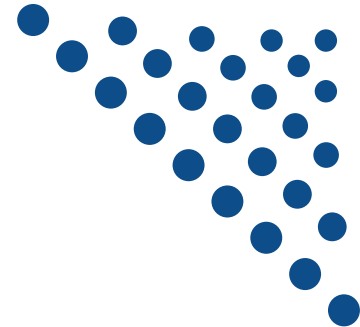
- The price of one currency in terms of another
- Thus, for example
  - The number of dollars you pay for one euro:  $\$/\epsilon$
  - Or, the number of euros you'll get for one dollar:  $\epsilon/\$$
- Rates reported in data are from transactions between major banks
- Rates you see in banks, stores, and currency exchanges will be worse for you
  - To cover cost and make profit for them

# Exchange Rates Can Be Confusing

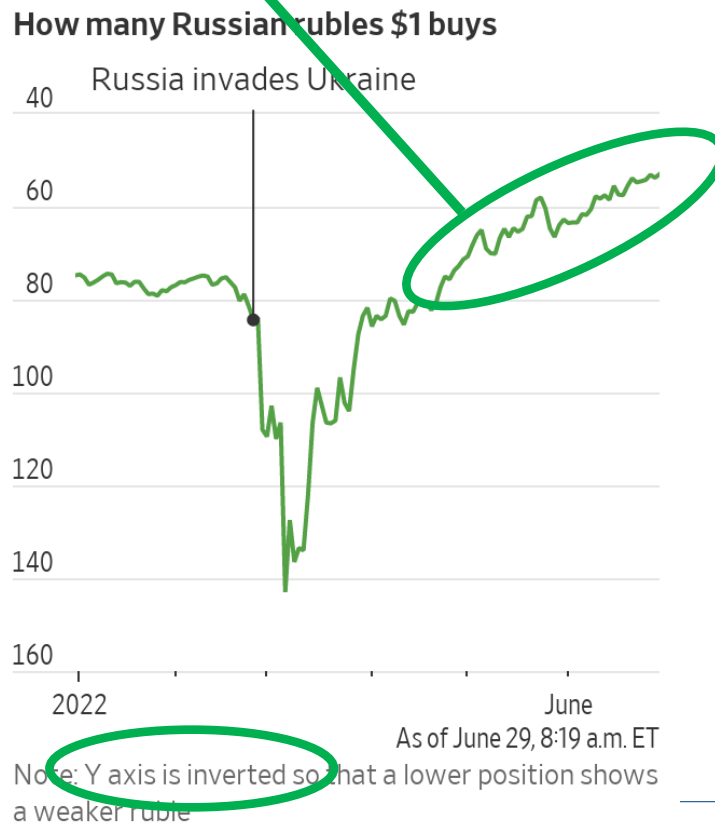


- **Confusing in how they are reported**

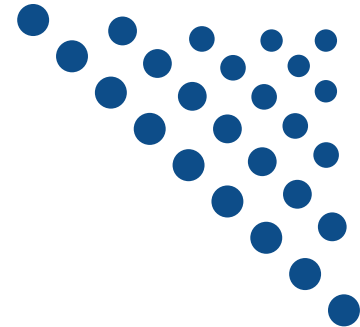
- Hard to know what is up and what is down
  - i.e., “The Japanese yen rose today from 152 to 144” (10/21/22)
  - Makes sense because the numbers are understood to be ¥/\$, not \$/¥, so the change from 152 to 144 is in fact a rise in the value of the yen
- Yen is reported that way because alternative would be
  - “The Japanese yen rose today from \$0.0066 to \$0.0069”
- For currencies worth much less than \$1, scales often show currency/\$
  - Graphs of rates over time may be drawn on an “inverted scale”
  - Or alternatively, “strength” may appear as a drop on the graph



# Russia's Surprising Economic Headache: **A Strong Ruble**



Wall Street Journal  
June 29, 2022



# Russia's rouble is now stronger than before the war

Rouble v US dollar

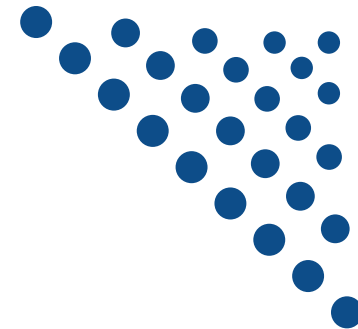


The Conversation  
June 13, 2022

Trading View



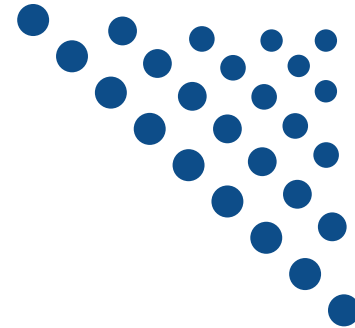
# Exchange Rates Can Be Confusing



- **Confusing in the names for currencies**

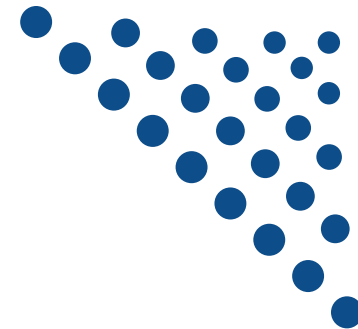
- Different names or spellings for the same currency
  - Russia: ruble vs. rouble (see above)
  - China: yuan vs. renminbi
  - UK: pound vs. sterling
- Different countries with the same-named currency
  - Dollar: Australia, Canada, Hong Kong, Zimbabwe, US, ...
  - Peso: Argentina, Chile, Colombia, Mexico
  - Pound: Egypt, Lebanon, UK
- Different-named currencies use the same symbol
  - ¥: Japan's yen, China's yuan

# What Determines Exchange Rates



- Exchange rates are determined in markets
- Thus they respond to changes in demand and supply

# What Determines Exchange Rates

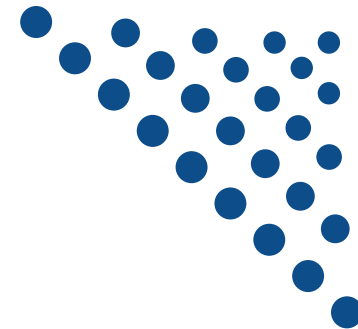


- **Main sources of demand for our country's currency**

Increases that cause our currency to rise (or “appreciate”):

- Exports, i.e., foreign purchases of our
  - Goods
  - Services
- “Capital inflows,” i.e., foreign purchases of our
  - Stocks
  - Bonds
  - Currency

# What Determines Exchange Rates

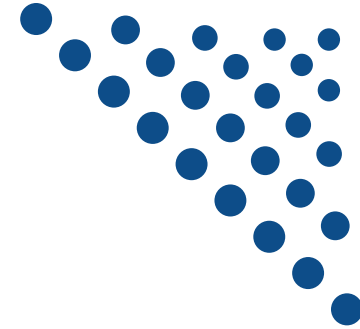


- **Main sources of supply of our country's currency**

Increases that cause our currency to fall (or “depreciate”):

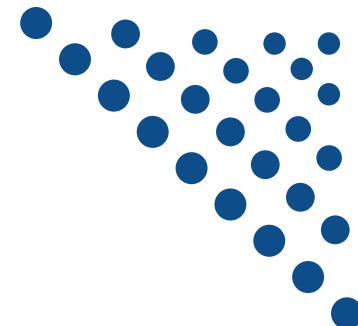
- Imports, i.e., our purchases of foreign
  - Goods
  - Services
- “Capital outflows,” i.e., our purchases of foreign
  - Stocks
  - Bonds
  - Currencies

# What Determines Exchange Rates



- **So changes that cause our currency, the \$, to rise in value:**
  - More US exports and/or less US imports
  - Rise in US interest rates and or fall in foreign interest rates
  - New expectation that dollar will rise
    - Causes wealth holders to buy more \$ assets
  - Other central banks choose to hold more \$ in reserves
- **Opposites of above cause the \$ to fall**

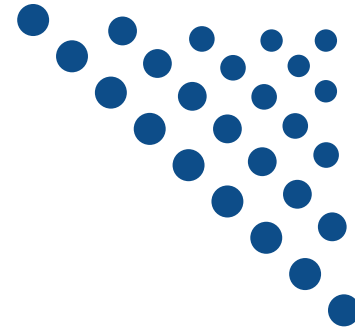
# What Determines Exchange Rates



- **Historic Roles of Governments and Central Banks**

- Define the value of currency in terms of gold or silver
  - The Gold Standard of the 19<sup>th</sup> and early 20<sup>th</sup> century
- Intervene in markets to “peg” their currency to another
  - The Dollar Standard of 1945-1973
    - Most currencies were pegged to the US \$
    - Other central Banks bought and sold dollars to achieve this.
- Let major currencies “float” since 1973
  - Many weaker countries still intervene in markets, buying or selling to
    - Peg to another currency
    - Reduce currency fluctuations
  - A few intervene in markets to “manipulate” their currencies
    - Reduce their value to encourage exports

# How Have Exchange Rates Changed

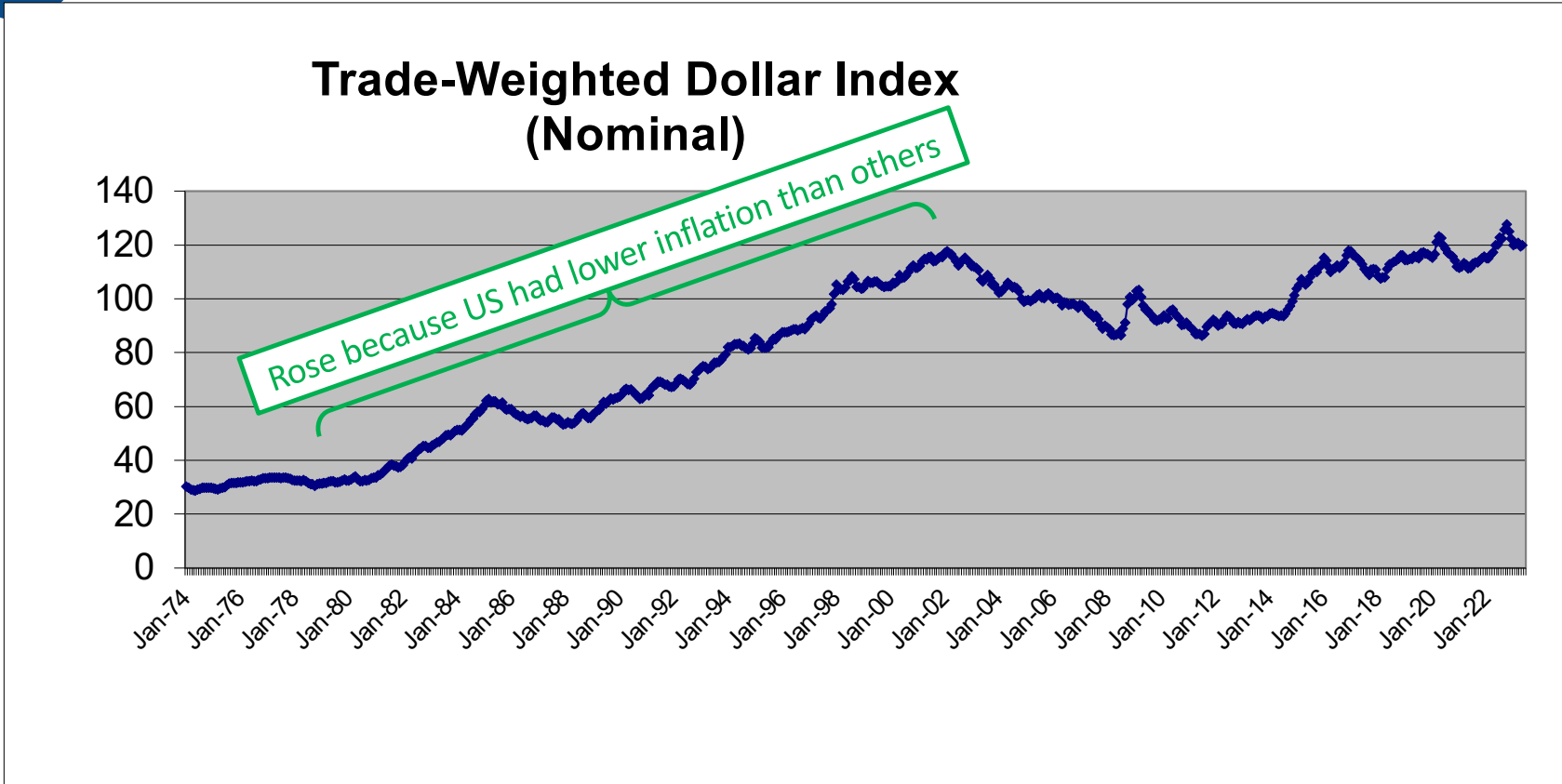
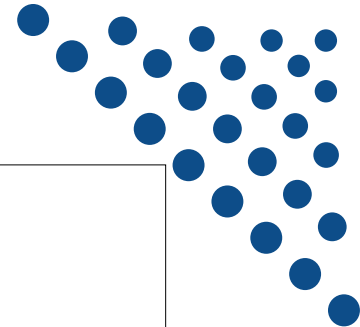


- **We'll look at**

- US dollar
- France, Germany, Italy, and Euro Area's euro
- Canadian dollar
- Mexican peso
- British pound
- Japanese yen
- Chinese renminbi

I'll skip these if time is short.

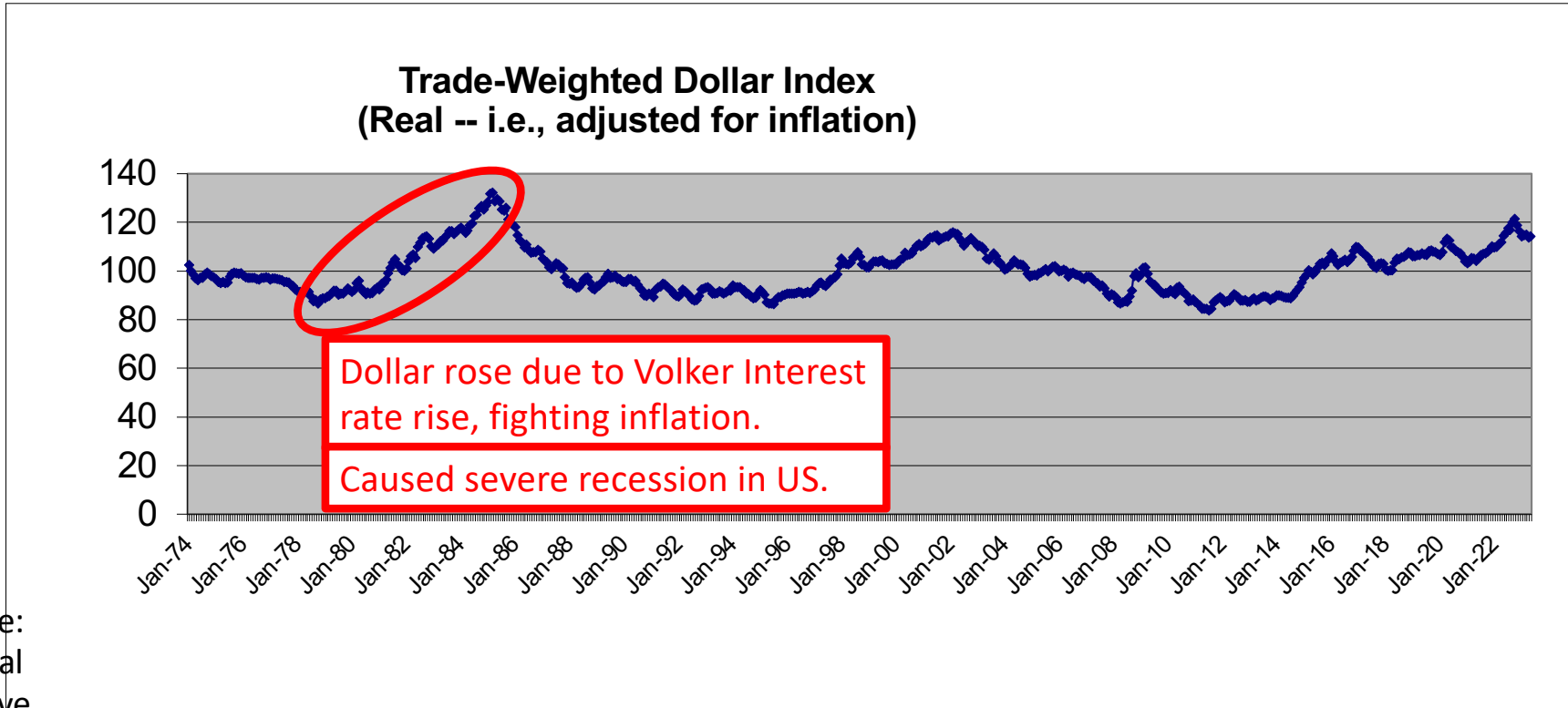
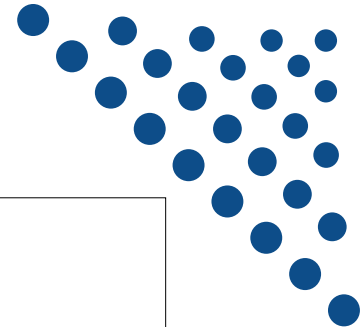
# US Exchange Rate



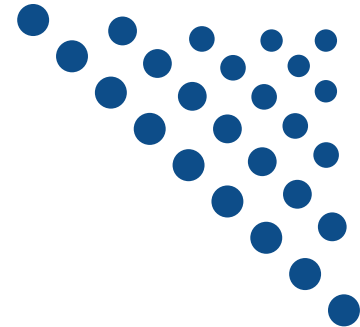
Source:  
Federal  
Reserve



# US Exchange Rate



# US Exchange Rate



The dollar has declined as US inflation has eased

■ US CPI inflation ■ US Dollar index



Source:  
FT, 1/17/23

# Euro Area

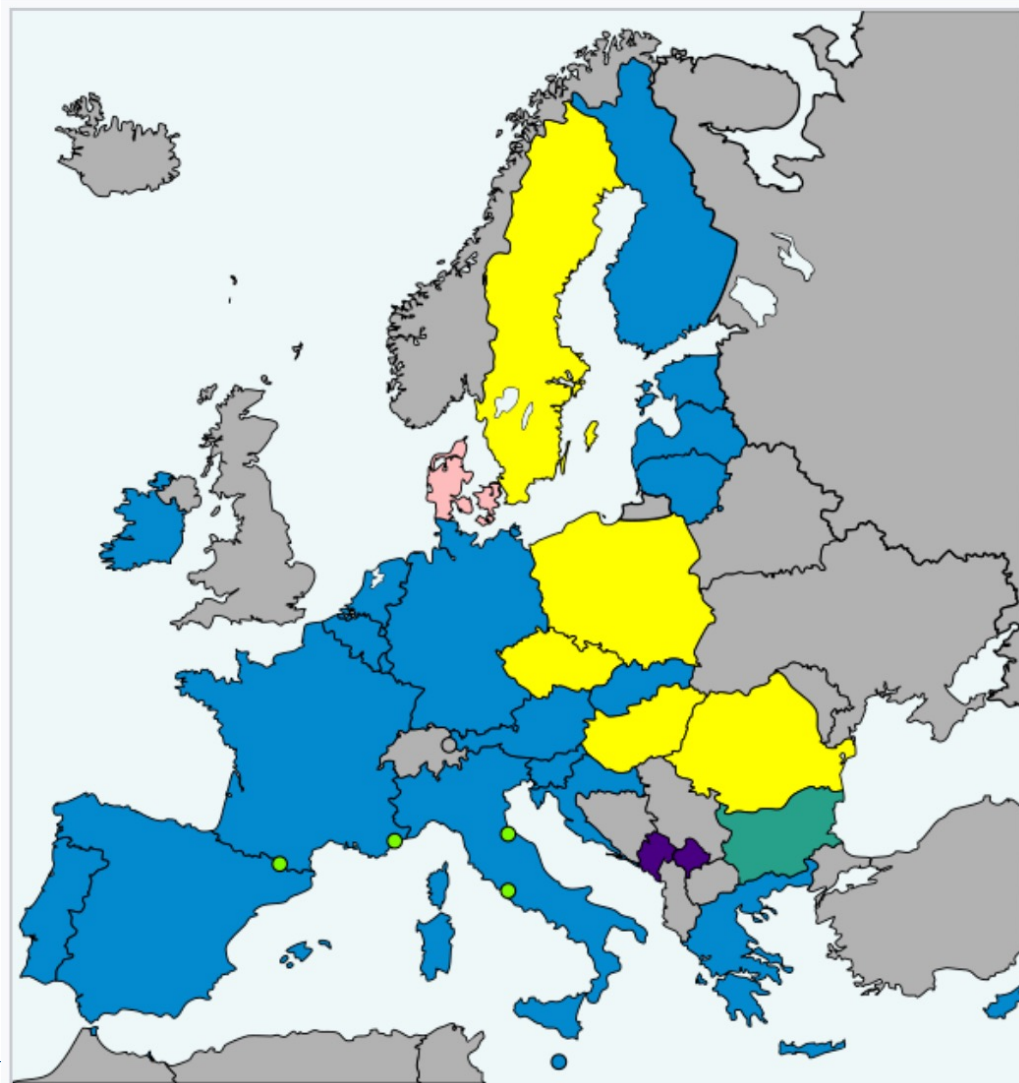
## Eurozone participation

### European Union member states

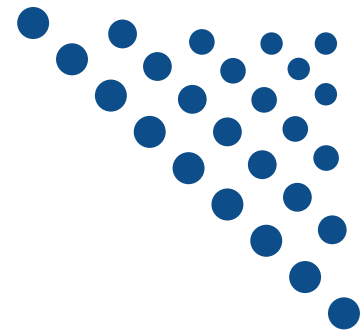
- 20 in the **eurozone**
- 1 in **ERM II**, without an **opt-out** (**Bulgaria**)
- 1 in **ERM II**, with an **opt-out** (**Denmark**)
- 5 not in **ERM II**, but obliged to join the eurozone on meeting the convergence criteria (**Czech Republic, Hungary, Poland, Romania, and Sweden**)

### Non-EU member states

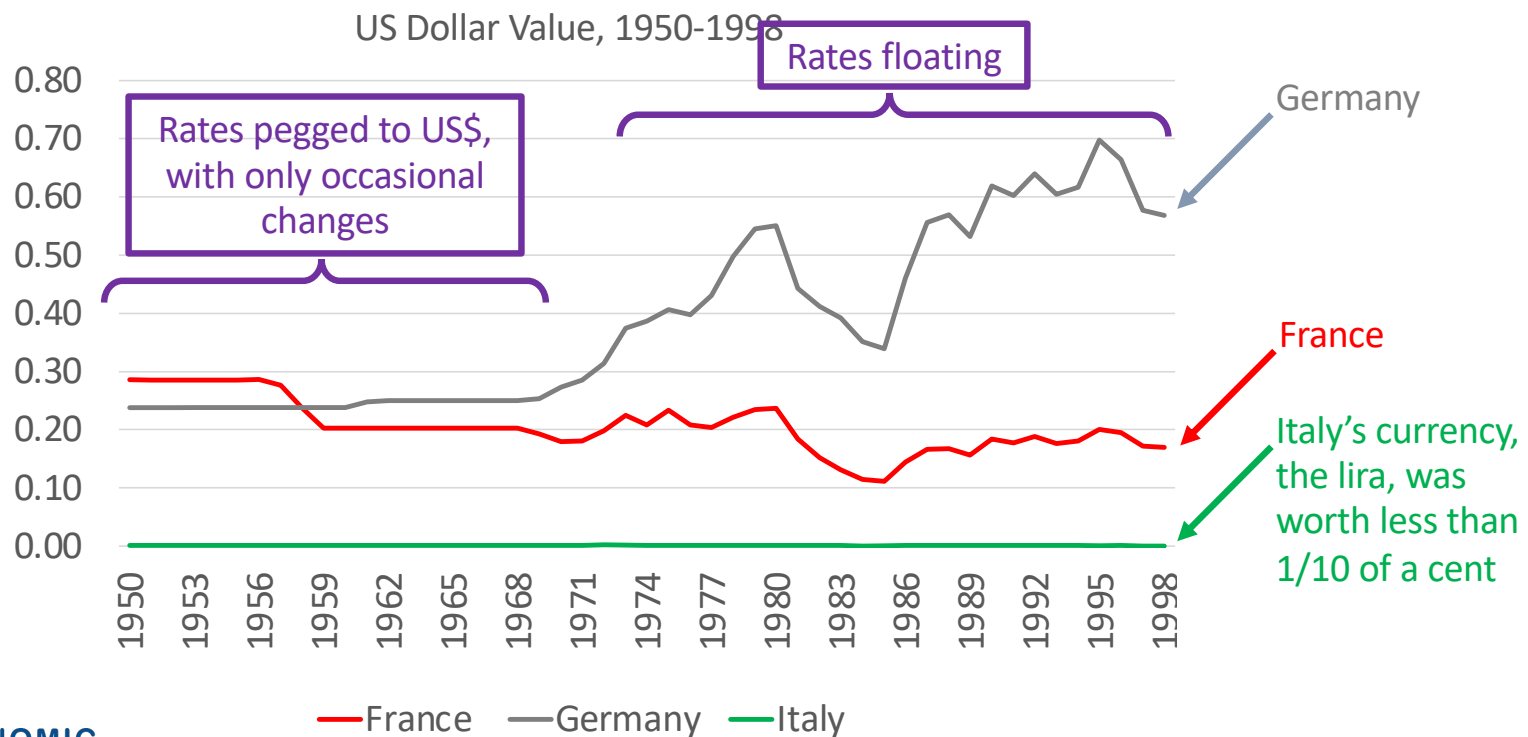
- 4 using the euro with a monetary agreement (**Andorra, Monaco, San Marino, and Vatican City**)
- 2 using the euro unilaterally (**Kosovo<sup>[1]</sup>** and **Montenegro**)



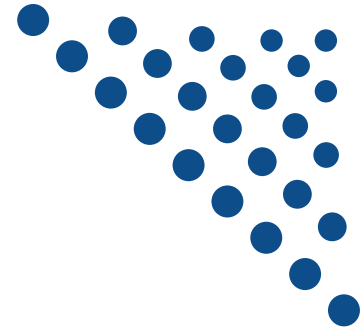
# Dollar Value of Other Currencies



France, Germany, Italy:  
Before euro



Source:  
IMF  
*International  
Financial  
Statistics*

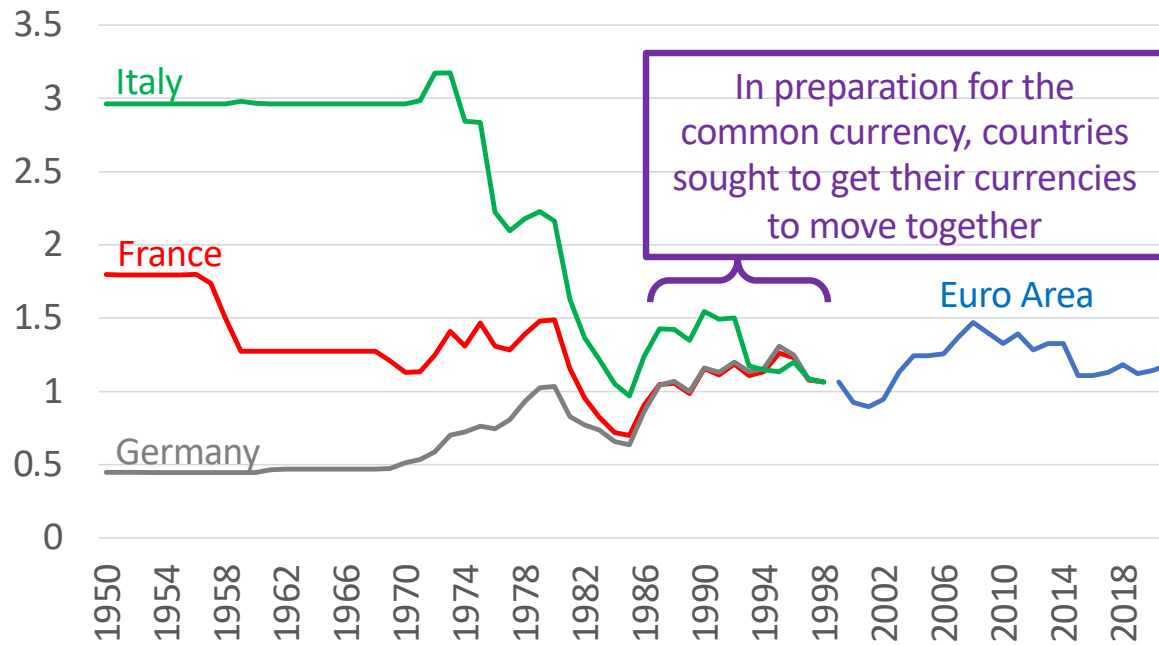


# Dollar Value of Other Currencies

## France, Germany, Italy + Euro

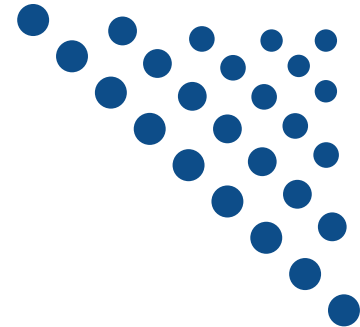
US Dollar Value

Rates here are scaled up to match value of euro in 1998.



Source:  
IMF  
*International  
Financial  
Statistics*

— Euro Area — France — Germany — Italy



# Dollar Value of Other Currencies

## *Euro Falls to Equal the U.S. Dollar for the First Time in 20 Years*

The New York Times

July 14, 2022

How many dollars one euro buys



As of 8:42 a.m. Eastern time Wednesday • Source: FactSet • By The New York Times



# Dollar Value of Other Currencies

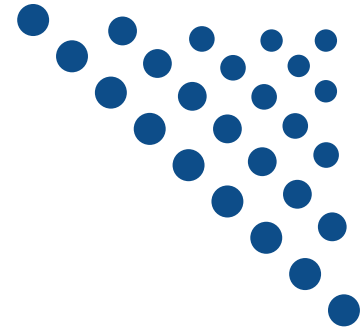


## Euro

X-rates.com  
Jun 12, 2023



# Dollar Value of Other Currencies



## Percentage change of select currencies versus dollar

THE WALL STREET JOURNAL.  
July 18, 2022



Source: Tullett Prebon

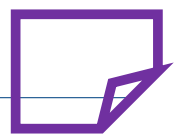


# Dollar Value of Other Currencies

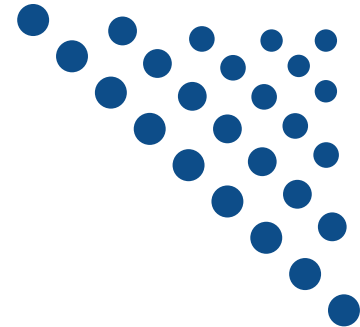


Source:  
FT, 1/27/23

Skip  
Canada,  
Mexico,  
UK, Japan,  
China

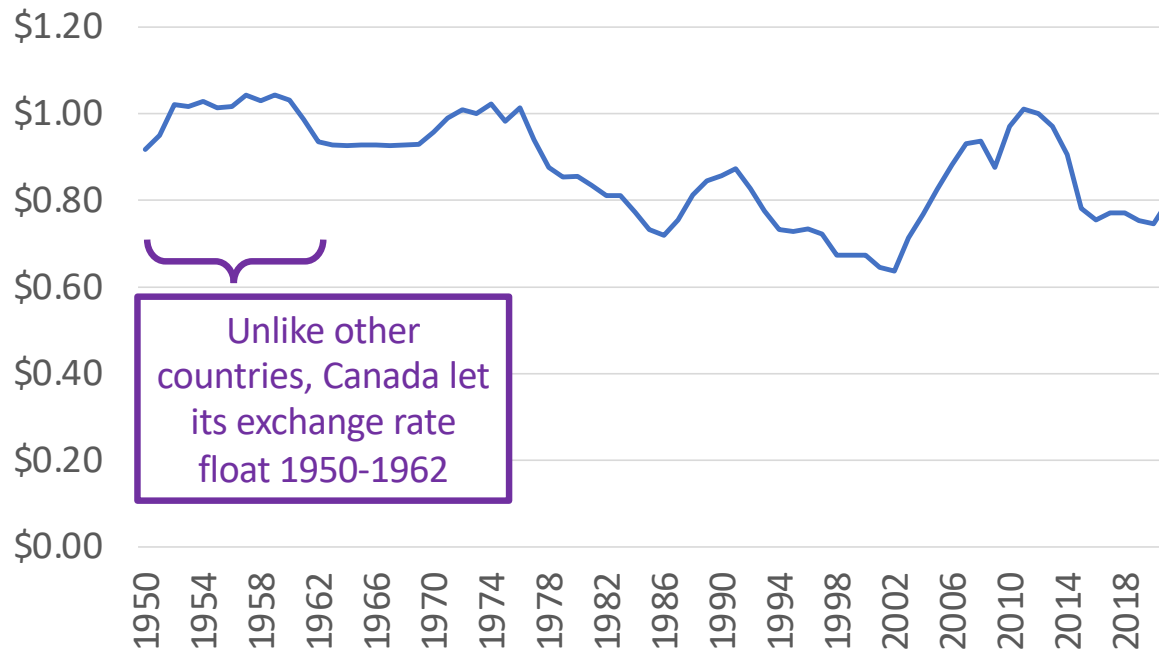


# Dollar Value of Other Currencies



## Canadian Dollar

US Dollar Value



Source:  
IMF  
*International  
Financial  
Statistics*



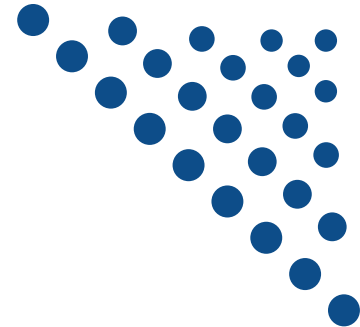
# Dollar Value of Other Currencies

## Canadian dollar

X-rates.com  
Jun 12, 2023

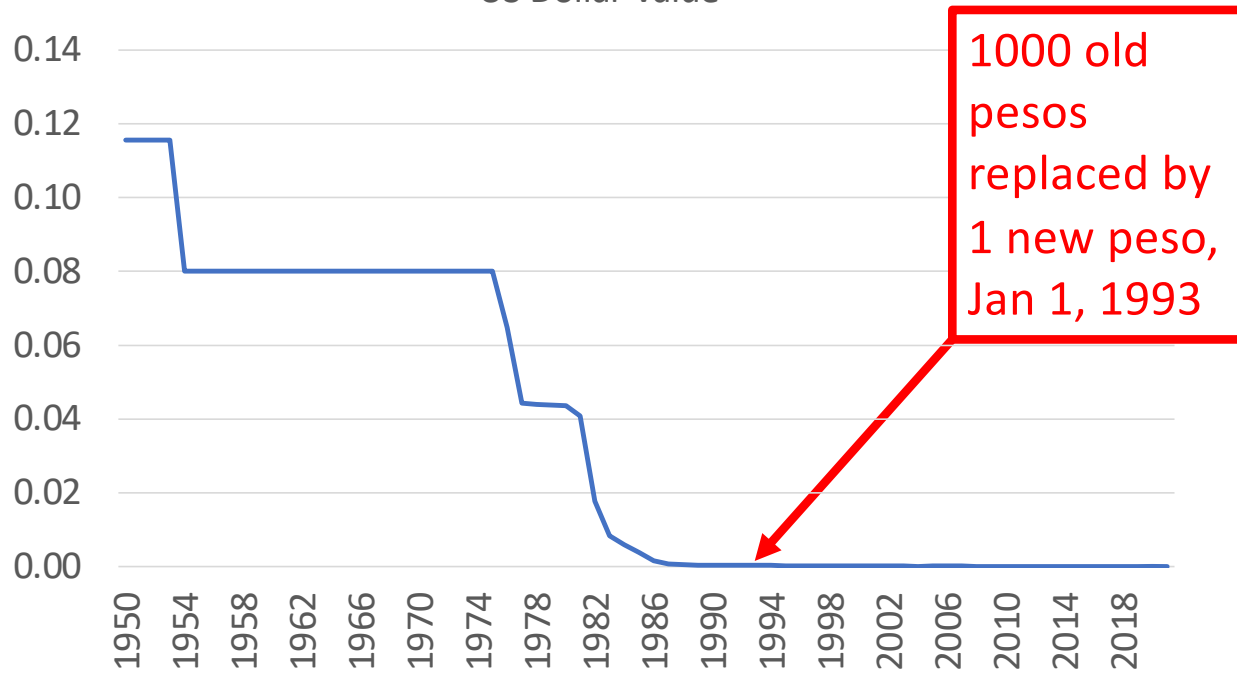


# Dollar Value of Other Currencies

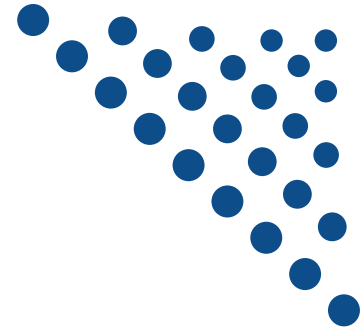


## Mexico (Old) Peso

US Dollar Value



Source:  
IMF  
*International  
Financial  
Statistics*



# Dollar Value of Other Currencies

## Mexico (New) Peso

US Dollar Value  
1990-2021

1000 old pesos replaced by 1 new peso, Jan 1, 1993



Source:  
IMF  
*International  
Financial  
Statistics*

# Dollar Value of Other Currencies

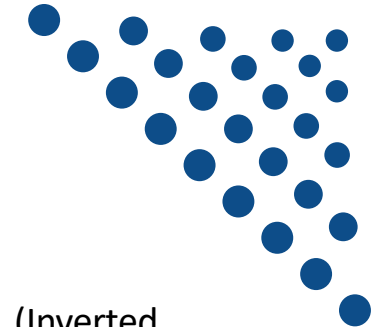
Mexican peso hits five-year high against the dollar

Peso-\$



Source: Refinitiv  
© FT

Financial Times  
Mar 7, 2023



(Inverted scale, Peso/\$)

(After this it fell, but then rose even more)



# Dollar Value of Other Currencies



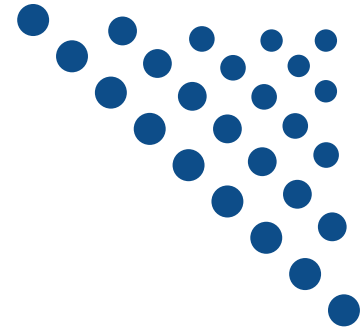
Mexican peso

X-rates.com  
Jun 12, 2023



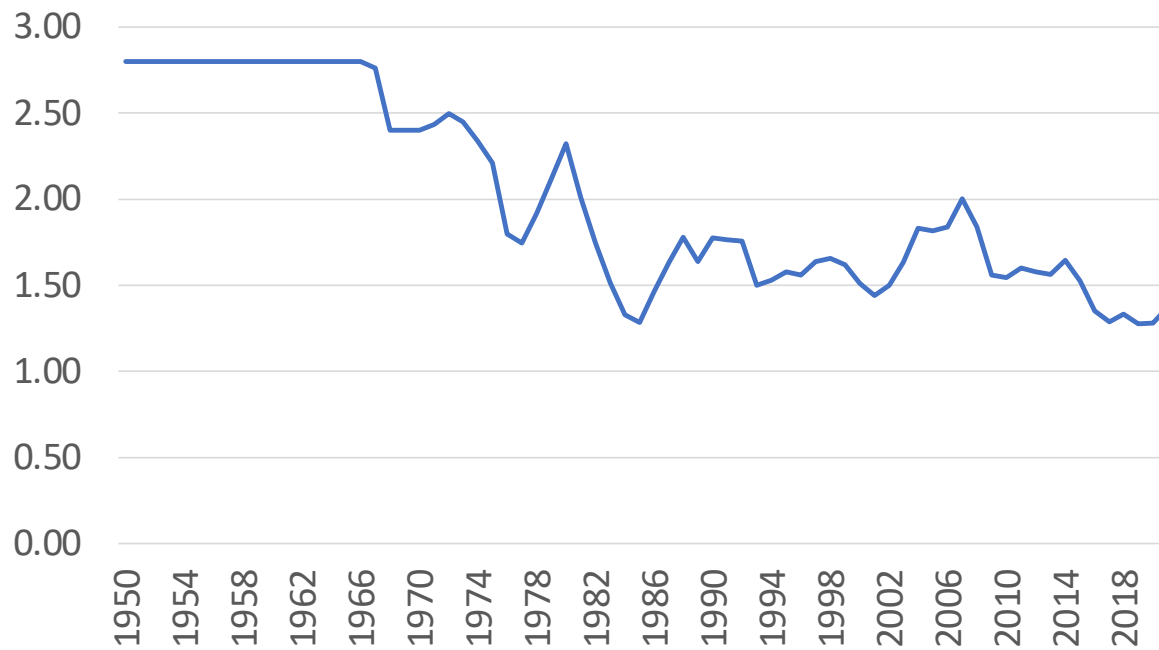
Since last July, peso has risen more than 20%.

# Dollar Value of Other Currencies



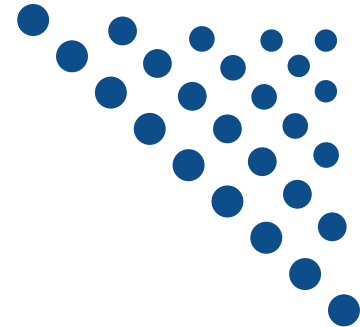
## United Kingdom: pound £

US Dollar Value



Source:  
IMF  
*International  
Financial  
Statistics*

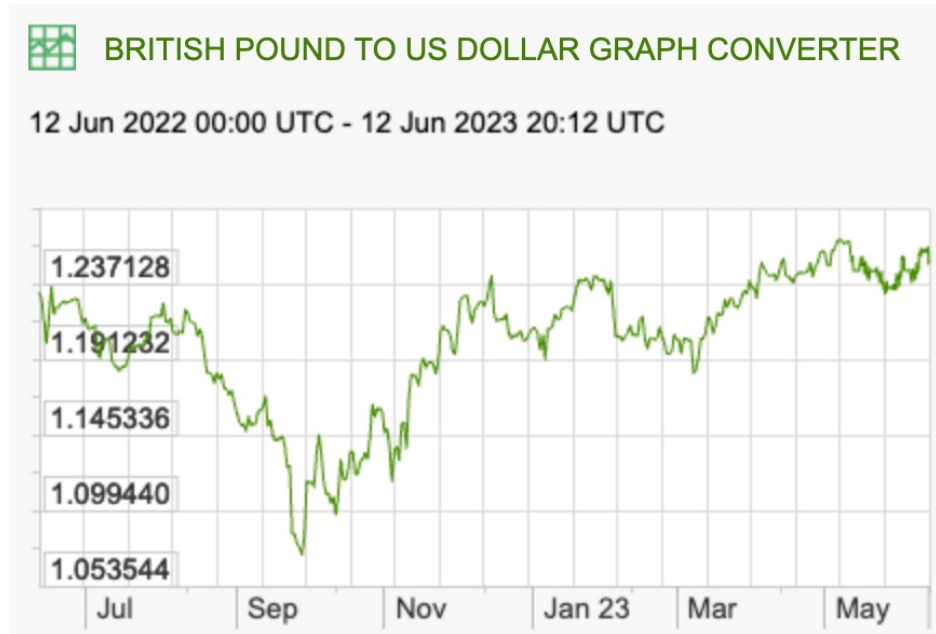




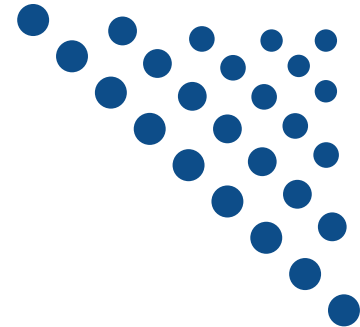
# Dollar Value of Other Currencies

UK  
pound

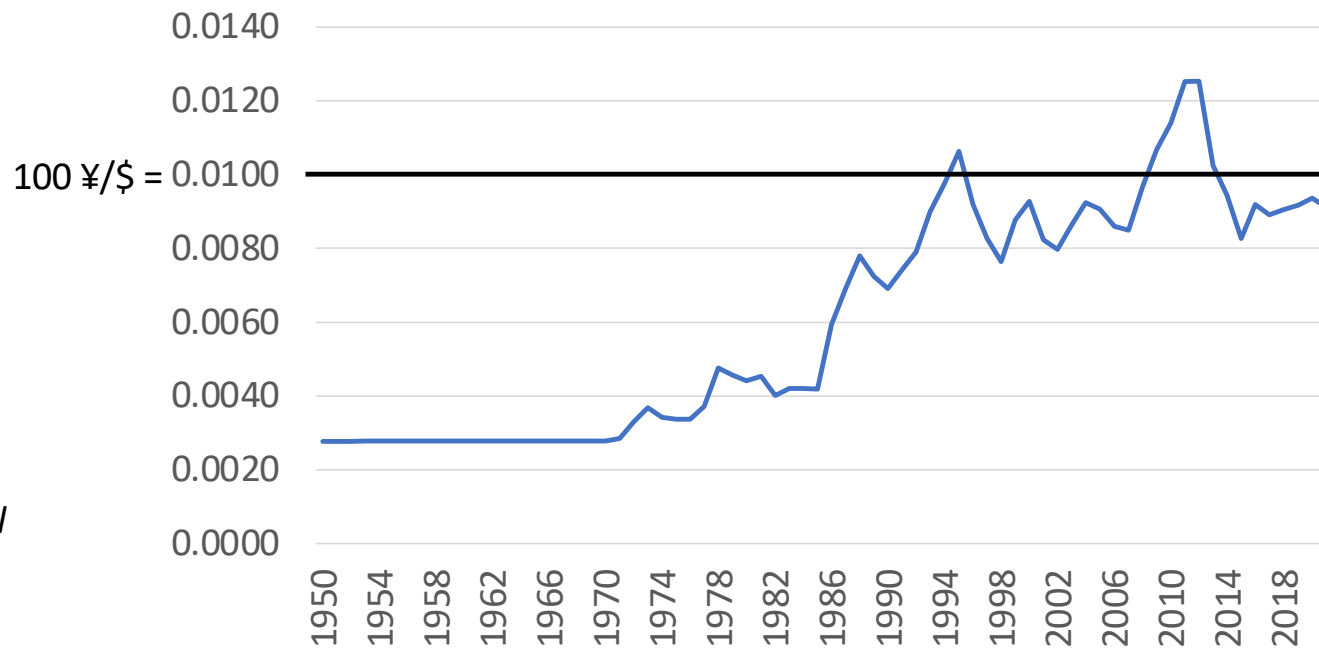
X-rates.com  
Jun 12, 2023



# Dollar Value of Other Currencies

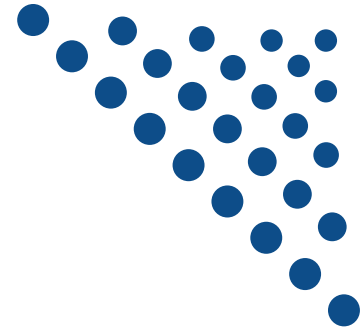


Japan: yen ¥  
US Dollar Value

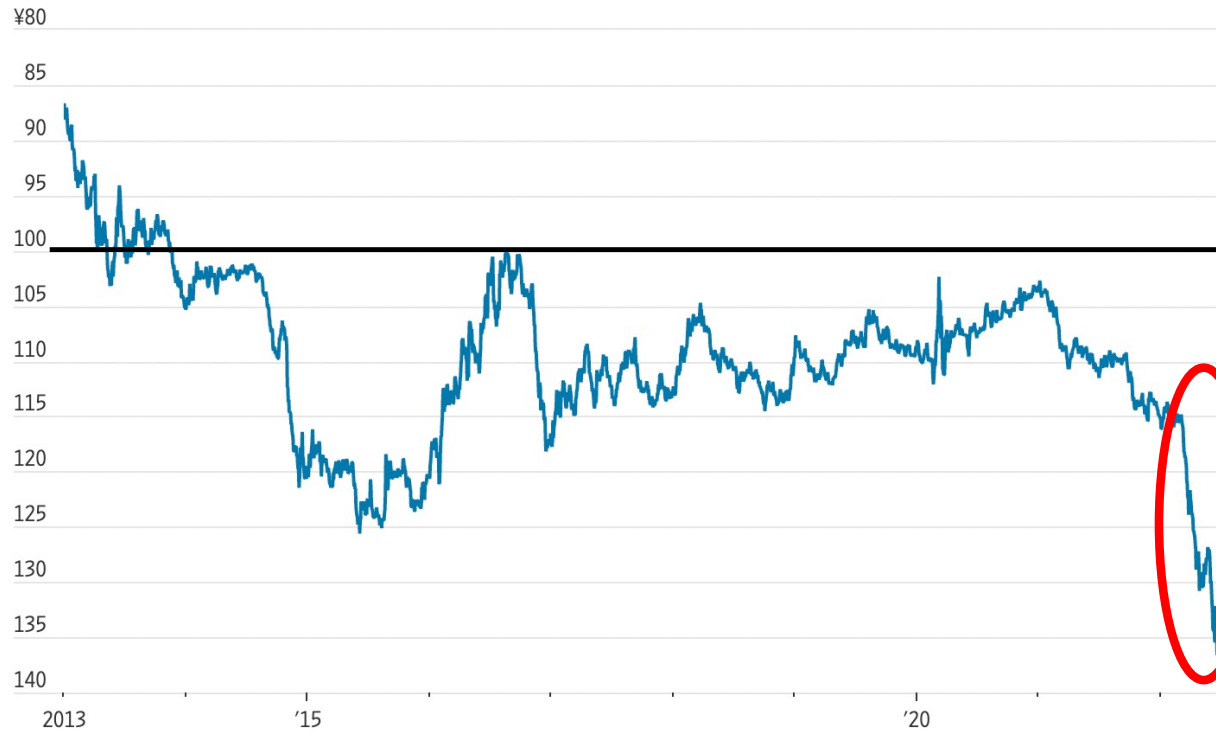


Source:  
IMF  
*International  
Financial  
Statistics*

# Dollar Value of Other Currencies



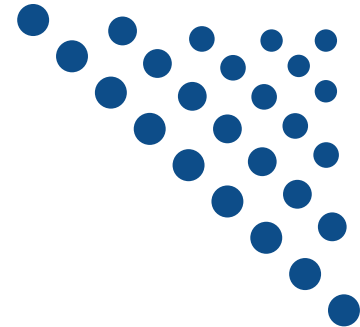
Yen per dollar



Recent drop since March 1, 2022

Source:  
WSJ, 7/11/22

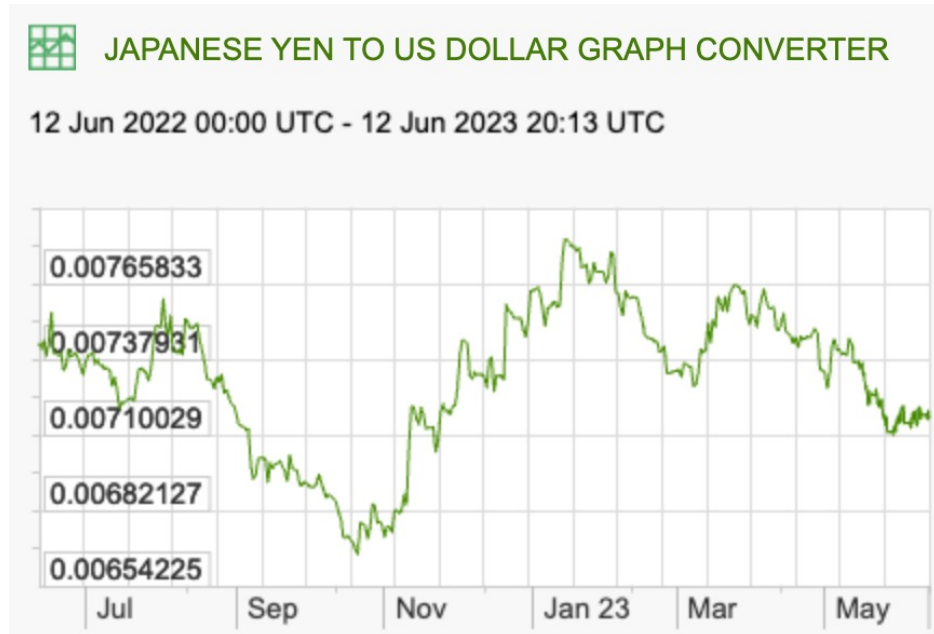
Note: Axis inverted  
Source: Fidelity Prebon



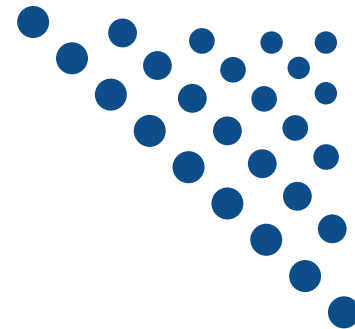
# Dollar Value of Other Currencies

Japanese  
yen

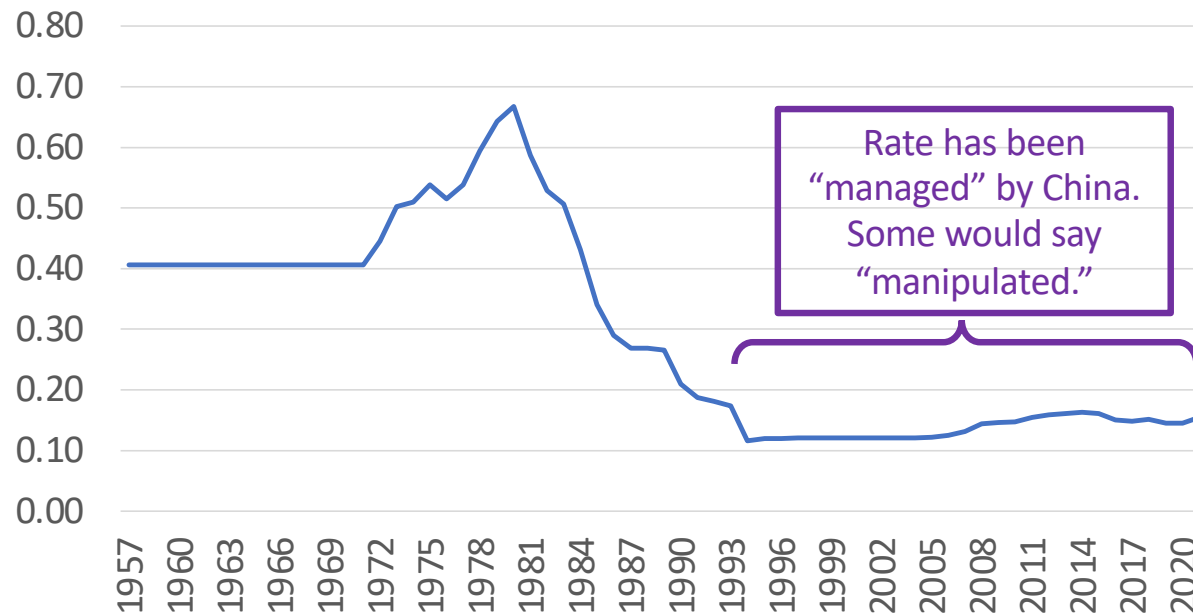
X-rates.com  
Jun 12, 2023



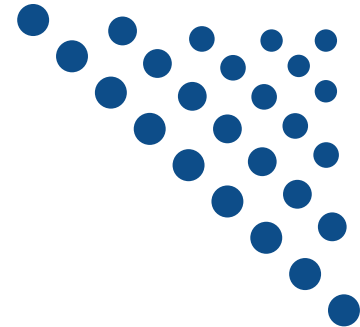
# Dollar Value of Other Currencies



## China: yuan (renminbi) US Dollar Value



Source:  
IMF  
*International  
Financial  
Statistics*



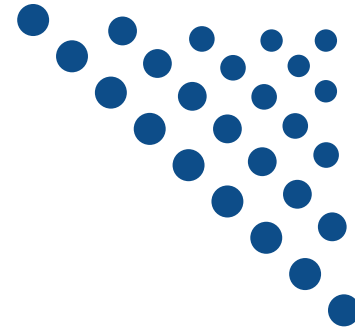
# Dollar Value of Other Currencies

Chinese  
yuan

X-rates.com  
Jun 12, 2023



# How Exchange Rates Matter



- **Effects of an exchange rate depreciation**

- (fall in value of the country's currency)

- Trade

- Exports become less expensive and quantity likely rises

- Imports become more expensive and quantity likely falls

- Trade balance likely improves (surplus ↗ or deficit ↘)

- Macroeconomic

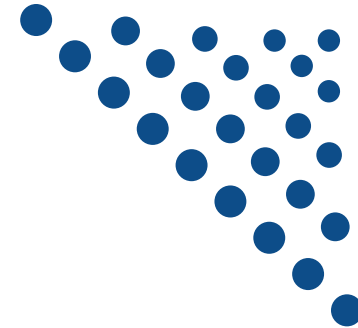
- Raises domestic prices of imports and thus inflation

- If at full employment, real income falls, causing less spending

- If in recession, increased demand for products increases employment



# How Exchange Rates Matter

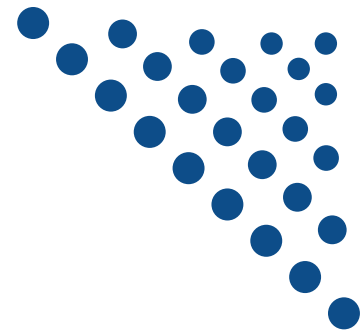


- **More effects of an exchange rate depreciation**
  - (fall in value of the country's currency)
  - Domestic value of foreign assets and debts rises
    - Net creditors gain, net debtors lose
      - Effect on interest/dividend payments is opposite
    - Those who have borrowed abroad to finance investment at home lose
      - May go bankrupt
- **Effects of expectation of exchange rate depreciation**
  - Holders of assets in domestic currency try to sell and move abroad
    - ↳ This speculative attack causes greater depreciation
  - Example from 1997 Asian Crisis

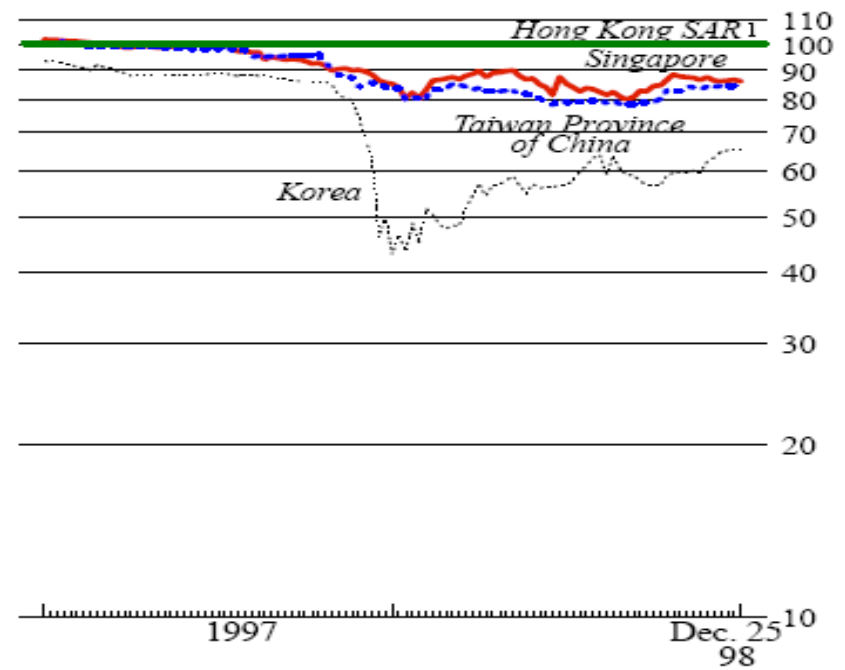
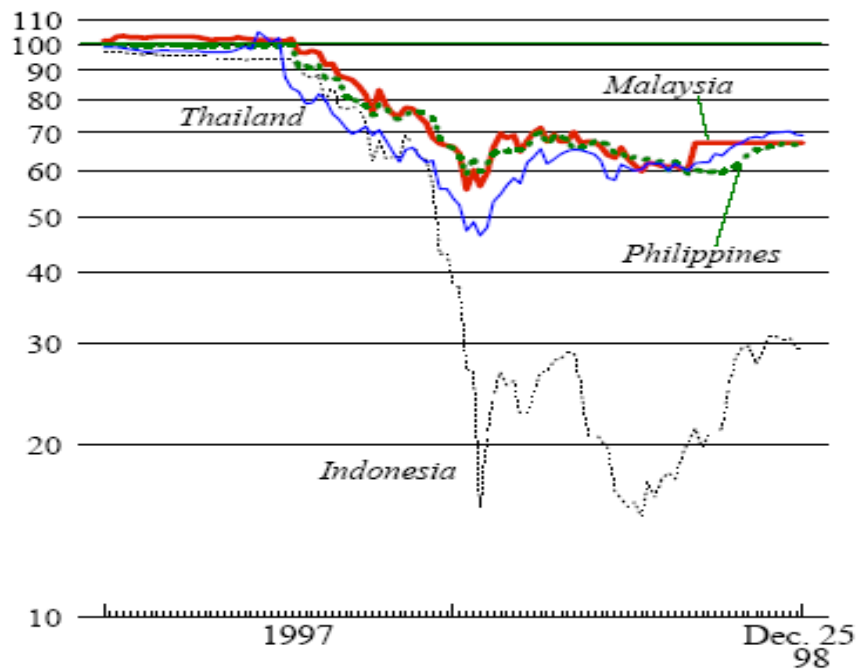




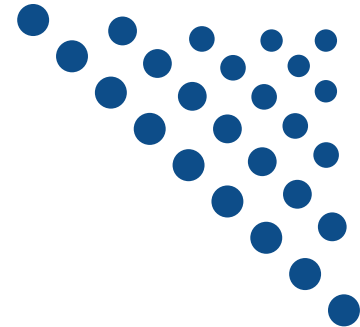
# The Asian Crisis of 1997



**Bilateral U.S. Dollar Exchange Rates**

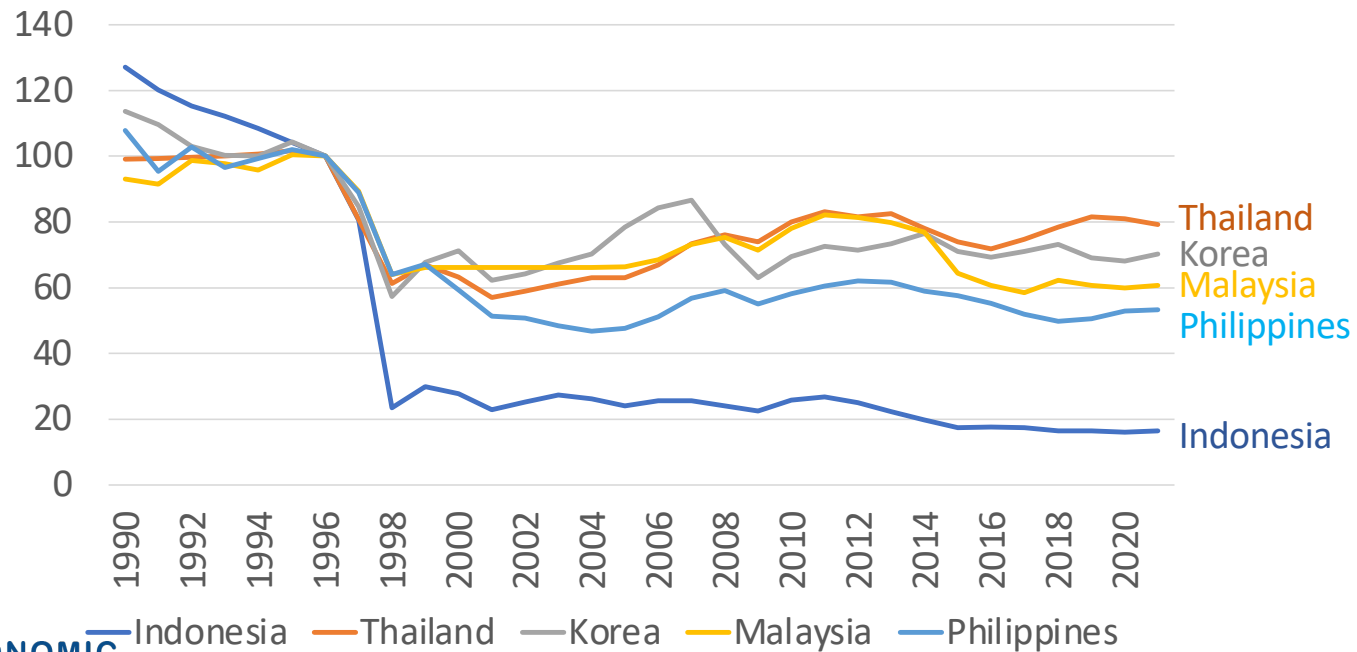


# The Asian Crisis of 1997

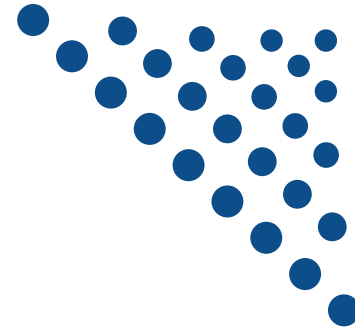


## Asian Crisis 1997 Countries

Indonesia, Korea, Malaysia, Philippines, Thailand  
US dollar values, scaled to 100 in 1996



# Currency Manipulation

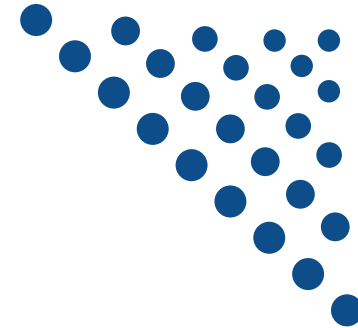


- **Currency Manipulation**

- Defined as
  - Intervention in the exchange market by Central Bank or Government
  - In order to push down, or keep down, the value of the currency
- Presumed purposes: To...
  - Increase exports
  - “Gain unfair advantage” in international trade and competitiveness
  - Stimulate the domestic economy
  - Accumulate foreign assets



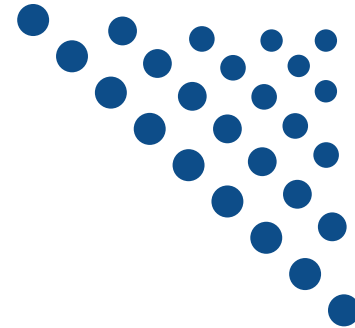
# Currency Manipulation



- **US Official Definition of Currency Manipulation**

- US Treasury issues report on currency manipulation twice each year
- Criteria for manipulation:
  1. Persistent net official purchases of foreign currency  
(more than 2 percent of GDP)
  2. A material trade (current account) surplus  
(more than 2 percent of GDP)
  3. A significant bilateral trade surplus with the United States  
(more than \$20 billion per year)

# Currency Manipulation



- **US Treasury Report June 10, 2022**

- “No major U.S. trading partner during 2021 manipulated the rate of exchange between its currency and the U.S. dollar for purposes of preventing effective balance of payments adjustments or gaining unfair competitive advantage in international trade.”

- “Switzerland meets all three criteria ... over the four quarters through December 2021, and therefore Treasury is conducting enhanced analysis of Switzerland’s macroeconomic and exchange rate policies in this Report.

- 12 economies are on “Monitoring List”: China, Japan, Korea, Germany, Italy, India, Malaysia, Singapore, Thailand, Taiwan, Vietnam, and Mexico

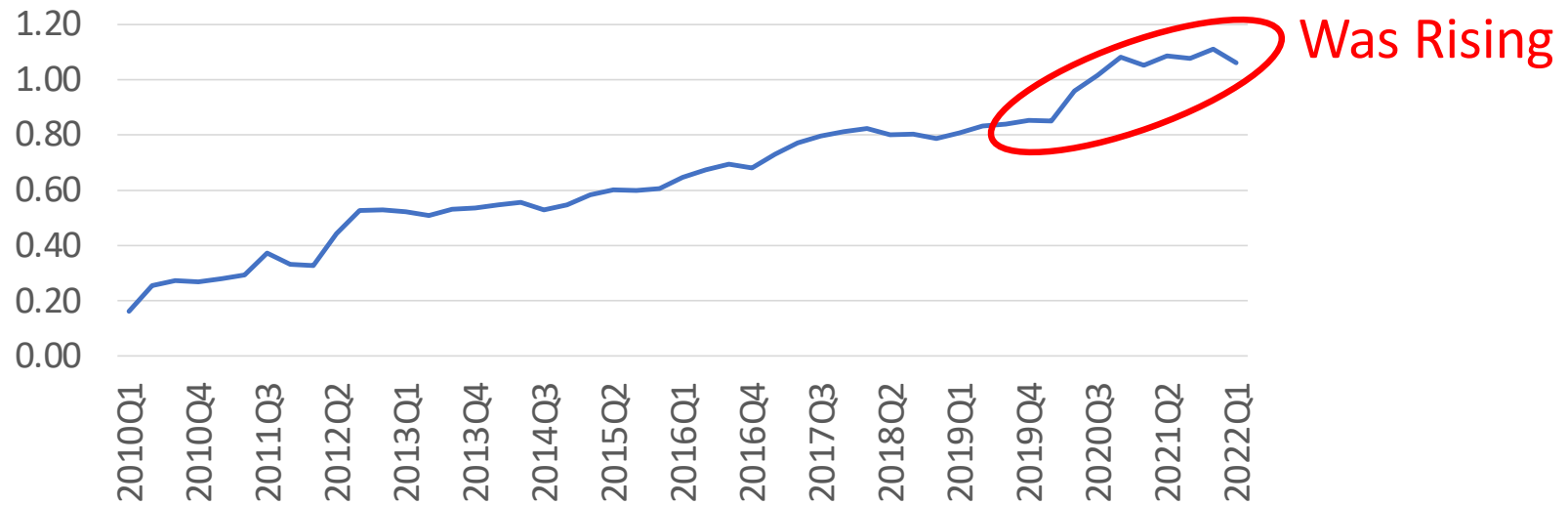
- **Look at data for two: Switzerland and China**

# Currency Manipulation



## Manipulation Criteria: Net Official Purchases of Foreign Currency (Reserves)

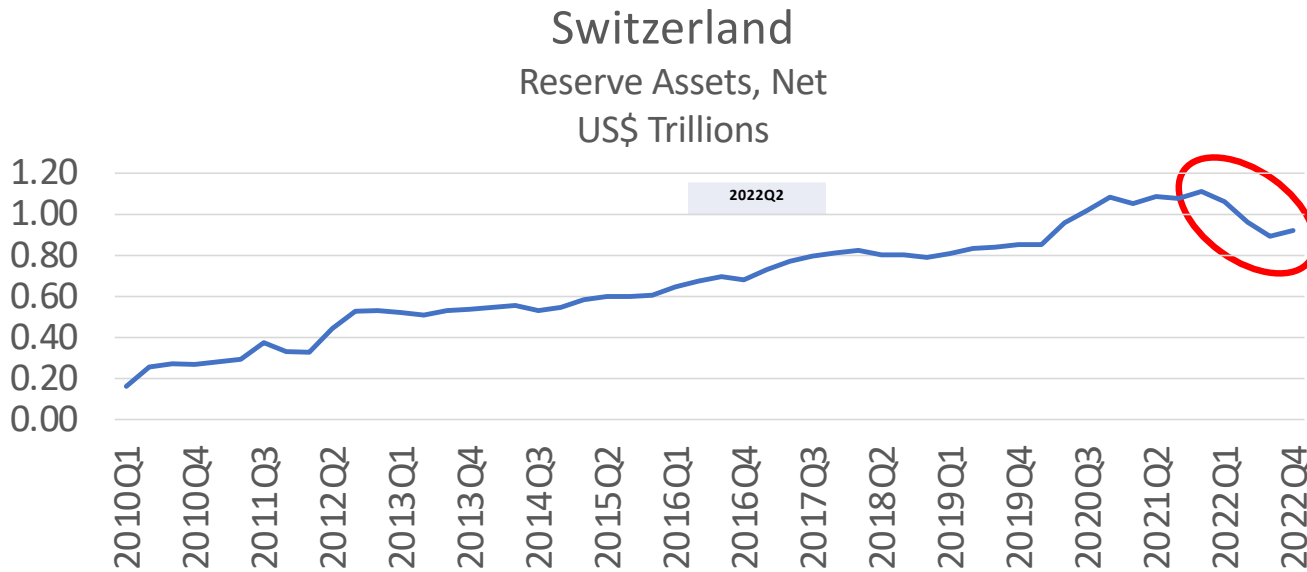
Switzerland  
Reserve Assets, Net  
US\$ Trillions



# Currency Manipulation

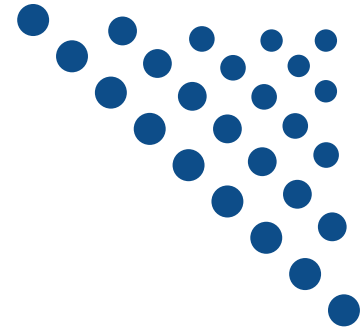


Manipulation Criteria: Net Official Purchases of Foreign Currency (Reserves)



Now Falling

# Currency Manipulation



Manipulation Criteria: Net Official Purchases of Foreign Currency (Reserves)



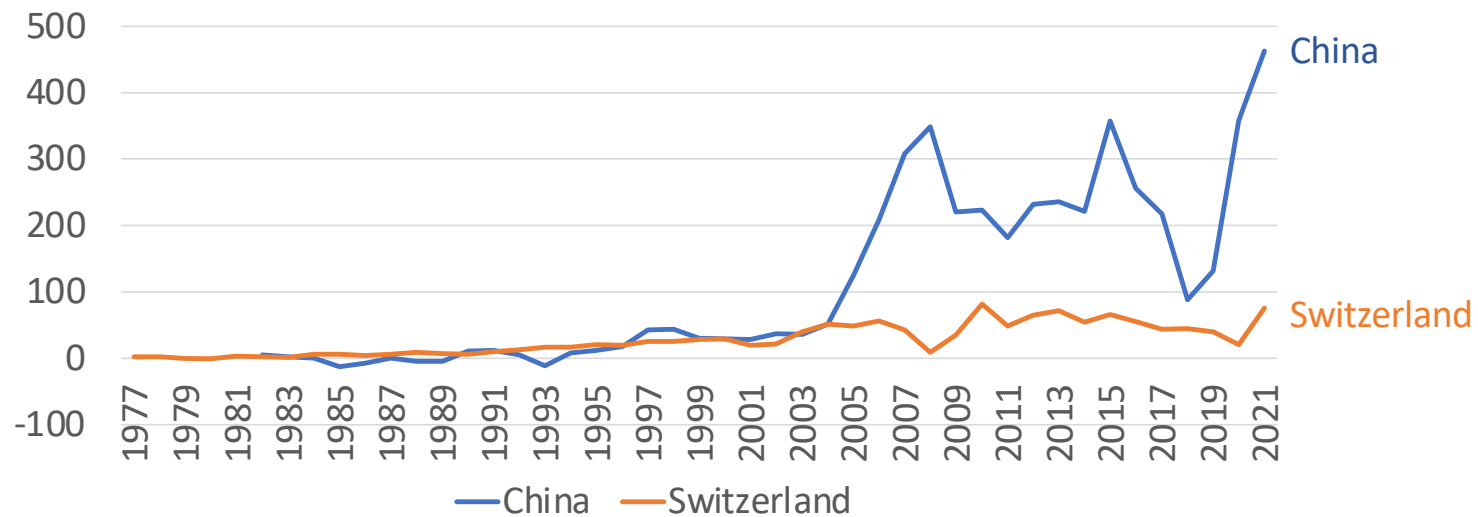


# Currency Manipulation



## Manipulation Criteria: Current Account Surpluses

Current Account Balances  
China and Switzerland  
\$ billions



# Currency Manipulation

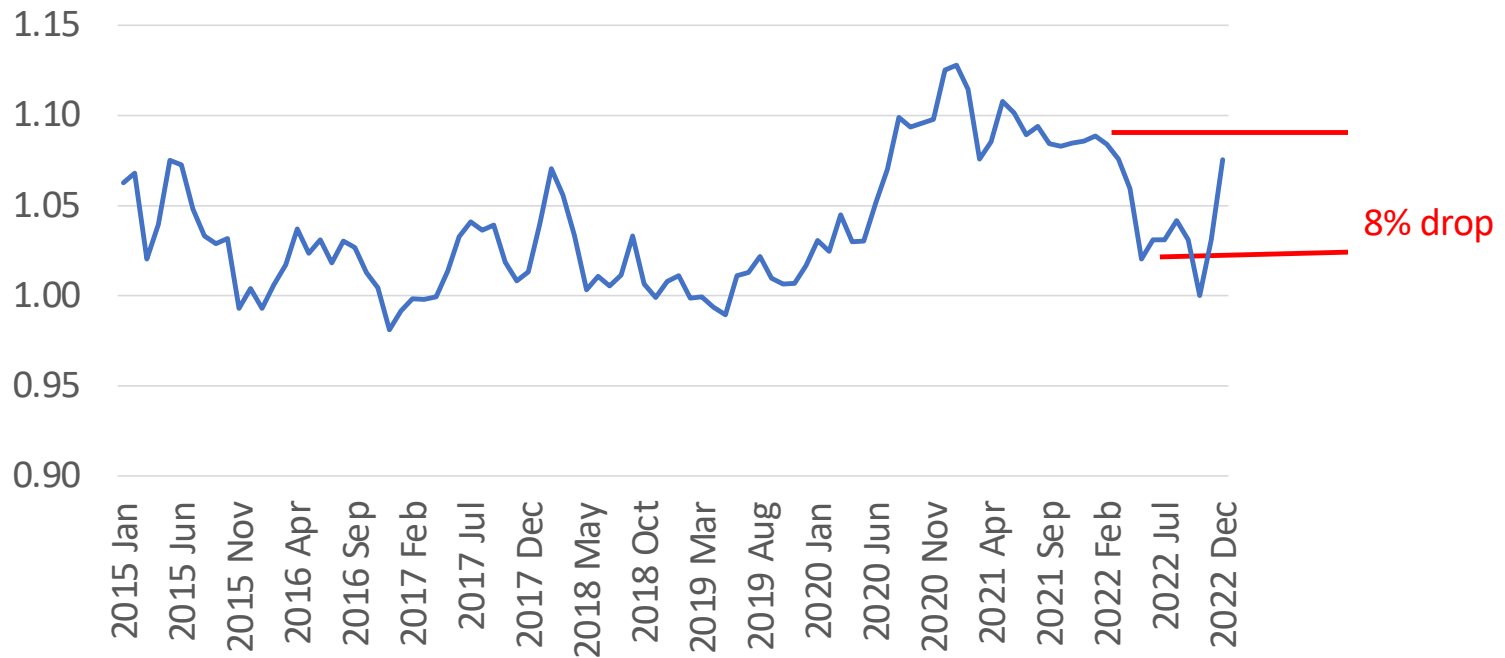
## Manipulation Criteria: US Bilateral Deficits

US Bilateral Trade Deficits larger than \$20 billion		US Bilateral Trade Surpluses larger than \$20 billion	
China	-923.2	Netherlands	20.3
Mexico	-365.8	Hong Kong, China	25.9
Japan	-236.5		
Germany	-104.9		
Vietnam	-70.1		
Ireland	-58.8		
Italy	-58.5		
Canada	-53.0		
Malaysia	-33.7		
Switzerland	-33.3		
India	-28.4		
Korea, Rep.	-25.5		
Thailand	-24.7		

# Currency Manipulation

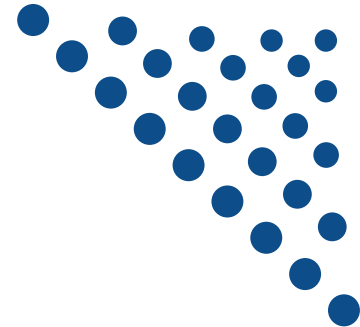
## Not Manipulation Criteria: Exchange Rates

Switzerland's Exchange Rate, US\$/franc, 2015-2022

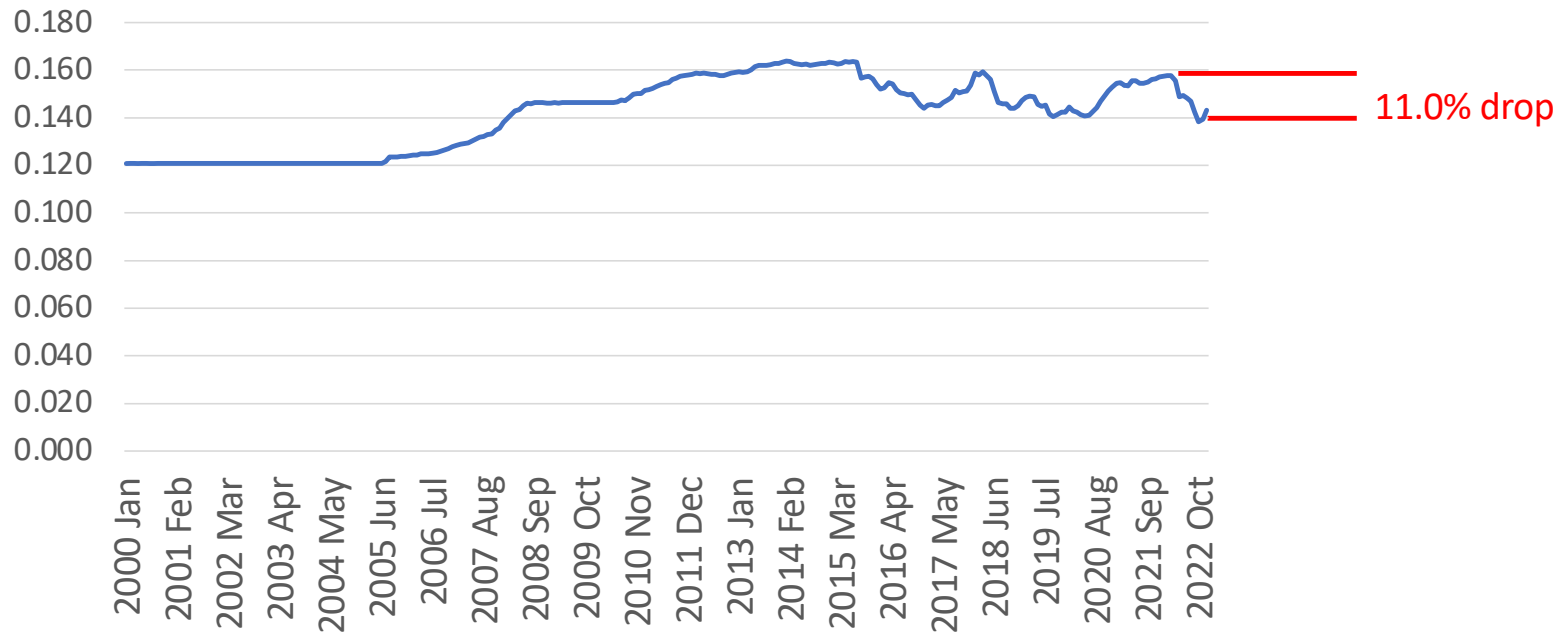


# Currency Manipulation

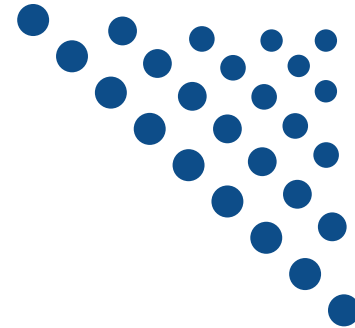
## Not Manipulation Criteria: Exchange Rates



China's Exchange Rate, US\$/Yuan, 2000-2022



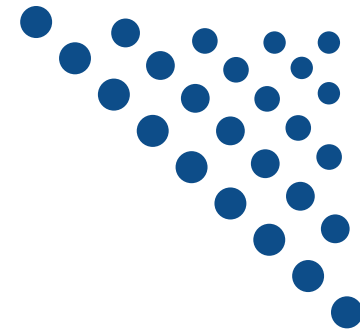
# Currency Manipulation



- **US Treasury Report November, 2022**

- “[The U.S.] Treasury has concluded that no major trading partner of the United States engaged in [currency manipulation] during the relevant period.”
- “Switzerland once again exceeded the thresholds for all three criteria...”
- “Italy, India, Mexico, Thailand, and Vietnam have been removed from the Monitoring List in this Report, having met only one out of three criteria for two consecutive Reports..”
- “In this Report, the Monitoring List comprises China, Japan, Korea, Germany, Malaysia, Singapore, and Taiwan.” (7 countries)
- “China’s failure to publish foreign exchange intervention and broader lack of transparency around key features of its exchange rate mechanism make it an outlier among major economies and warrants Treasury’s close monitoring.”

**Next Week**

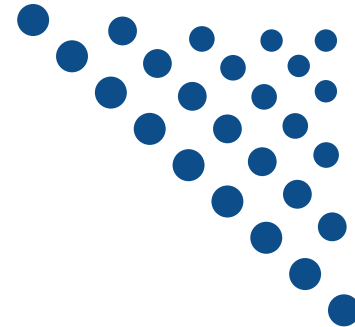


Topic

Speaker  
From

**Thank you!**

# Any Questions?



[www.NEEDelegation.org](http://www.NEEDelegation.org)

Alan Deardorff

[alandear@umich.edu](mailto:alandear@umich.edu)

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