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INTERNATIONAL AND MONETARY ECONOMICS

2° YEAR BIEF

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INTERNATIONAL AND MONETARY ECONOMICS

LESSON 1 - International Monetary Systems

Exchange Rates and the Real Economy

- The classic view is known as the ***expenditure switching effect***
  - Exchange rate depreciation boosts demand for domestically produced goods

- Firms price their internationally traded goods in different currencies:
  - *Producer currency pricing* (**PCP**)
  - *Local currency pricing* (**LCP**)
  - *Dominant currency pricing* (**DCP**)➔ e.g. Dollar Currency Pricing

LESSON 2 - Aggregate Economic Activity

- If we take an historical perspective of the aggregate economic activity, we can notice that during the Great Depression (1929) policymakers had only disaggregated information, such as stock prices and measures of industrial production
  - There was no measure whatsoever on aggregate activity that could help to quantify the crisis and assess the effectiveness of economic policies
  - The danger with this is that rumors could trigger a self-fulfilling depression

➔ In order to solve the problem, Simon Kuznets and colleagues developed in the 1930s the **National Income and Product Accounts** (**NIPA**) to obtain aggregate information about the economic activity in a country

- During the 2008 financial crisis, even though policy makers had information about the aggregate economic activity, they lacked information about the *interconnectedness of banks*

The National Income Accounts

- Gross domestic product (**GDP**) is the *market value* of the *final* goods and services *newly produced* in an economy over a *certain period*
  - Gross means that it does not consider the depreciation of the physical assets in an economy

$$GDP = Consumption + Investments + Governement\ Purchases + Trade\ Balance$$

- There is a difference between Government Purchases and Government Spending
  - *Government Purchases* refer to purchases of goods and services by the government (e.g., Healthcare is a service purchased by the State for citizens)
  - *Government Spending* refer to the redistribution of wealth between citizens of a country done by the government

- GDP is a *flow variable* because it measures the value of final goods and services produced in an economy during a certain period of time:
  - It is NOT a *stock variable* because it does not measure the amount of capital in an economy, for instance

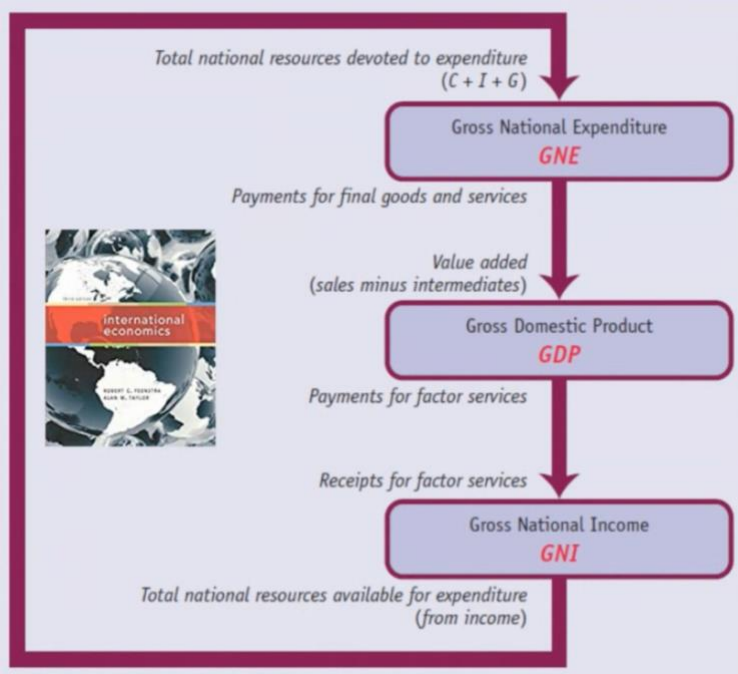
Useful GDP values

- World: $94.9 trillion
- European Union: $23.2 trillion
- US: $22.9 trillion
- China: $16.9 trillion
- Italy: $2.1 trillion

National Income and Product Accounts (Closed Economy)

- A closed economy is an economy that does not trade with other countries:
  - *Gross National Expenditure* (GNE) → Expenditure approach counts all the purchases in the economy
  - *Gross Domestic Product* (GDP) → Product approach counts all the final goods produced in the economy
  - *Gross National Income* (GNI) → Income approach counts workers' income and firms' profits in the economy

→ In a closed economy GNE=GDP=GNI because the country does not enter into transactions with other countries



Gross National Expenditure
Counts the total payments for final goods and services

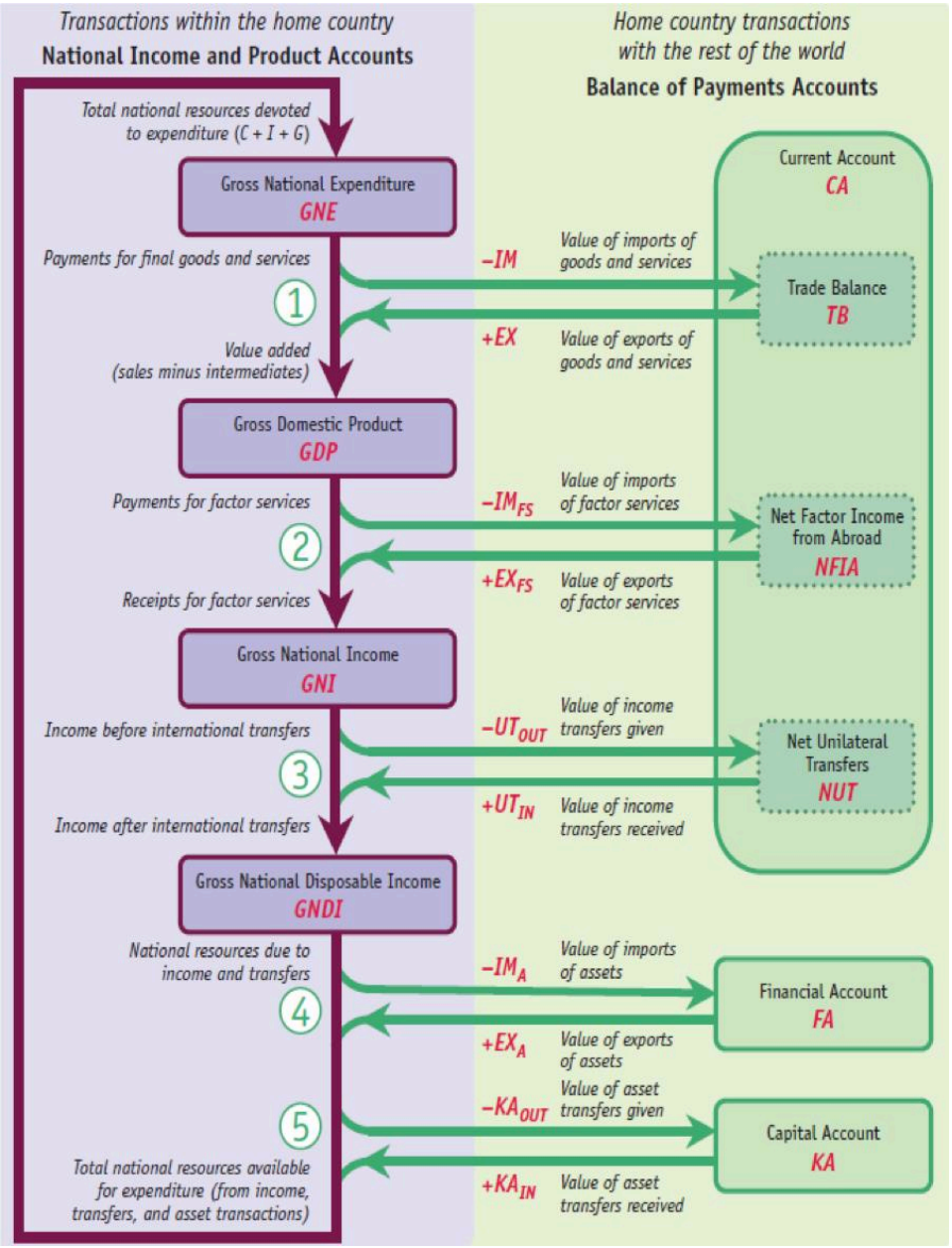
Gross Domestic Product
Value of all intermediate and final goods and services produced as output by firms, minus the value of all intermediate goods and services purchased as inputs by firms

Gross National Income
Sum of the incomes of all the factors of production in an economy (capital, labor, and land)

- In Macroeconomics, *investments* refer to physical investments:
  - *Business Fixed Investment* refers to the spending by firms on plants, machinery, and equipment
  - *Residential Investment* refers to the construction of new houses and apartment buildings
  - *Inventory Investment* refers to changes in inventory of final or intermediate goods

➔ In a closed economy, ***Savings=Investments***

The Flow of Payments in an Open Economy



1. From *Gross National Expenditure* to *Gross Domestic Product*
    - **GNE**=C+I+G
    - **GDP**=C+I+G+Exports – Imports

NB
GDP<NX in the case in which investments are negative:

- This can be possible if a country does not invest in new inventory and liquidates the whole country inventory
- In this case, the country disinvests in national capital
- If the inventory is completely sold to foreigners, then Net Exports can be higher than GDP

➔ **(Exports – Imports)** is called the *trade balance* or *net exports*

2. From *Gross Domestic Product* to *Gross National Product*
    - **GNP**= C+I+G+(Exports-Imports) +NIFA
    - **NIFA**= Exports of Factor Services – Imports of Factor Services

➔ **NIFA** is the *Net Factor Income from Abroad*:

- **GNI** accounts also for factors of production provided or given to foreign countries
- If an Italian worker works in Switzerland and takes his income back to Italy, this income must be added to Italian GDP and not Swiss GDP
- If an Italian investor owns Apple's shares and is paid some dividends, these must be subtracted from US GDP and added to Italian GDP

3. From *Gross National Product* to *Gross National Disposable Income*
    - **GNDI**= GNP+*Net Unilateral Transfers*
    - **Net Unilateral Transfers**= Unilateral Transfers IN – Unilateral Transfers OUT

➔ *Net Unilateral Transfers* are **non-market transactions** such as foreign aid, remittances by migrants to their families back home, and gifts from abroad

- In some developing countries, *Net Unilateral Transfers* are a large component of the economy

4. However, we should notice that a country's capacity to spend is not restricted to be equal to its GNDI, but it can be increased or decreased by:
    - The *Financial Account*
    - The *Capital Account*

➔ ***Financial Account = Value of Asset Exports – Value of Asset Imports***

- When foreign entities pay to acquire financial assets from home entities, the value of these *asset exports* increases the resources available for spending at home
- When a domestic entity pays to acquire financial assets from abroad, the value of these *asset imports* decreases the resources available for spending
- In general, the financial account keeps track of all the international purchases or sales of financial assets

➔ ***Capital Account = Capital Transfers IN – Capital Transfers OUT***

- The capital account records all the transfers of wealth between countries
- Contrary to the financial account, the capital account records mostly non-market activities or the acquisition and disposal of nonproduced, nonfinancial, and possibly intangible assets
- A country may not only buy and sell assets, but can also receive or transfer assets as gifts, which are measured by the capital account
- An example of gift may be the forgiveness of debt

➢ From the graph above we can see that, after adding the Current Account, the Financial Account, and the Capital Account to the Gross National Expenditure, we still get the Gross National Expenditure:

➔ This means that the **sum** of all **balance of payments accounts** must add to **zero**

$$\boldsymbol{FA + KA + CA = 0}$$

➢ Remember that every international transaction enters the balance of payments twice, once as a credit and once as a debit:
- Any transaction resulting in a receipt from foreigners is entered in the balance of payments as a ***credit***
- Any transaction resulting in a payment to foreigners enters the balance of payments as a ***debit***

GNP VS GDP: The Ireland Case

➢ Until the 70s, Ireland was one of the poorest countries in Europe:
- Between 1970 and 2008, the country experienced the so-called Irish Miracle

➔ One of the drivers of growth was *capital imports*, since many foreigners started to invest in the country

➢ Even though GDP increased substantially, a large part of it went to the foreigners who owned the factors of production
- In 2004, Ireland was the 4th richest country by GDP, but the 17th richest by GNP
- Similarly to Ireland, Luxembourg has a GDP 50% higher than GNP due to foreign workers

LESSON 3 – MEANING OF CURRENT ACCOUNT

- We can discuss 2 interpretations of Current Account
  - Current Account, Savings, and Investment
  - Current Account and NIIP

Current Account, Savings, and Investment

- The open economy national income identity is:

$$GNDI = C + I + G + CA$$

- By definition, *Saving* is the part of income that is not consumed:

$$S = GNDI - (C + G)$$

  - Recall the different between *Saving* and *Savings*:
- Saving it the part of income that is not consumed
- Savings is a stock variable that result from the accumulation over the years

- If we rearrange the national income identity, we get:

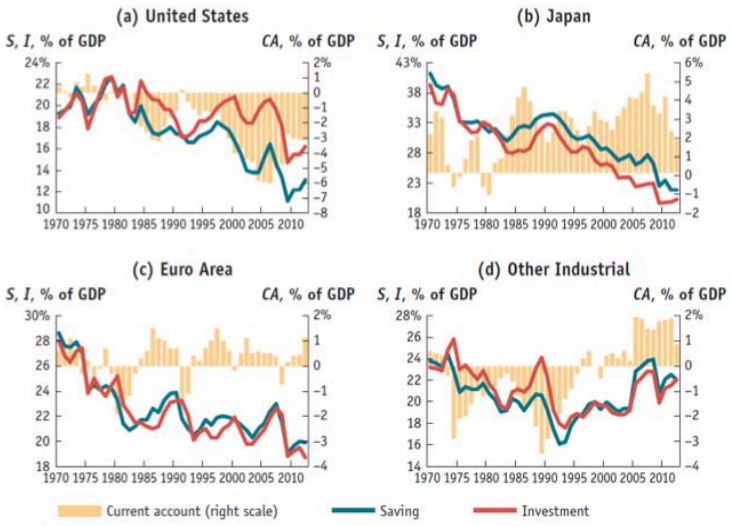
$$CA = (GNDI - C + G) - I \rightarrow \boldsymbol{CA = S - I}$$

➔ A country can save more than it invests by having a current account surplus, which means by lending to the rest of the world

$$If\ S > I \rightarrow CA > 0$$

➔ A country can Invest more than it saves by having a current account deficit, which means by borrowing from abroad

$$If\ S < I \rightarrow CA < 0$$



- Saving/GDP fell in most industrialized countries
- When Investments are larger than Saving, the country runs a current account deficit
- Investment behavior changes among countries

➔ Current account automatically reflects these differences

- Some reasons behind the fall of Savings/GDP:
  - Many rich countries are aging, so they retire, do not earn income, and start tio dissave
  - The secular decline in the interest rates after the '80s give small incentive to save

- Japan has a positive current account, despite both savings and investments are falling
  - This is because the difference between savings and investment is positive
  - For this reason, the trade balance is positive

- In the US, the current account has been negative for the last 40 years as investments have usually been larger than savings
  - A big question is how it is possible that it manages to run large current account deficits for decades

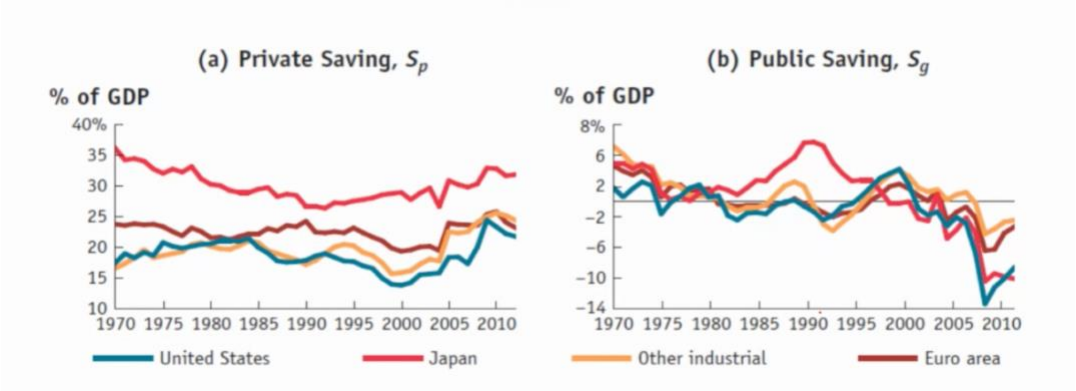
Decomposing Saving

- We can decompose saving in two components:
  - ***Private Savings***, which are part of private disposable income that is saved rather than consumed

$$S^P = (GNDI - T) - C$$

  - ***Government Savings***, which is the extent to which the government is borrowing to finance its expenditure

$$S^G = T - G$$



➔ ***National Savings*** are the sum of private plus public savings

$$S = S^P + S^G = I + CA$$

- During the boom before the housing collapse, Japan's public savings increased as the government was collecting more taxes
  - However, after the housing market crash, public savings declined dramatically

➔ In general, Public Saving is much more volatile than Private Saving because the government must adjust them to counteract the economic cycle

- We must notice that a Government Deficit does not necessarily trigger a current account deficit:
  - Recall that $CA = S^P + S^G - I$
  - For instance, according to the *Ricardian Equivalence*, a government deficit does not cause current accounts deficits because, as Government Savings go down, agents will understand that this translates in an increase in future taxes, therefore they will increase their Private Savings

    ➔Basically, economic agents undo what the government does
  - On the other hand, it might also be the case that individuals do not have access to financial markets or would consume everything today; in this case, a decrease in government saving might also trigger a decrease in private saving
  - Another reason why a decline in government saving does not necessarily trigger a current account deficit is the behavior of investment; if, we are in a recession, the government will reduce government saving, but in this case also investment will decline

- China is a country with very high investments that, however, manages to run large current accounts:
  - This can only be possible because of large savings

Current Account and Net International Investment Position

$CA = Net\ Export + Net\ Income\ from\ Abroad + Net\ Unilateral\ Transfers$

- Assuming that $Net\ Income\ from\ Abroad = Net\ Unilateral\ Transfers = 0$:
  - If $\boldsymbol{NX < 0}$, the country imports more than what it can pay with exports, hence the difference must come from borrowing from foreigners
  - If $\boldsymbol{NX > 0}$, the country exports more than what it gets back with imports, hence it must be selling goods on credit, which means, it is lending to foreigners

- The ***Net International Investment Position*** is the difference between foreign assets held by domestic residents and domestic assets held by foreign residents (i.e., domestic liabilities)

➔ Current account results in a change in NIIP

$$\Delta NIIP_t = NIIP_t - NIIP_{t-1} \approx CA_t$$

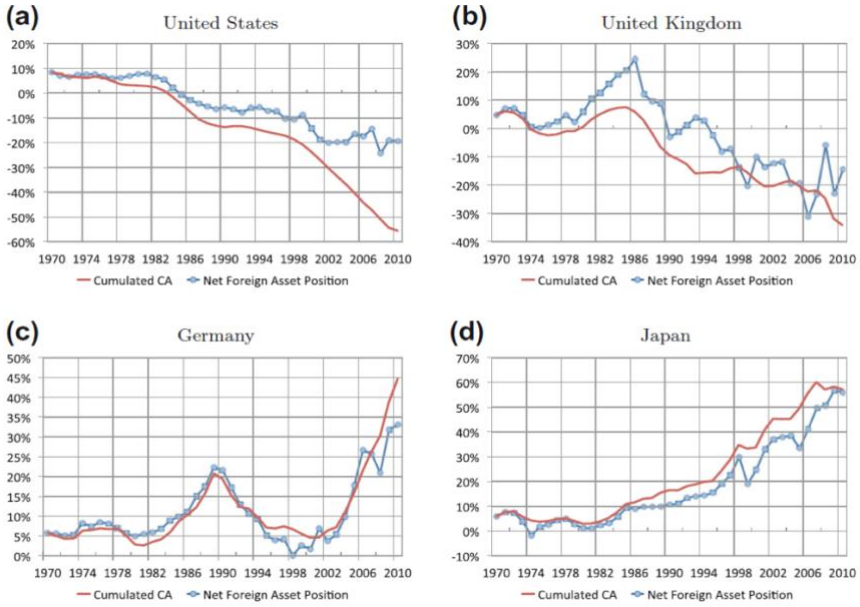
- $NIIP_t$ is the country's net international investment position at the end of period *t*
- This approximation derives from the *valuation effect*

- If a country has a negative international investment position, this does not imply that the country receives a negative return on this position:
  - The US have a negative NIIP but a positive Net Investment Income
  - This happens if the return on assets is sufficiently larger than the interest on liabilities
  - The US have the so-called *exorbitant privilege*, as the return on investment abroad is higher than the interest on its liabilities

- In the US, the *exorbitant privilege* is possible because it is a very leveraged investor
  - The US is long on risky-high return foreign assets and short on safe-low return domestic assets
  - This means that the US sells abroad low-risk, low-return assets and uses the income from the sale to purchase risky assets with high returns from abroad
  - The yield that the US receives on its assets was higher than the yield it paid on its liabilities by about 2% over 1952-2011

Valuation Effect

$$\Delta NIIP_t = NIIP_t - NIIP_{t-1} \approx CA_t$$



- From empirical data, we can see that current account is approximately equal to the change in the Net International Investment Position
  - If it was an exact equality, the red and blue lines above would coincide

- We can say that $\Delta NIIP_t = CA_t + valuation\ effect$:
  - The *Valuation Effect* is the difference between the change in the value of assets held abroad, minus the change in the value of domestic assets held by foreigners

➔ For instance, a change in the exchange rates may have a strong impact on the Net International Investment Position, without countries changing their current account at all

- In the 2007-2008 financial crisis, investors started to sell their holdings of risky assets and purchased safe US government bonds
    - This increased the value of the US dollar wrt other currencies, but reduced the Net International Investment Position

- As aforementioned, China is a country with very high investment and large current accounts:
    - The discussion done so far highlights that running large current accounts leads to high investments abroad
    - Indeed, it is wrong to say that China is investing its trade surpluses to build up its own economy, but it is using them to invest and build up the rest of the world
    - China has massive infrastructure project in China and Asia, in addition to a large share of the US treasury

The Balance of Payments Accounts

- A country's balance of payments account keeps track of both its payments to and receipts from foreigners
- An accounting convention is:
    - Any payment **to foreigners** enters as a **debit**
    - Any payment **from foreigners** enters as a **credit**

➔ The convention results in FA+CA+KA=0

- Any international transaction automatically gives rise to two offsetting entries in the balance of payments resulting in an identity
- However, due to the *statistical discrepancy*, not always the three balance of payments accounts add up to zero

- The Balance of Payments rarely sums to zero because of errors and non-reported transactions:
    - Theoretically, $NIIP^{World} = 0 = A^{World} - L^{World}$
    - In practice, $NIIP^{World} < 0$
    - The reason behind this has been thought to be tax evasion, since individuals hide their assets in order to avoid paying taxes
    - Researchers have indeed shown that about 8% of world wealth is hidden in tax heavens (*Zucman, The Hidden Wealth of Nations*)

- Because of tax heavens, official figures may be distorted:
    - Indeed, in the last two decades there has been a huge rise in cross-border investment through tax heavens
    - For instance, despite restrictions by Chinese authorities, Americans own a lot of assets in China
    - We can say that China and the US are way more integrated than official data show

LESSON 4 – THE NOMINAL EXCHANGE RATE

- J.M. Keynes is the father of macroeconomics and an influential person in the development of the Bretton Woods system
    - He coined the *interest rate parity* term

- The **nominal exchange rate** is the amount of currency needed to buy one unit of another currency

- Notation:
    - *Units after the number*: 1.13 USD/EUR means that you need 1.13 dollars to buy 1 euro
    - *Units before the number*: USD/EUR 0.89 means that you need to pay 0.89 euros to get 1 dollar

➔ In class, we will use the notation $E_{\frac{\$}{€}}$ to refer to the USD/EUR

- Exchange rate can be quoted in two ways:
    - **Direct➔** price of the foreign currency in terms of home currency
    - **Indirect➔** The price of domestic currency in term of foreign currency

  We will use the *direct quotation*

- *Depreciation of home currency*
    - An increase in the price of foreign currency in the terms of home currency (*E* increases)
    - Home goods become cheaper to foreigners, and foreign goods become more expensive for domestic residents
    - All else equal, a depreciation lowers the relative prices of a country's exports and raises the relative prices of its imports

- *Appreciation of home currency*
    - A decrease in the price of foreign currency in the terms of home currency (*E* decreases)
    - Home goods become more expensive for foreigners, and foreign goods become cheaper for domestic residents
    - All else equal, an appreciation raises the relative price of a country's exports and lowers the relative prices of a country's imports

FX markets

- The daily volume of foreign exchange transaction was $6 trillion in April 2019, which is 3x Italian GDP
    - Over the last 20 years, the volume of currency exchanges has been growing fast
    - This means that the world is increasingly more integrated

- Most transactions exchange foreign currencies for USD:
  - The prices of some of the most traded goods are typically stated and paid in USD
  - Many trades for smaller currencies are made using the dollar as **vehicle currency** because it is a very liquid currency

- FX trade is concentrated in big financial centers:
  - The FX market is always opened
  - London is the largest FX market center
  - Given the huge activity on FX markets, prices are quickly equalized in all major trading places in the world

- Financial firms are the key participants in the FX market:
  - Banks, hedge funds, insurance companies… either directly speculate on currencies or need to get foreign currency to let their clients invest in foreign stocks and bonds
  - Banks allow firms and citizens to convert their domestic currency to make purchases abroad
  - Non-financial firms conduct currency transactions to buy/sell goods, services, and assets
  - Central Banks conduct official international transactions

- The three most used contracts in the FX markets are:
  - **Spot contracts**, which allow to enter in the exchange market for immediate payment and delivery
  - **Forward contracts**, which allow to enter the exchange market for payment and delivery at some future date, pre-agreed upon
  - **Swap contracts**, which consist in a spot sale of a currency combined with a forward repurchase of that currency

➔ Swaps are by far the most common contracts in the FX market because they allow to reduce transaction costs. Indeed, entering into a swap contract that combines both a spot and froward contract, reduces the transaction costs from entering firstly a spot and then a forward contract

- FX markets are *bilateral* and <u>not</u> centralized

- Spot and forward exchange rates tend to move in a highly correlated fashion according to empirical evidence

Demand for Currency Deposits

- The demand for a foreign currency deposit is influenced by the same considerations that influence the demand for any other asset:
  - Rate of return
  - Risk
  - Liquidity

- Assuming that investors are primary concerned about the rates of return on currency deposits, rates of return depend on:
  - Interest rates that the assets will earn
  - Exchange rate growth expectations

- The *expected rate of appreciation* of a currency is:

$$\frac{E^e - E}{E}$$

- For instance, the dollar rate of return on Euro deposits approximately equals:
  - The interest rate on euro deposits
  - **Plus** the expected rate of appreciation of the euro

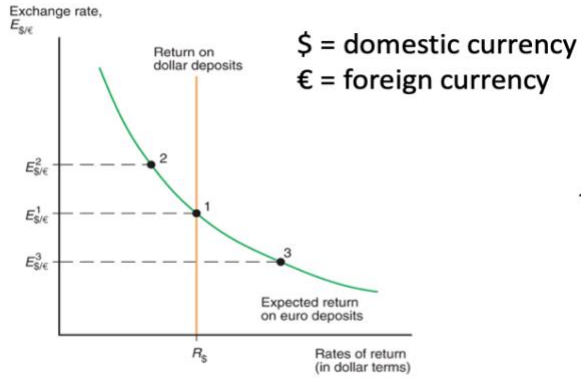
$$R = R^* + \frac{E^e - E}{E}$$

- At equilibrium, deposits of all currencies offer the same expected return:
  - This situation is known as the **interest rate parity**

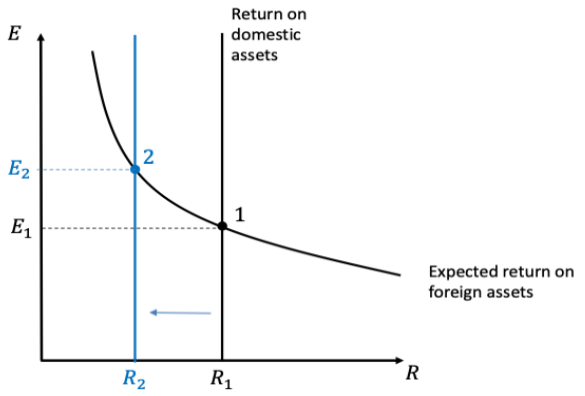
- Therefore, assuming that $R < R^* + \frac{E^e - E}{E}$, we can say that:
  - No investor wants to hold home deposits
  - Demand for deposit in domestic currency will decline
  - Demand for deposit in foreign currency will increase
  - Home currency will depreciate, and the exchange rate will increase

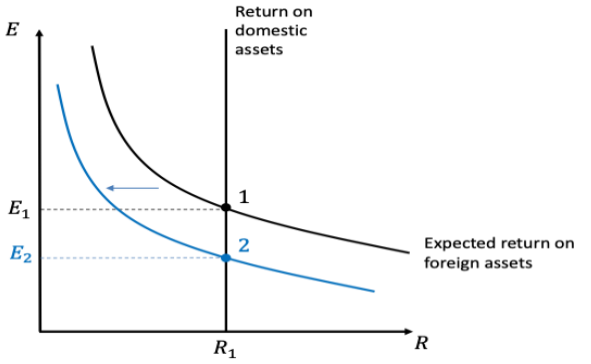
➔ It becomes more expensive to purchase foreign currency in terms of national currency until the return on national currency equals that on foreign currencies

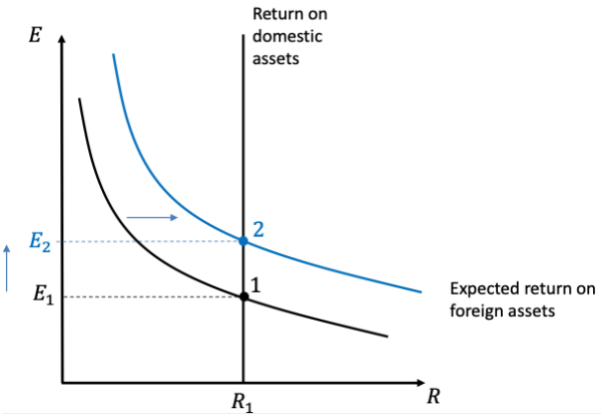
Representing the parity using diagrams



Note: $R_€$ and E^e are fixed on this diagram







- In this case, we have an equilibrium condition in which:

$$R = R^* + \frac{E^e - E}{E}$$

- If domestic interest rates fall, at E1 the expected return on foreign assets is higher than R2
  - Demand for foreign currency increases

➔ The domestic currency will *depreciate*

- If foreign interest rates decrease, the expected rate of return on foreign assets E1 is lower than R1
  - Demand for domestic currency will increase

➔ The domestic currency *appreciates*

- If the expected Exchange rate Ee increases, demand for foreign currency will increase

➔ The foreign currency will appreciate, and the domestic currency will depreciate

➔ It is worth underlying that exchange rates behave like any other asset, since its value today depends on expectations of its value in the future

Interest Parities

- *Covered Interest Rate Parity* (**CIP**)

$$R = R^* + \frac{F - E}{E}$$

  - F is the forward exchange rate
  - The forward exchange rate contract covers the FX risk

- *Uncovered Interest Rate Parity* (**UIP**)

$$R = R^* + \frac{E^e - E}{E}$$

  - It is called uncovered because it is exposed to exchange rate risk

***Empirical evidence con Covered Interest Rate Parity* (CIP)**

- After the UK and Germany lifted capital controls, the difference between the return of German deposits and UK deposits dropped quickly:
  - Indeed, with capital controls, there was no possibility to carry out arbitrage by opening deposit accounts in countries with higher interest rates
  - As investors became able to freely carry out arbitrage, the interests on deposit almost equalized between countries

- However, the Covered Interest Rate Parity holds only in normal times:
  - Indeed, during times of crisis, evidence shows that the Covered Interest Parity condition did not hold

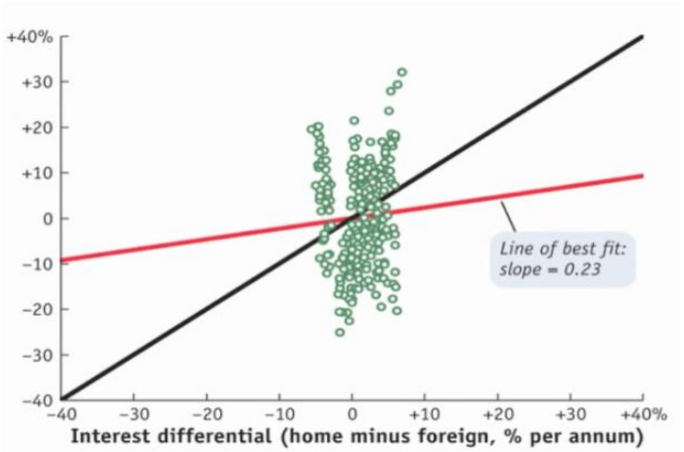
➔ The condition does not hold because of:
  - Capital controls
  - Counterparty and liquidity risk
  - New financial regulations

- Some examples of the recent deviations from the CIP are:
  - The enormous increase in counterparty risk after the collapse of Lehman Brothers
  - Persistent deviations after the 2008 financial crisis due to new regulations that limit the financial positions of banks

***Evidence on Uncovered Interest Parity* (UIP)**

The UIP relationship is described as:

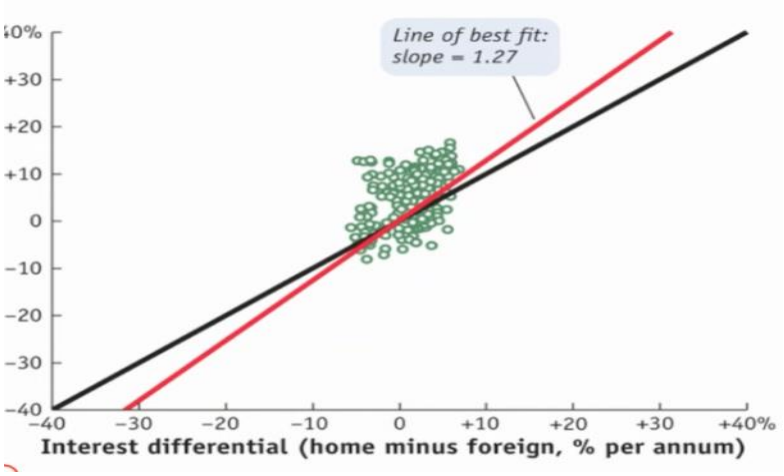
$$\frac{E^e - E}{E} = R - R^*$$



- On the *x-axis* we have plotted the *interest rate differential*, $R - R^*$
- On the *y-axis* we have plotted the *Actual Rate of Depreciation* $\frac{E^e - E}{E}$
- The black 45° line represents the UIP model $\frac{E^e - E}{E} = R - R^*$

➢ Assuming that the UIP holds, the data gathered should fit the 45° line
- However in the 70s Eugene Fama substituted the Future Expected Exchange Rates with the **Future Realized Exchange Rates** and saw that these data did not actually fit the model
- Using the Future Realized Exchange Rate (green dots), data does not seem to support the Uncovered Interest Parity Model
- The observed failure of the UIP is usually called the **forward premium puzzle**

- After Fama discoveries, new researches were made by asking to traders what was the Future Exchange Rate they Expected

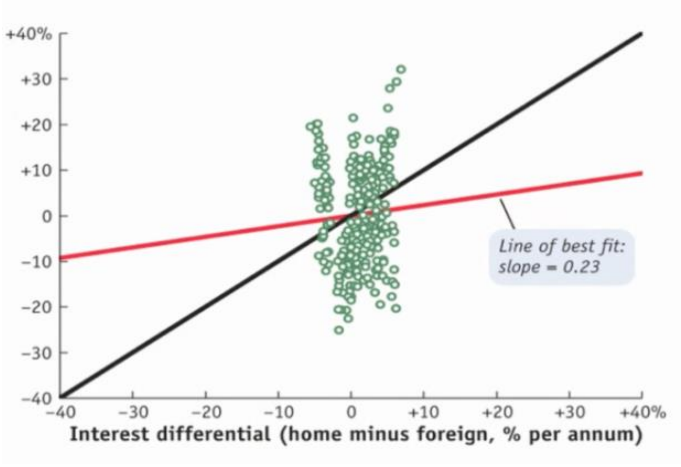


  - The plot shows that UIP does not hold perfectly, however it provides a useful approximation of the positive relationship between the Expected Rate of Depreciation and the Interest Differential
  - One of the explanations behind the imperfect fit of the model is the risk-premium, which we have not considered so far

The Carry Trade Strategy and UIP

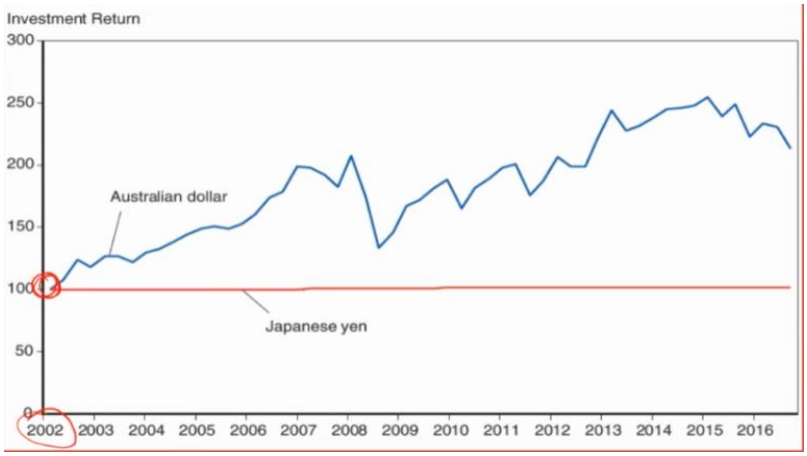
- The Carry Trade Strategy assumes that investors do arbitrage by borrowing in low interest rate currency and investing in high interest rate currency
  - The low interest currency is known as **funding currency**
  - The high interest currency is known as **target currency**

- Investors also hope that the funding currency does not appreciate against the target currency



- Researchers noticed that the Interest Rate differential is not related to the Actual Rate Depreciation
    - This means that Exchange Rates fluctuate continuously over time and therefore at some point in time these fluctuations will cancel each other out and will allow investors to earn the difference in the interest rates

- An example is the cumulative total investment return in Australian Dollar compared to the Japanese Yen:



    - On average, the Australian Dollar-Yen carry trade has been profitable, however it is subject to sudden large reversals

➔ Therefore, another potential explanation of the **forward premium puzzle** is that positive carry trade return can be a compensation for the **disaster risk**, which is the abrupt exchange rate movement occurring during financial crises when other risky assets lose value

- In this sense, we can say that Exchange Rate Fluctuations are **skewed** since ups and downs are not equally likely
    - Studies have shown that currencies with high interest rates tend to have negative skewness of FX changes
    - This means that the currency appreciates most of the times, but sometimes is abruptly crashes

LESSON 6

Money and Interest Rates

- The word *money* refers to the asset people use to make transactions and set prices in terms of
  - Money refers also to a kind of asset that is very liquid in the market

- Money has different functions:
  - **Store of Value**, and its value is expressed in terms of good and services
    ➔ If this was not the case, nobody would accept it as a mean for transactions

  - **Medium of Exchange**, since it solves double-coincidence-of-wants problems
    ➔ Indeed, money eliminates the search costs connected with a barter system because it is universally acceptable
    ➔ Scholars say that a good medium of exchange must be an *information insensitive* asset, because its value does not fluctuate after new information

  - **Unit of Account**, since it is used as a unit of measure of value for goods and services in a certain area
    ➔ Exchange rates allow us to translate different countries' money prices into comparable terms

Money Supply

- The *money supply* is the set of things that people use for transactions:
  - In reality, some assets are used more frequently in transactions than others
  - As a result, central banks compute several measures of money supply
  - In general, the money supply is controlled and directly regulated by the Central Bank, which has direct control over the amount of checking deposits issued by private banks

- Monetary base
  = notes and coins **in circulation**
  + notes and coins **in bank vaults**
  + *reserve deposits at the Federal Reserve*
  } Bank reserves

- $M1$ = ~~*Monetary Base*~~
  notes and coins **in circulation**
  + demand deposits
  + other checkable deposits
- $M2$ = $M1$
  + retail money market mutual funds
  + savings and small time deposits
  + overnight repurchase agreements

- $M1$ = currency, overnight deposits

- $M2$ = $M1$
  + deposits with agreed maturity up to 2 years
  + deposits redeemable at notice up to 3 months
- $M3$ = $M2$ + repurchase agreements, money market mutual funds debt securities up to 2 years' maturity

- We should distinguish between:
  - **Public Money**,
  - **Private Money**,

- The **monetary base** includes all the most liquid assets in the economy:
  - In Europe, this aggregate is called M1, which includes currency and overnight deposits
  - By adding to M1 bank deposits, we can form a second aggregate called M2 in Europe
  - In Europe, M3 is the aggregation of M2 and assets like repos, money market mutual funds, and liquid debt securities

- In the US, the **monetary base** includes all the notes and coins in circulation, plus the bank reserves, composed of notes and coins in bank vaults and reserve deposits at the Fed
  - M1 is equal to the notes and coins in circulation, plus demand deposits and other checkable deposits; it does not include the bank reserves
  - M2 aggregates M1 with retail money market mutual funds, savings and small-time deposits, and overnight repos

Central Bank Digital Currency

- The CBDC includes digital tokens created by central banks:
  - These are digital records of value that can be exchanged in transactions
  - Essentially, firms and regular people have access to central bank reserves
  - CBDC is an important recent trend related with the digitalization of money

- CBDC have the objective of preserving the role of **public money** in a digital economy:
  - Central banks' money does not face banks' solvency problems because it is supported by governments' power to tax and by legal tender
  - Central Bank money provides the ultimate settlement asset between banks, which is very useful in times of crises
  - Central Banks also define the unit of account, thus allowing the conduct of monetary policy

- Banks main activities are Issuing Deposits, Distributing Credit, and Clearing Payments:
  - If customers find CBDS more attractive to park their deposits and use for payments, funding will be more expensive for traditional banks
  - This will increase the cost of credit to firms and people, harming investment
  - Hence, this will be costlier in Europe, where bank intermediation is more prevalent than, for example, the US

Money Demand

- Money demand is affected by different factors:
  - *Interest rates* and *expected rates of returns*
    ➔ Recall that money does not pay any interest
    ➔ *R* is called the opportunity cost of money, which is the interest rate on government bonds
    ➔ All else equal, an increase in the interest rates reduces the demand for money because individuals will prefer to buy government bonds and earn a higher return

  - *Risk* comes mainly from *unexpected inflation*, which reduces the purchasing power of money
    ➔ However, since the risk of holding money is the same as the risk of holding bonds, an increase in risk should not reduce money demand and increase demand for interest paying securities

  - *Liquidity* is the fact that money is a convenient medium of transaction
    ➔ It is the key reason why people want to hold it despite a lower return compared to government bonds
    ➔ A rise in the average value of transactions carried out by a household or firm causes its demand for money to rise

- *Aggregate Money Demand* is the sum of the individual money demands of households, financial and non-financial firms, and it is determined by:

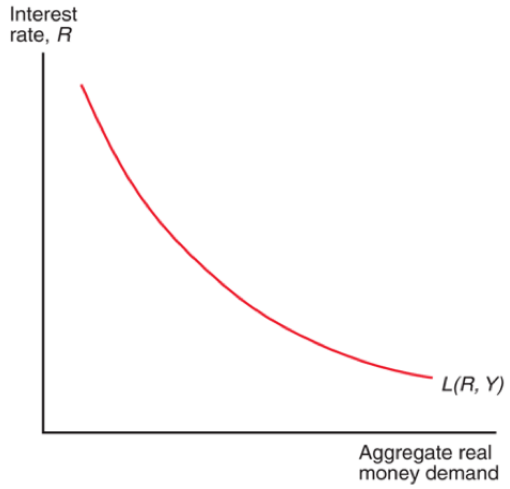
1. *Interest rates*
- Interest rates give the opportunity cost of capital
- All else equal, a rise in the interest rates causes each individual in the economy to reduce his demand for money because of a higher opportunity cost of capital
- Therefore, aggregate demand for money will fall

2. *Income*
- GDP≈ value of transactions
- When the national income (GNP) increases, more goods and services are sold in the economy
- Therefore, this increase in the value of transactions leads to an increase in the demand for money, given the price level

3. *Price level*
- If the price level rises, individual households and firms must spend more money to purchase their usual basket of goods
- Hence, after an increase in the price level, households and firms will require more money

- The aggregate money demand can be expressed by:

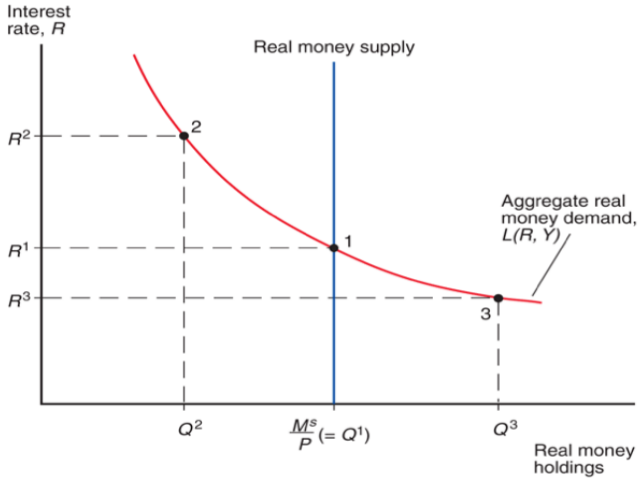
$$\frac{M^d}{P} = L(R, Y)$$



  - ➔ As the interest rate (R) increases, the money demand (L) drops because the opportunity cost of holding money increases

- The **money market equilibrium** is given by the equality of money demand and money supply:

$$Equilibrium\ Condition \rightarrow \frac{M^s}{P} = \frac{M^d}{P} \rightarrow \boldsymbol{\frac{M^s}{P} = L(R, Y)}$$



- Assume that $M^s > M^d$:
  - People are willing to buy interest bearing assets (bonds)
  - The price of these assets increases, and the interest rate decreases
  - The money demand will go up until a new equilibrium is reached

- A decrease in the money supply will increase in the interest rate:
  - For a given money demand, supply will be lower
  - Therefore, interest rates will rise until demand and supply will be in equilibrium again

- If Real Income decreases, the money demand will fall:
  - The level of transaction decreases, thus leading to a lower demand for money
  - Hence, individuals will have more incentive to hold bonds rather than currency
  - As individual buy more bonds, their price rises, and interest rates fall

LESSON 7

Money and FX Markets Equilibrium in the Short Run

- In the forex market, the equilibrium is given by the non-arbitrage condition:

$$R = R^* + \frac{E^e - E}{E}$$

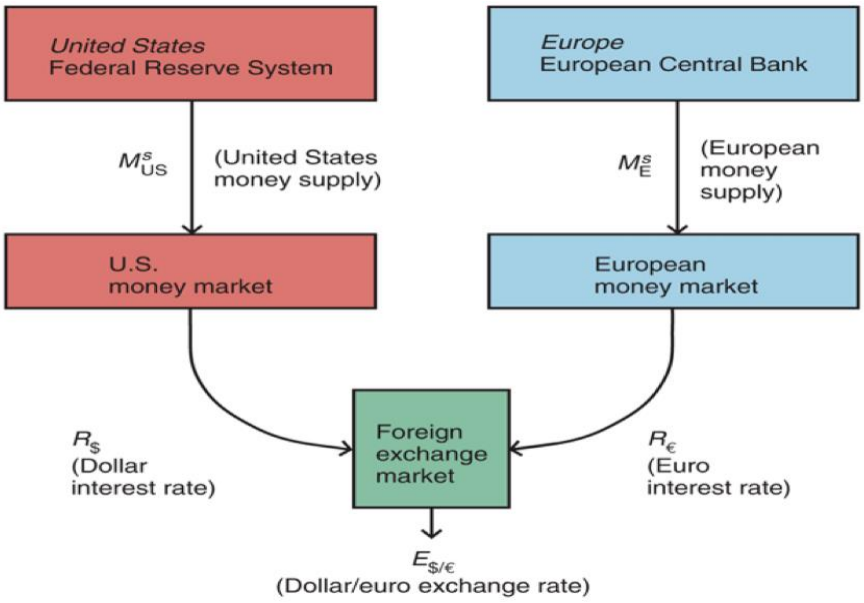
- In the money market, equilibrium is given by:

$$\frac{M^s}{P} = L(R, Y)$$

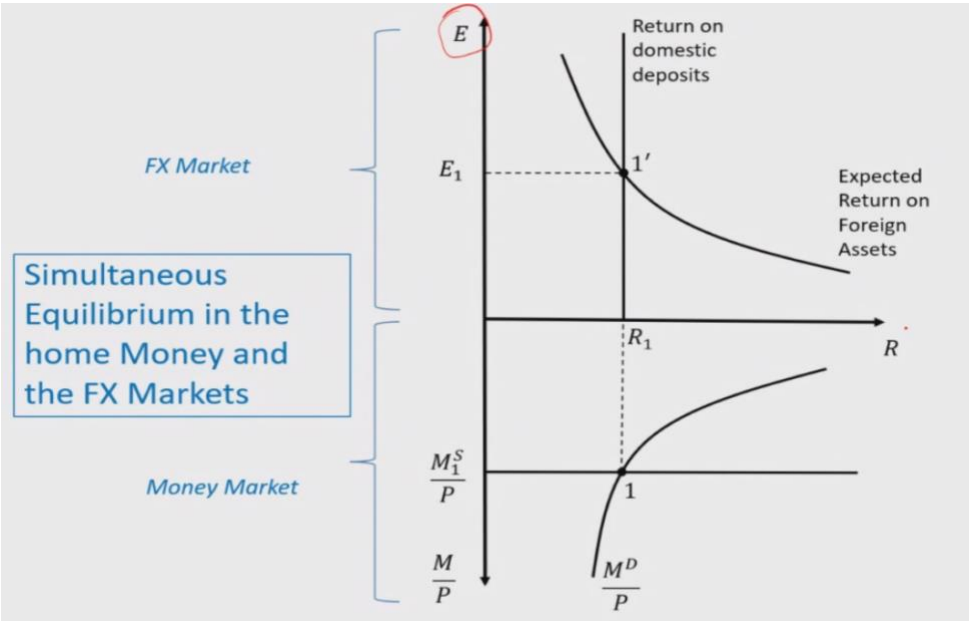
- Assumptions:
  - Y, Y^* are fixed for simplicity
  - E^e is fixed for simplicity, because perhaps policy experiments are temporary and do not affect future exchange rates
  - P, P^* are fixed (*sticky*) in the short run

- In the short run, the nominal exchange rate is much more variable than the price level
  - However, this may not always be the case

- A counterexample may be price indexation during hyperinflations



➢ Here we are connecting the money market in one country, with the money market in another:
  - The two currencies meet in the foreign exchange market with different interest rates, and determine the exchange rates



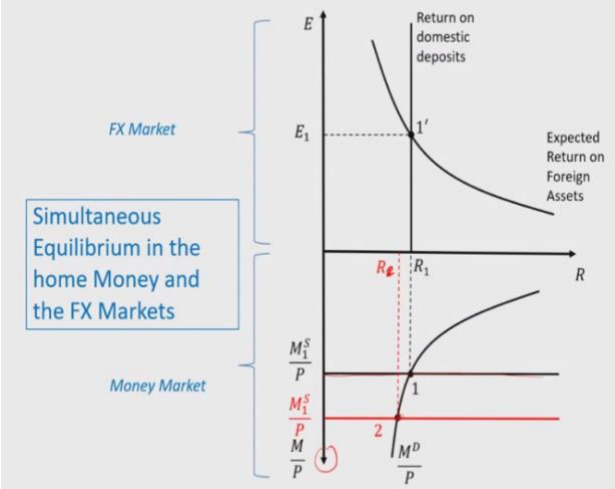
➢ On the top graph:

- The vertical line represents the interest rate at home, which is set on the domestic money market
- The downward sloping line is the Expected Return on Foreign Assets, which is a declining function of the domestic interest rate

➔ The lower the domestic interest rate is, the more convenient will be investing abroad

- On the bottom graph, we have the money market equilibrium, which in turn determines the domestic interest rate

➢ *Example*

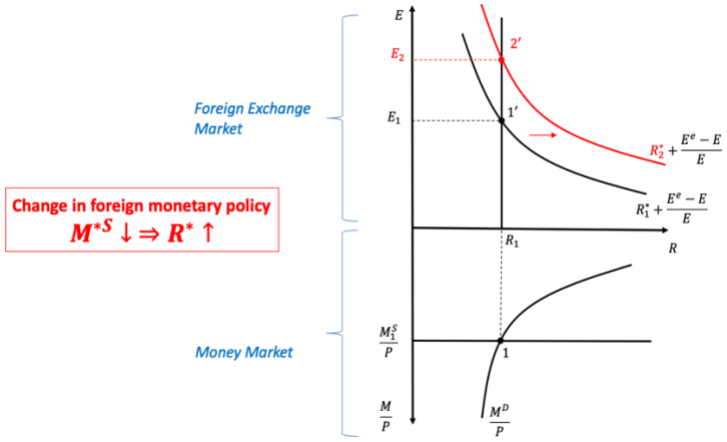


➢ If a Central Bank increases the money supply, at the initial interest rate (R1) there is an excess in the money supply, hence the interest rate falls, and a new equilibrium is reached

➢ When domestic interest rates fall, investors will see an arbitrage opportunity because they can invest in a foreign country currency by borrowing at the domestic low interest rates

➢ Therefore, the exchange rate will increase, and the domestic currency will depreciate

➢ *Example*



➔ A reduction in the foreign money supply will lead to an increase in the foreign interest rates:

- Since foreign assets now pay a higher return, investors will try to exploit the opportunity borrowing at home with lower interest rates to invest abroad, where interest rates are higher

- As the demand for the foreign currency increases, the exchange rate increases as well, and the domestic currency depreciates

Money and Prices in the long run

- In the short run:
  - Prices are sticky
  - Output is fixed for simplicity
  - The money market equilibrium determines the nominal interest rate

- In the long run:
  - Prices are flexible
  - Output varies but it is determined by real factors, and not by monetary policy changes
  - The money market equilibrium determines the equilibrium price level

- The money market equilibrium is given by:

$$\frac{M^s}{P} = L(\bar{r} + \bar{\pi}, \bar{Y})$$

  - $\bar{Y}$ is the level of output determined by real factors like labor force, capital stock, or technology
  - $\bar{r}$ is the real interest rate determined by real factor like trend output growth, or population growth
  - $\bar{\pi}$ is the long-run inflation targeted by the central bank

➔ The bars on top of the variables mean that the variables are **exogenous**, which means that they do not depend on the level of money supply

- *Long run money neutrality*
  - A change in the level of the supply of money has no effect on the long run value of real output
  - A permanent increase in the money supply causes a proportional increase in the price level's long run value, assuming that the economy is initially at full employment

- Changes in the money demand also affect long-run price level:

$$P = \frac{M^s}{L(\bar{R}, \bar{Y})}$$

  Which implies that:

$$\frac{\Delta P}{P} = \frac{\Delta M^s}{M^s} - \frac{\Delta L}{L}$$

- Empirical evidence shows that in the period between 1980 and 2014, money supply changed significantly in many different countries:
  - Based on this evidence, we can say that changes in price level are highly correlated with changes in money supply

- Indeed, the graph below shows that years with higher money growth also tend to be years with higher inflation
- The deviations from the 45-degree line suggests that changes in money demand have also noticeable effect on the price level
- The relationship, however, is not precisely a one-to-one relationship since factors like output, real interest rates, and aggregate real money demand can shift for reasons different from the money supply

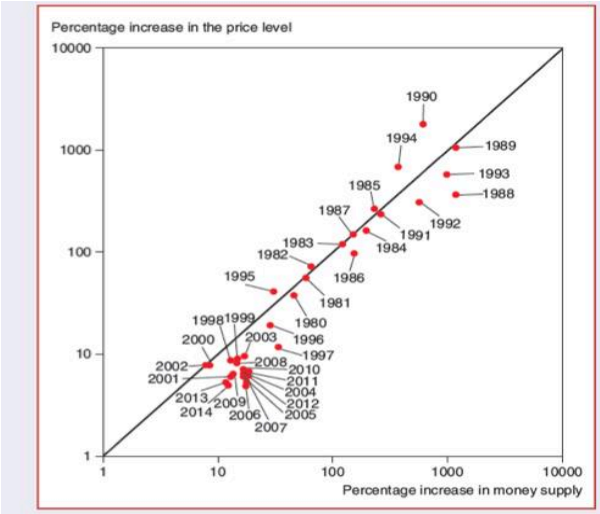


FIGURE 15-10

Average Money Growth and Inflation in Western Hemisphere Developing Countries, by Year, 1980–2014

Even year by year, there is a strong positive relation between average Latin American mone supply growth and inflation. (Both axes have logarithmic scales.)

Source: World Bank development indicators database and own calculations. Regional aggregates are weighted by shares of dollar GDP in total regional dollar GDP.

Money and FX in the long run

- The **long-run** money neutrality proposition states that a permanent increase in a country's money supply causes a proportional long-run depreciation of its currency against foreign currency
  - The reason behind it is the purchasing power parity theory

- In the **short run**, when prices and output are fixed, changes in money supply affect interest rates and, as a result, the exchange rate
  - The assumption about the short-run stickiness of prices is backed by empirical evidence

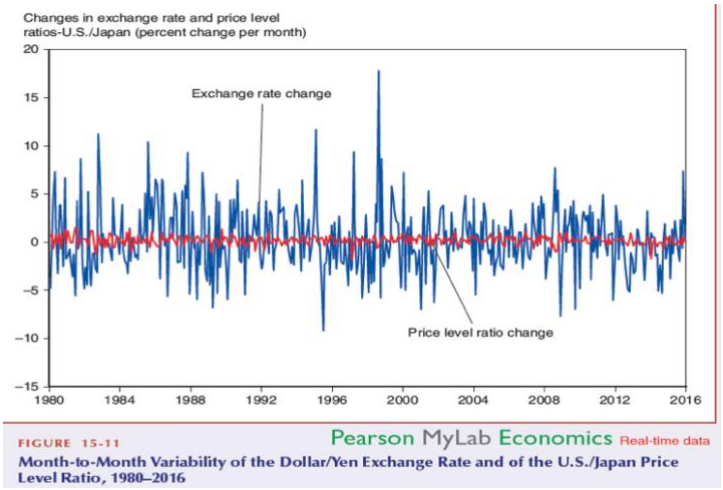
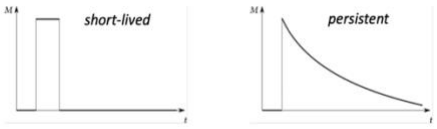


FIGURE 15-11 Pearson MyLab Economics Real-time data

Month-to-Month Variability of the Dollar/Yen Exchange Rate and of the U.S./Japan Price Level Ratio, 1980–2016

- In the **long run**, when prices are flexible, changes in money supply affect prices and, as a result, the nominal exchange rate

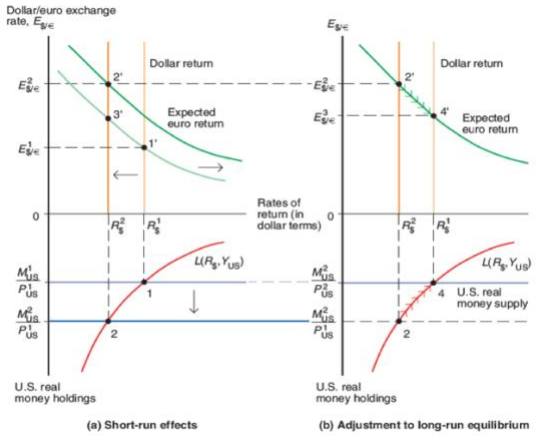
- A temporary change



- A permanent change

- Assume that the domestic central bank starts to *increase permanently* its money supply:
  - A change in money supply not only affects the nominal exchange rate, but also the expected exchange rate
  - This effect is sometimes called the **Dornbusch overshooting model**

➔ Therefore, a permanent increase in money supply affects the future because investors expect a higher future exchange rate beside the higher current exchange rate



- The graph above shows the short-run and long-run effects of a permanent increase in the money supply:
  - As the FED permanently increases the money supply, interest rates will fall in the short run and the dollar depreciates
  - However, the rise in the dollar/euro exchange rate also increases the expected return of euro deposits, thus shifting the downward sloping curve to the right
  - On the other hand, if expectations did not increase, the short run equilibrium will be point 3 instead of point 2 in the graph above
  - Therefore, the dollar depreciation is greater if we consider the expected depreciation
  - In the long run, the increase in the price level must be proportional to the increase in the money supply
  - Since output is given and the real money supply eventually returns to its initial level, the equilibrium interest rate must again be equal to the initial one in the long run
  - The rising US interest rates causes an appreciation of the dollar against the euro during the adjustment process

- **Exchange rate overshooting** is an important phenomenon because it helps explain why exchange rates move so sharply from day to day:
  - The exchange rate is said to overshoot when its immediate response to a disturbance is greater than its long-run response
  - Overshooting is a direct result of. sluggish short-run price level adjustment and interest parity
  - In a world where the price level could adjust immediately to its new, long-run level after a money supply increase, the dollar interest rate would not fall because prices would adjust immediately and prevent the real money supply from rising
  - Therefore, there would not be any need for overshooting to maintain equilibrium in the foreign exchange market, but the exchange rate would jump to its new, long-run level right away

CHAPTER 16 - PRICE LEVELS AND EXCHANGE RATES IN THE LONG RUN

The Law of One Price

- The **Law of One** Price states that in competitive markets free of transportation costs and official barriers to trade, identical goods sold in different countries must sell for the same price, when their prices are expressed in terms of the same currency

$$E_{\$/€} \times P_E^i = P_E^i$$

  - The Law of One Price has as index *i,* which means that it refers to a particular good *i*

- The **Purchasing Power Parity** (**PPP**) theory was developed by David Ricardo, and proposes that:

$$E_{\$/€} = \frac{P_{US}}{P_{EUROPE}}$$

  - Therefore, the PPP states that the nominal exchange rate between two currencies is equal to the ratio of the price levels
  - Recall that the domestic purchasing power of a country's currency is reflected in the country's price level, the money price of a reference basket of goods and services

➔ The PPP theory predicts that a fall in a currency's domestic purchasing power (indicated by an increase in the price level) will be associated with a proportional currency depreciation in the foreign exchange market

- The **Law of One Price** applies to individual commodities, while the **PPP** applies to the general price level, which is a composite of the price of all the commodities that enter into the reference basket

  - If the Law of One Price holds true for every commodity, then the Purchasing Power Parity must hold as well, as long as the reference baskets used to reckon different countries price levels are the same

$$\boldsymbol{E_{\$/€} \times P_E^i = P_E^i \; for \; all \; i \Rightarrow E_{\$/€} \times P_{EUROPE} = P_{US}}$$

  - However, if the Purchasing Power Parity holds, this does not imply that the Law of One Price holds

$$\boldsymbol{E_{\$/€} \times P_{EUROPE} = P_{US} \not\Rightarrow E_{\$/€} \times P_E^i = P_E^i \; for \; all \; i}$$

➔ The main reason why the Law of One Price does not necessarily hold true is that many goods are *non-traded*, therefore they cannot have the same price in all countries

- **Absolute PPP** is the relationship we have used so far, which states that the exchange rate between two currencies is the ratio of their price levels:

$$E_{\$/€} = \frac{P_{US}}{P_{EUROPE}}$$

  - The main issue with this approach is that consumption baskets are different for each country, and may lead to mistakes in the computation

- **Relative PPP** states that the percentage change in the exchange rate between two currencies over any period equals the difference between the percentage changes in national price levels
  - Relative PPP translates Absolute PPP from a statement about price and exchange rate levels, to a statement about *price and exchange rate changes*
  - It asserts that prices and exchange rates change in a way that preserves the ratio of each currency's domestic and foreign purchasing powers

$$\frac{E_{\frac{\$}{€},t} - E_{\frac{\$}{€},t-1}}{E_{\frac{\$}{€},t-1}} = \pi_{US,t} - \pi_{EUROPE,t}$$

The Fisher Effect

- An increase in the inflation rate translates in an increase in the nominal interest rate:
  - The effect combines the *UIP condition* and the *Relative Purchasing Power Parity condition*

$$UIP \rightarrow \frac{E^e - E}{E} = R - R^*$$

$$Relative\ PPP \rightarrow \frac{E^e - E}{E} = \pi^e - \pi^{e*}$$

$$\boldsymbol{\pi^e - \pi^{e*} = R - R^*}$$

➔ The *Fisher Effect* states that a rise in the domestic inflation rate causes an equal rise in the interest rate on deposits of domestic currency in the **long run**, assuming everything else remains constant
  - This is the *opposite* of what happens in the **short-run**, where a rise in the interest rates reduces domestic inflation

- Notice that the condition leads us to the no-arbitrage condition in real assets, since:

$$\pi^e - \pi^{e*} = R - R^*$$

$$R - \pi^e = R^* - \pi^{e*}$$

$$\boldsymbol{r = r^*}$$

Purchasing Power Parity Model of Long-Run FX

- By combining the framework of money demand and supply and the PPP model, we can obtain a useful theory of how exchange rates and monetary factors interact in the **long-run**
  - This is called the **monetary approach to the exchange rate**
  - This theory only applies to the *long-run* because it does not allow for the **price rigidities** that characterize the short-run
  - Instead, the monetary approach proceeds as if prices can adjust right away to maintain full employment as well as the Purchasing Power Parity

- To develop the model, we will assume that in the long-run the foreign exchange market sets the rate so that PPP holds:

$$\boldsymbol{E}_{\frac{\$}{€}} = \frac{\boldsymbol{P_{US}}}{\boldsymbol{P_{EUROPE}}}$$

- Furthermore, we can express the domestic price level in terms of domestic money demand and supply:

$$\boldsymbol{P_{US}} = \frac{\boldsymbol{M^s_{US}}}{\boldsymbol{L(\bar{r}_{US} + \bar{\pi}_{US}, \bar{Y}_{US})}}$$

$$\boldsymbol{P_{EUROPE}} = \frac{\boldsymbol{M^s_{EUROPE}}}{\boldsymbol{L(\bar{r}_{EUROPE} + \bar{\pi}_{EUROPE}, \bar{Y}_{EUROPE})}}$$

  - ➔ The *Monetary Approach* makes the prediction that the exchange rate, which is the relative price of American and European money, is fully determined in the long-run by the relative supplies of those monies and the relative demand for them
    - Shifts in interest rates and output levels affect the exchange rate only through their influences on money demand

Predictions of long-run effects of the monetary approach

- A *permanent increase* in the US money supply causes a proportional long-run depreciation of the dollar against the euro
  - If $\boldsymbol{M^s_{US}}$ increases permanently, $\boldsymbol{P_{US}}$ will increase
  - Under PPP, a rise in $\boldsymbol{P_{US}}$ leads to an increase in $\boldsymbol{E}_{\frac{\$}{€}}$
  - Therefore, the permanent increase in the US money supply leads to a long-run depreciation, proportional to the increase in money supply

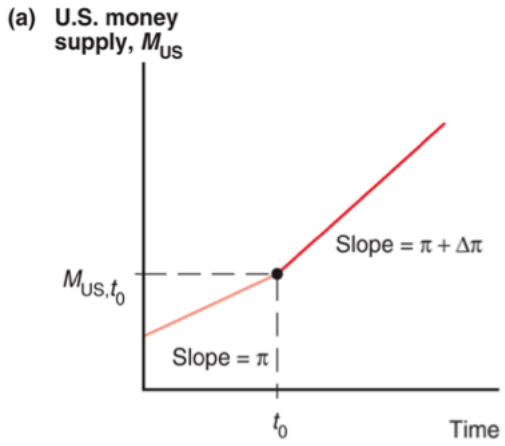
- A *rise in the interest rate* on dollar denominated assets *lowers* real US money demand $\boldsymbol{L(\bar{r}_{US} + \bar{\pi}_{US}, \bar{Y}_{US})}$
  - This will lead to an increase in the long-run US price level
  - Therefore, under PPP, $\boldsymbol{E}_{\frac{\$}{€}}$ will increase and the dollar will **depreciate** against the euro

- A *rise in output* in the US leads to a higher real money demand, $\boldsymbol{L(\bar{r}_{US} + \bar{\pi}_{US}, \bar{Y}_{US})}$
  - An increase in the real money demand leads to a fall in the long-run US price level
  - According to PPP, $\boldsymbol{E}_{\frac{\$}{€}}$ will decrease and the dollar will appreciate against the euro

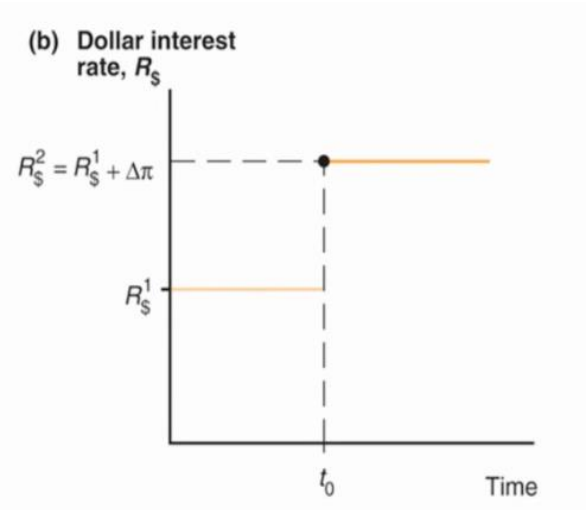
Exercise

- Assume that the domestic central bank increases the growth rate of the money at time t_0 from π to $\pi + \Delta\pi$ after t_0 (the foreign inflation rate remains constant)
  - For inflation to adjust quickly, we assume we consider long periods

- According to the **Fisher Effect**, the domestic interest rate will increase to a new higher level



When the central bank announces that money will start growing at a faster pace, the slope of the money supply line will increase from π to $\pi + \Delta\pi$

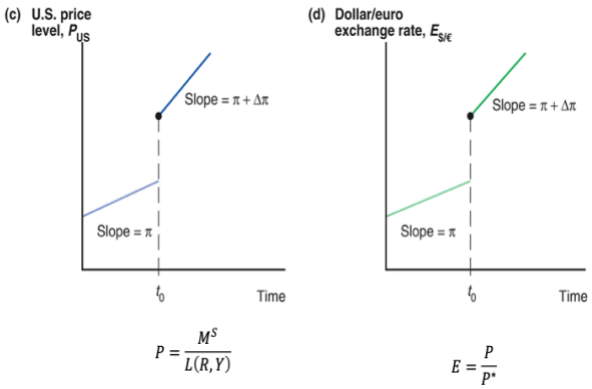


After the money supply growth rate increases at time t_0, interest rate will adjust at a new level that reflects the extra expected dollar depreciation

Recall the relationship:

$$R - \pi^e = R^* - \pi^{e*}$$

The dollar interest rate rises not because of a change in the current money supply or demand, but because people expect a more rapid future money supply growth and dollar depreciation

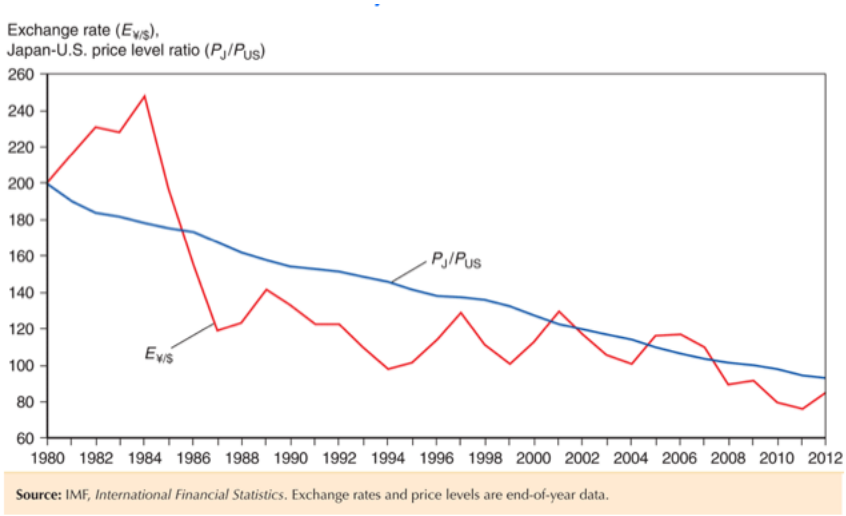


- The price level will increase because, after the increase in interest rates, demand for money L(R, Y) will drop and P will increase
  - ➔ The increase in money supply makes the price level jump due to the increase in the interest rate, and makes it grow at a faster pace
- The exchange rate will appreciate consistently with the PPP theory
  - ➔ Therefore, a rise in the interest rates makes the dollar depreciate against the euro

➔ It is important to keep in mind that an interest rate increase is associated with higher expected inflation and a currency that will be weaker on all future dates

- The result is an immediate currency depreciation

Empirical Evidence about PPP



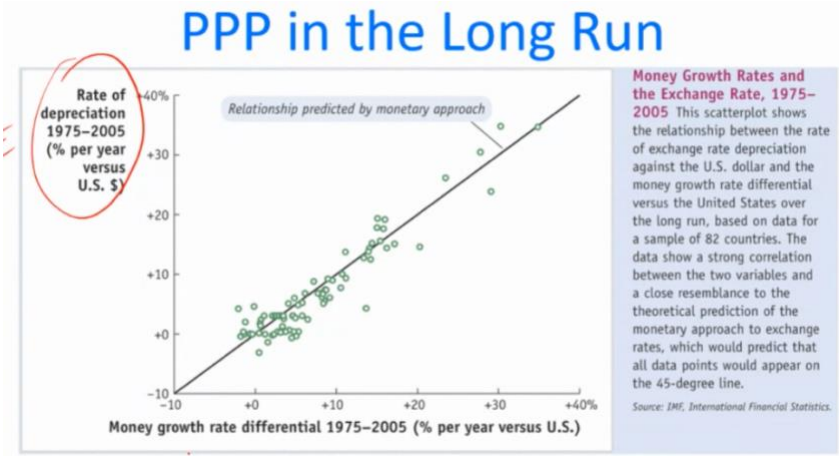
- The graph shows the relationship between the Yen-Dollar exchange rate and the Japan-US price level ratio in a long-run period from 1980 to 2012
  - According to the PPP, the two lines should be identical

➔ We can clearly notice deviations between the Exchange Rate and the Price Level ratio, which can also last for decades

- However, we can see that the trend of the two variables is the same
- Indeed, despite the deviations, we can see that in the long run they track each other very closely

- FX and relative price levels do not always move together:
  - Relative price levels change slowly and have a small range of movement
  - FX moves abruptly and experiences large fluctuations

➔ However, the key point here is that PPP is a **long-run theory**



- The graph shows the relation between the *Money Growth Rate Differential* ($\pi_i - \pi_{US}$) and the percentage rate of depreciation of currency *i* against the dollar in the **long-run**

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

Problems with the Purchasing Power Parity Model

1. ***Trade Barriers and Non-tradable Products***

- Transport costs and trade restrictions
  - The greater the transport costs, the greater the range over which the exchange rate can deviate from its Purchasing Power Parity value
  - Some goods and several services are often non-traded, which means, they have very high transportation costs

- Law of One Price empirical support is weak in the data:
  - The prices of identical goods, when converted to a single currency, differ substantially across countries

- The *Big Mac Index* focuses on a common specific good, which can be identified as a basket of goods locally produced (agriculture, labor, real estate…)
  - If we divide the dollar price of a Big Mac by its euro price, the result is 1.33$/€, which is a value greater than the euro-dollar exchange rate, 1.22 $/€
  - In this case, we say that the dollar is 10% overvalued than the euro
  - Even though the PPP is a long-run theory and does not have to hold in the short run because of price stickiness, it gives signals about exchange rate movements in the long-run
  - Another reason that may lie behind differences in the price of a Big Mac between countries is the value of *non-traded goods* such as labor, which varies widely between countries

2. ***Imperfect Competition***

- Imperfect competition and trade frictions or regulations may result in price discrimination (**pricing to market**)
  - A firm sells the same product for different prices in different markets to maximize profits, based on expectations about what customers are willing to pay

- Therefore, another example of a failure of the Law of One Price is the *iPhone Index*
  - The index focuses on a common, specific good that has identical performance characteristics
  - Unlike BigMac, iPhone is not produced locally
  - Price differences depend on transportation costs, taxes, and pricing to market rather than on the presence of non-traded, such as labor input, as in the case of the Big Mac Index

3. ***Differences in Baskets***

- Levels of average prices (P) differ across countries because of differences in how representative baskets of goods and services are measured
  - For instance, in Italy more coffee is consumed, while in Argentina more steaks

- Relative PPP partly addresses this issue, however relative price changes can lead to deviations from relative PPP

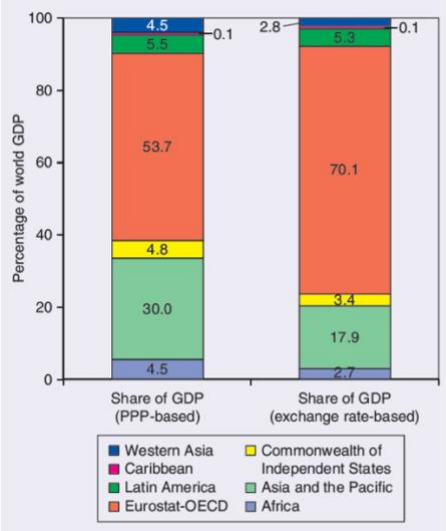
PPP and Income Comparison

- Assuming we want to compare the size of the US economy with that of the Chinese economy:
  - Usually, differences are measured in terms of GDP-per-capita, which however is expressed in local currency units
  - The FX exchange rate is not convenient for converting the two currencies into a single one since it is affected by wide fluctuations in the short-run

- Comparing income levels across countries can be challenging for different reasons:
  - Conversion of GDP using the market FX contaminates the comparison with factors that influence the FX in the short-run
  - Due to the failures of the Law of One Price, same goods can have different prices in different countries, hence identical incomes buy different quantities in different countries

➔ The solution is to **use the PPP exchange rate**, since it equalizes the value of comparable market baskets of goods and services between two countries
  - The PPP exchange rate is computed using the prices of identical baskets, for example the Big Mac Index, or the iPhone Index, or the International Comparison Program

$$E_{\frac{\$}{€}} = \frac{P_{BIG-MAC,US}}{P_{BIG-MAC,EUROPE}}$$



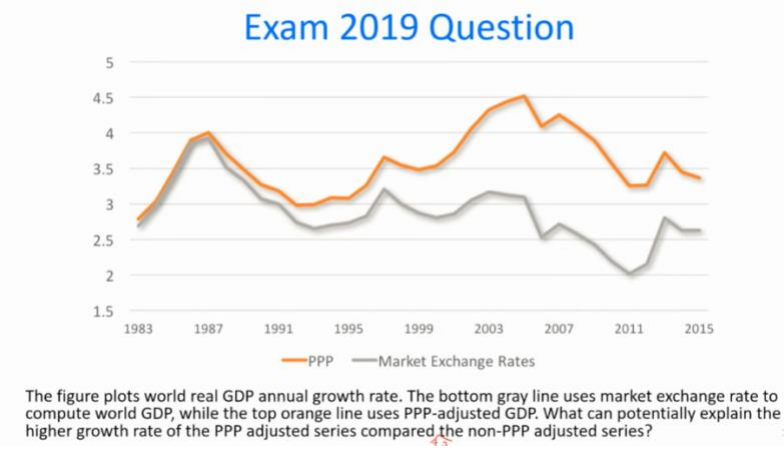
The share of rich economies output in the world output is considerably smaller when the PPP conversion is used as opposed to the FX market exchange rates

➔ The main reason behind this is that prices of non-traded goods are much higher in richer countries than in poorer ones

➔ Indeed, we can say that rich countries have much higher Price Indexes than other currencies

- Therefore, if we want to know which economy is bigger, US or China, PPP or FX market exchange rates start to matter
  - Keep in mind that the purpose of the conversion also matters
  - PPP is mostly used to compare the cost of living between two countries
  - FX market is used to understand the size of an economy, for example during a military conflict

Exam Question

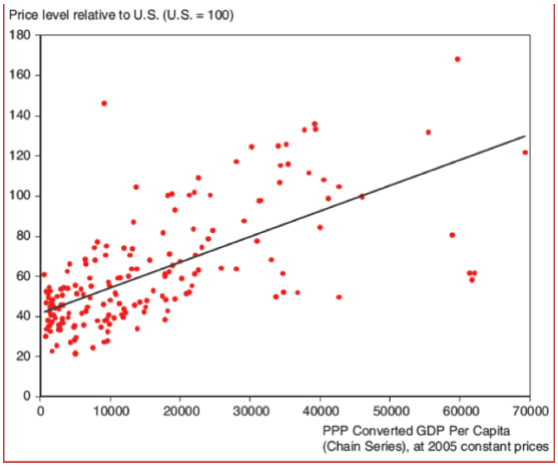


- By looking at the grey line, it is possible to notice that there is a secular decline in the world GDP
    - Instead, if we look at the orange line, which gives the world GDP in terms of PPP, the world economy does not show a declining trend

- The main reason behind this is that, starting from the 1990s, emerging countries like China started to grow at a higher pace, with low costs of non-tradable goods. Therefore, after the PPP adjustment, it is reasonable to expect that the GDP of developing economies will be higher than it is using the FX exchange adjustment. Therefore, the growth rate of PPP-adjusted world output must be higher than the growth rate of world GDP using market exchange rate.

Price Levels and Income

- Empirical Evidence shows that price levels are lower in poor countries, and higher in rich countries



- The **Balassa-Samuelson Effect** explains this phenomenon:
    - Assume that poor countries are less productive in tradable goods than rich countries
    - Assume that productivity differences are negligible in the non-traded sector

- The **Balassa-Samuelson Effect** points out that, if traded goods satisfy the Law of One Price, then lower traded goods productivity leads to:
    - lower wages (in terms of traded goods)
    - lower prices of non-traded goods (in terms of traded goods)
    - and the overall price level is lower, relative to a foreign currency

- The **Bhagwati-Kravis-Lipsey-Effect** is a different attempt to explain why price levels are lower in poorer countries
    - Rich countries have higher level of capital relative to labor compared to poorer countries

$$\left(\frac{K}{L}\right)^{rich} > \left(\frac{K}{L}\right)^{poor}$$

    - Marginal Labor Productivity is higher in rich countries with respect to poor countries, and therefore also wages will be higher

$$MPL^{rich} > MPL^{poor}$$

$$wage^{rich} > wage^{poor}$$

    - Since non-tradable goods are more labor intensive, prices of non-tradable goods are higher in richer countries
    - This will lead to a higher price level in richer countries

Real Exchange Rates

- The Monetary Approach presented previously, which assumed the PPP, is too simple to give predictions about the real world, hence we need to distinguish between **nominal** and **real** exchange rates in order to extend the PPP theory:
  - The *Nominal Exchange Rate* is the relative price of a currency
  - The *Real Exchange Rate* is the relative price of two baskets of goods

$$q_{\frac{\$}{€}} = \frac{E_{\frac{\$}{€}} \times P_E}{P_{US}}$$

  - US is a home country, while Europe is a foreign currency
  - P_{US} is the price of a typical US basket of goods
  - P_E is the price of a typical Euro basket of goods

➔ If $q_{\frac{\$}{€}}$ increases, we call it a **real depreciation** of the dollar against the euro

- Therefore, after a real depreciation of the dollar against the euro, a basket of US goods will be cheaper compared to a basket of European goods

Real Interest Rate Parity

- Given that the *real exchange rate* is equal to:

$$q = \frac{EP^*}{P}$$

- We can rewrite it in terms of expected change:

$$\frac{q^e - q}{q} \approx \frac{E^e - E}{E} - (\pi^e - \pi^{*e})$$

➔ By using the UIP relationship, we then obtain:

$$\boldsymbol{R - R^* = \frac{q^e - q}{q} + (\pi^e - \pi^{*e})}$$

Given that the real interest rate is equal to the difference of the nominal interest rate and the expected inflation rate:

$$r = R - \pi^e$$

We get that, by combining the equations, we obtain the **real interest rate parity:**

$$\boldsymbol{r - r^* = \frac{q^e - q}{q}}$$

➔ The Real Interest Rate Parity tells us that, whenever real exchange rate moves over time, we must see a difference in real returns in the economy

A General Theory of FX in the Long Run

- Absolute Purchasing Power Parity tells us that:

$$q_{\$/€} = \frac{E_{\$/€} \times P_E}{P_{US}} = \mathbf{1}$$

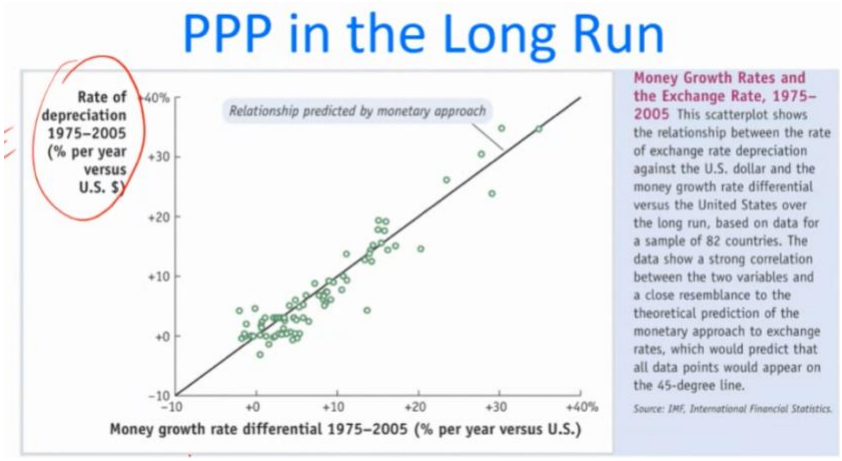
  Because the PPP hold and, therefore, $E_{\$/€} = P/P^*$

- Relative Purchasing Power Parity, is an alternative, more flexible version of the Absolute Purchasing Power Parity, by which:

$$q_{\frac{\$}{€}} = \frac{E_{\frac{\$}{€}} \times P_E}{P_{US}} = \boldsymbol{constant} \neq 1$$

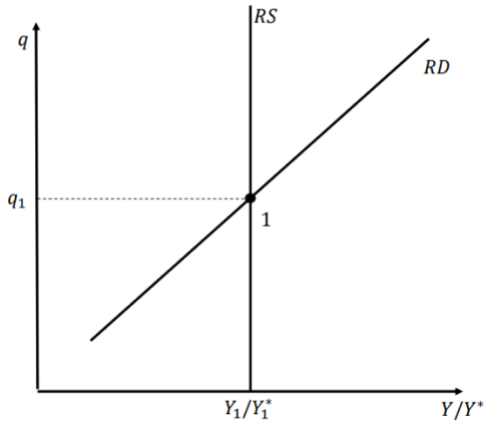
  ➔ Therefore, it is easy to see why the real exchange rate cannot change if the PPP holds
  - If Absolute PPP holds, the real exchange rate will always be equal to 1
  - If Relative PPP holds, the real exchange rate will always be equal to a constant number different from one
  - This means that, if relative PPP holds, an increase in the Nominal Exchange rate will always be offset by a fall in the price ratio

- When discussing the PPP theory, we underlined that it is a long-run theory and empirical evidence almost confirms the prediction of the model that all of the observation should lie on the 45° line:



  - The small deviation from the 45-degree line can be thought of as variations in the long-run real exchange rate

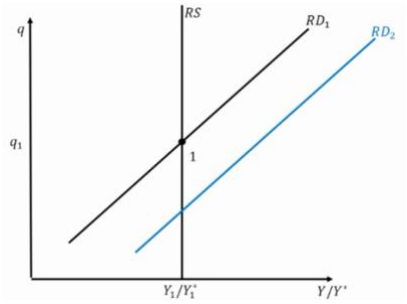
- In the long-run, the real exchange rate is determined by **relative demand and supply**:



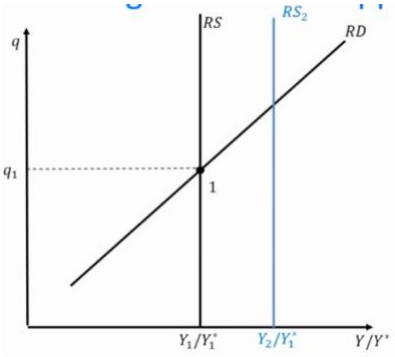
- The graph gives the real exchange rate as a function of the relative quantities of goods produced at home over goods produced abroad
- The *relative demand of domestic goods over foreign goods* is upward sloping because, when the real exchange rate increases, domestic goods will become cheaper in terms of foreign goods, and therefore they will be more demanded
- The way to think of it is that, if q increases, we need more domestic goods to purchase a unit of foreign goods

- We assume that *relative supply of domestic goods over foreign goods* is vertical because it depends on factors like labor, capital, and technology, which are sticky in the short-run

- From the above condition, we can infer that:



An increase in the world relative demand for domestic output causes a real appreciation of the domestic currency against foreign currencies



An increase in the domestic output causes a long-run real depreciation of the domestic currency against foreign currencies

➔ This is because higher supply of domestic goods for a given demand lowers their price

A General Theory of Long-Run Exchange Rates

- The real exchange rate is given by:

$$q_{\frac{\$}{€}} = \frac{E_{\frac{\$}{€}} \times P_E}{P_{US}}$$

- Therefore, a **general theory of nominal exchange rate** is:

$$\boldsymbol{E_{\frac{\$}{€}} = q_{\frac{\$}{€}} \times \frac{P_E}{P_{US}}}$$

  - The equation implies that, for a given euro/dollar exchange rate, changes in money demand or supply in Europe or the United States affect the long-run nominal dollar-euro exchange rate as in the monetary approach
  - Changes in the long-run real exchange rate, however, also affect the long-run nominal exchange rate

- Assuming all variables start out at their long-run levels, we can now understand the most important determinants of long-run swings in nominal exchange rates:

1) If the relative money supply levels increase:
   - A permanent, one-time increase in a country's money supply has no effect on the long-run levels of output, the interest rate, or any relative price
   - Because the real exchange rate $\boldsymbol{q_{\$/€}}$ does not change, the nominal exchange rate change is consistent with relative PPP

➔ The only long-run effect of the US money supply increase is to raise all dollar prices, including the dollar price of the euro, in proportion with the increase in money supply

2) If the relative money supply growth rate increases:
   - The long-run US inflation rate will increase, and, through the Fisher Effect, the dollar interest rate will increase relative to the euro interest rate
   - Since relative US real money demand declines, P_{US} will
   - Because the change is purely monetary, it does not alter the real, euro-dollar exchange rate in the long-run

➔ The euro-dollar exchange rate will rise proportionally to the increase in P_{US}

3) If the world relative demand for domestic output increases:
   - The domestic currency will experience a real appreciation with respect to the foreign currency
   - This change is simply a rise in the relative price of US output

➔ Given that long-run national price levels are unchanged, we can say that a long-run nominal appreciation of the domestic currency against the foreign one must also occur

4) If the relative supply of domestic goods increases:
    - The real exchange rate will increase, thus leading to a depreciation of domestic goods
    - At the same time, the increase in the domestic output leads to an increase in the demand for domestic currency, raising the aggregate US money demand and thus pushing the long-run US price level down

➔ Therefore, since $\boldsymbol{q}_{\frac{\$}{€}}$ rises and $\boldsymbol{P_{US}}$ falls, the effect on the nominal exchange rate is ambiguous

- Therefore, we can conclude that when all the disturbances are monetary in nature, exchange rates obey relative PPP in the long run
    - In the long-run, a monetary disturbance affects only the general purchasing power of a currency, and this change in purchasing power changes equally the currency's value in terms of domestic and foreign goods
    - When disturbances occur in output markets, the exchange rate is unlikely to obey relative PPP, even in the long run

CHAPTER 17 – OUTPUT AND THE EXCHANGE RATE IN THE SHORT RUN

- So far, we have assumed that output is exogenous and fixed at a level $\overline{Y}$
  - However, we now relax this assumption in order to consider the effects of changes in monetary policy on the output level in the short run

- In the **long run**, prices are fixed, and output is at its **full employment**:
  - Therefore, output is determined by supply factors like *labor*, *capital,* and *technology*
  - For this reason, **aggregate demand** does not matter

- In the **short run**, prices are **sticky:**
  - Therefore, aggregate demand actually affects output

- **Aggregate Demand** is the amount of a country's goods and services demanded by households and firms around the world:

$$Y = C + I + G + NX$$

  - **C** is consumption demand
  - **I** is investment demand, which is assumed to be fixed
  - **G** is government demand, which is assumed to be fixed
  - **NX** are Net Exports

Consumption Demand

- The consumption demand of household *i* is given by:

$$C_i = C(Y_i^d, r, Y_i^{d,e}, W_i)$$

  - Y^d is the household's disposable income (after-tax income)
  - r is the real interest rate
  - $Y_i^{d,e}$ is the household's expected future disposable income
  - W_i is the household's total wealth

- Then, we can define the **Aggregate Desired Consumption**:

$$C = C(Y^d, r, Y^{d,e}, W)$$

  - One of the assumptions is the marginal propensity to consume is less than one:

$$\frac{dC}{dY^d} < 1$$

    This relationship means that, if income goes up by one, consumption will increase less than proportionally with income

Net Exports

- We assume that Net Exports are determined by two factors:

$$\mathrm{NX} = \mathrm{NX}\left(\frac{\mathrm{EP}^*}{\mathrm{P}}, \mathrm{Y}^{\mathrm{d}}\right)$$

  - $\frac{\mathbf{EP}^*}{\mathbf{P}}$ is the real exchange rate $\boldsymbol{q}$

- Consider trade between Italy (home country) and the UK (foreign country):
  - Then, Italian net exports will be the difference between Exports and Imports, which are measured in units of Italian output

$$\mathrm{NX} = \mathrm{Ex} - \mathrm{Im}$$

- Exports are goods that foreigners purchase from the domestic country:
  - When foreigners purchase Italian goods, they will compare the price of Italian goods with a substitute in the UK

$$\mathrm{Ex} = \mathrm{Ex}\left(\frac{\mathrm{P}^*}{\mathrm{P}^{\text{IM from ITA in £}}}\right) = \mathrm{Ex}\left(\frac{\mathrm{P}^*}{\mathrm{P}/\mathrm{E}}\right) = \mathrm{Ex}\left(\frac{\mathrm{P}^*\mathrm{E}}{\mathrm{P}}\right) = \mathbf{Ex}(\mathbf{q})$$

  - We assume that the Price of Imports from Italy in Pounds is the price of Italian goods in euro, divided by the exchange rate
  - This means that producers set export prices in their own currency

- Imports are goods that the domestic country purchase from foreigners:

$$\mathrm{Im} = \frac{\mathrm{P}^{\text{IM from UK in €}}}{\mathrm{P}} \times \mathrm{Ex}^*\left(\frac{\mathrm{P}}{\mathrm{P}^{\text{IM from UK in €}}}\right) = \frac{\mathrm{P}^*\mathrm{E}}{\mathrm{P}} \times \mathrm{Ex}^*\left(\frac{\mathrm{P}}{\mathrm{P}^*\mathrm{E}}\right) = \mathbf{q} \times \mathbf{Ex}^*\frac{\mathbf{1}}{\mathbf{q}}$$

  - Recall that imports from Italy can be thought as exports from the UK (Ex^*)
  - Always assume that domestic producers that domestic producers set prices in domestic currency (**producer-currency pricing** or **PCP**)

- Therefore, we can see that Net Exports will be:

$$\mathbf{NX(q) = Ex\left(\frac{P^*}{P^{IM\ from\ ITA\ in\ £}}\right) - \frac{P^{IM\ from\ UK\ in\ €}}{P} \times Ex^*\left(\frac{P}{P^{IM\ from\ UK\ in\ €}}\right)}$$
$$\mathbf{= Ex(q) - q \times Ex^* \frac{1}{q}}$$

  - An increase in domestic real exchange rate (a real depreciation of domestic currency) increases foreign demand for domestic goods, therefore export increase:

$$\frac{dEx}{dq} > 0$$

  - The relationship $\mathbf{q \times Ex^* \frac{1}{q}}$ gives the value of imports measured in terms of domestic ouput

➔ If we take the full derivative of the term, we get the following:

$$\frac{dIm}{dq} = \underbrace{1 \cdot Ex^*}_{\substack{\text{Value effect} \\ >0}} + \underbrace{q\frac{dEx^*}{dq}}_{\substack{\text{Volume effect} \\ <0}}$$

  - The **volume effect** tells us that, if the real exchange rate depreciates (q increases), foreign goods become more expensive than domestic goods and therefore, consumption of foreign goods will decrease
  - The **value effect** is the direct effect of a price change

- By combining $\frac{dEx}{dq}$ and $\frac{dIm}{dq}$, we can get $\frac{\boldsymbol{dNX}}{\boldsymbol{dq}}$:

$$\mathbf{\frac{dNX}{dq} = \left(\frac{dEx}{dq} - q\frac{dEx^*}{dq}\right) - Ex^*}$$

  - Since the terms in brackets are positive, while $(-Ex^*)$ is a negative number, whether NX improves or worsens depends on which effect of a real exchange rate change is dominant

➔ Two important insights about the direction of NX after a real depreciation are:
  - The Marshall-Lerner Condition
  - The J-Curve

Marshall-Lerner Condition

- Suppose that trade is initially balanced, which means that:

$$\text{Ex} = \text{Im} = \text{q} \times \text{Ex}^*$$

- The change in NX after a marginal change in q can therefore be written as:

$$\frac{dNX}{dq} = (\eta + \eta^* - 1)Ex^*$$

  - η and η^* are the trade elasticities of Ex and Ex^* with respect to the real exchange rate q

➔ The Marshall-Lerner Condition states that $\boldsymbol{\eta + \eta^* > 1}$, so that $\frac{dNX}{dq} > 0$

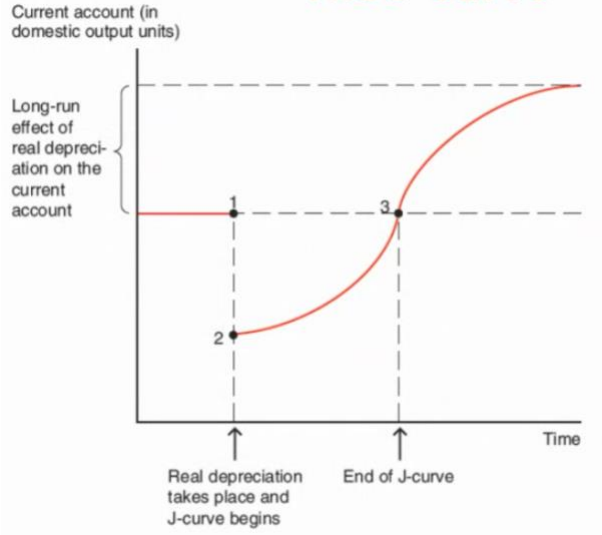
- In reality, empirical evidence shows that $\eta + \eta^* > 1$:
  - Does not hold right after the real depreciation occurs
  - Begins to hold in the short-run (6 months from the real depreciation)
  - Completely holds in the long run

TABLE 17A2-1 Estimated Price Elasticities for International Trade in Manufactured Goods

	η (6 months)	η (12 months)		η^*		
Country	Impact	Short-run	Long-run	Impact	Short-run	Long-run
Austria	0.39	0.71	1.37	0.03	0.36	0.80
Belgium	0.18	0.59	1.55	—	—	0.70
Britain	—	—	0.31	0.60	0.75	0.75
Canada	0.08	0.40	0.71	0.72	0.72	0.72
Denmark	0.82	1.13	1.13	0.55	0.93	1.14
France	0.20	0.48	1.25	—	0.49	0.60
Germany	—	—	1.41	0.57	0.77	0.77
Italy	—	0.56	0.64	0.94	0.94	0.94
Japan	0.59	1.01	1.61	0.16	0.72	0.97
Netherlands	0.24	0.49	0.89	0.71	1.22	1.22
Norway	0.40	0.74	1.49	—	0.01	0.71
Sweden	0.27	0.73	1.59	—	—	0.94
Switzerland	0.28	0.42	0.73	0.25	0.25	0.25
United States	0.18	0.48	1.67	—	1.06	1.06

Source: Estimates are taken from Jacques R. Artus and Malcolm D. Knight, *Issues in the Assessment of the Exchange Rates of Industrial Countries*. Occasional Paper 29. Washington, D.C.: International Monetary Fund, July 1984, table 4. Unavailable estimates are indicated by dashes.

➔ This relationship is described by the **J-Curve**:



- ➢ The curve describes the time lag with which a real currency depreciation improves NX
- At first, NX do not improve after the real depreciation
- After some time, the real depreciation improves net exports

➔ Therefore, we will assume that a real depreciation improves NX

Nominal Exchange Rates and Net Exports

- ➢ Under the assumption of **producer currency pricing**, we assessed that:

$$\mathrm{NX(q)} = \mathrm{Ex(q)} - \mathrm{qEx^*}\left(\frac{1}{\mathrm{q}}\right)$$

Where q is the real exchange rate, equal to:

$$\mathrm{q} = \frac{\mathrm{P^*E}}{\mathrm{E}}$$

- ➢ When prices $\mathrm{P^*}$ and P are sticky, then we can say that nominal exchange rates affect Net Exports in the same way as real exchange rates do:

$$\frac{\Delta q}{q} = \frac{\Delta E}{E}$$

Disposable Income and Net Exports

- ➢ An increase in disposable income $\mathbf{Y^d}$ worsens Net Exports
  - The main reason behind it is that people at home start to consume more foreign goods, thus increasing imports

- ➢ On the other hand, and increase in foreign disposable income $\mathbf{Y^{d,*}}$ improves the trade balance:
  - The main reason behind this is that foreigners start to purchase more domestic goods, thus increasing exports

Aggregate Demand

- The four components of aggregate demand are combined to get the total aggregate demand:

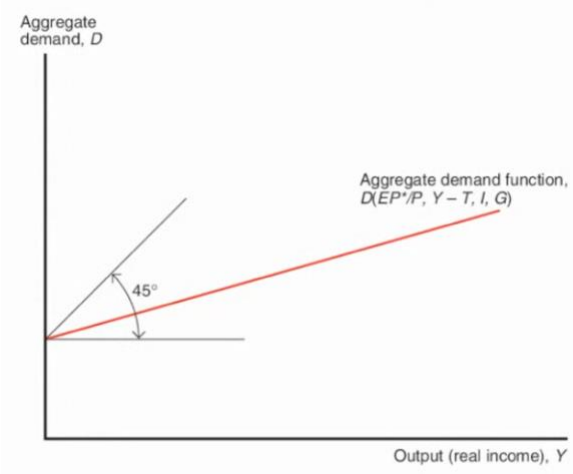
$$D = D(q, Y^d, I, G) = C(Y^d) + I + G + NX(q, Y^d)$$

1) $\frac{dD}{dq} > 0$
   - Real exchange rates positively affect aggregate demand by the Marshall-Lerner Condition
   - Indeed, a currency depreciation increases the aggregate demand

2) $\frac{dD}{dY^d} > 0$
   - An increase in disposable income increases aggregate demand, even though both domestic consumption and imports increase (two opposite effects)
   - The reason behind it is that consumption can be thought as Consumption of Domestic Goods and Consumption of Foreign Goods
   - Therefore, since Consumption for foreign goods cancels out with imports, what is left after an increase in disposable income is the higher domestic consumption

3) $\frac{dD}{dI} > 0, \frac{dD}{dG} > 0$
   - An increase in Investments and Government Spending will result in an increase in aggregate demand

- Furthermore, we can also say that:
  - $0 < \frac{dD}{dY^d} < 1$
    This means that aggregate demand reacts less than one-to-one to an increase in income, because trade balance drops
  - $D(Y^d = 0) > 0$
    This means that, even if disposable income is zero, aggregate demand will be positive because of Government spending, Investment, and foreign demand

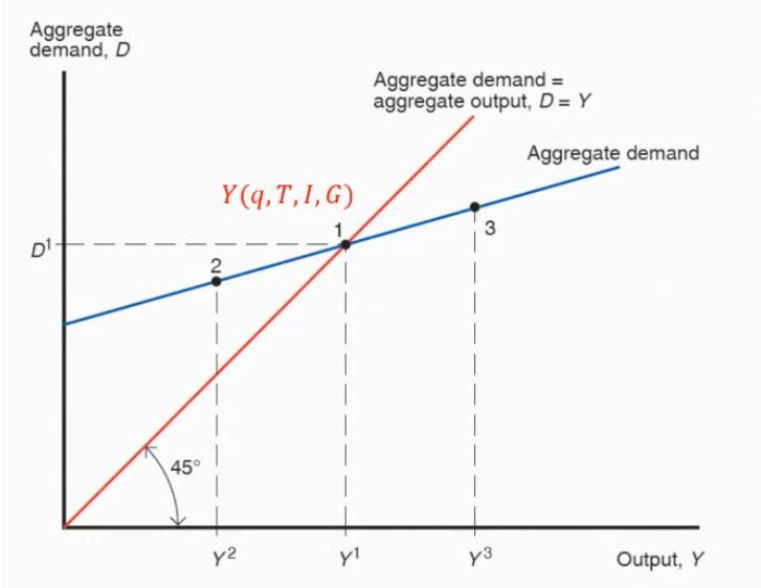


- When output and labor market is in equilibrium, **output equals aggregate demand**:

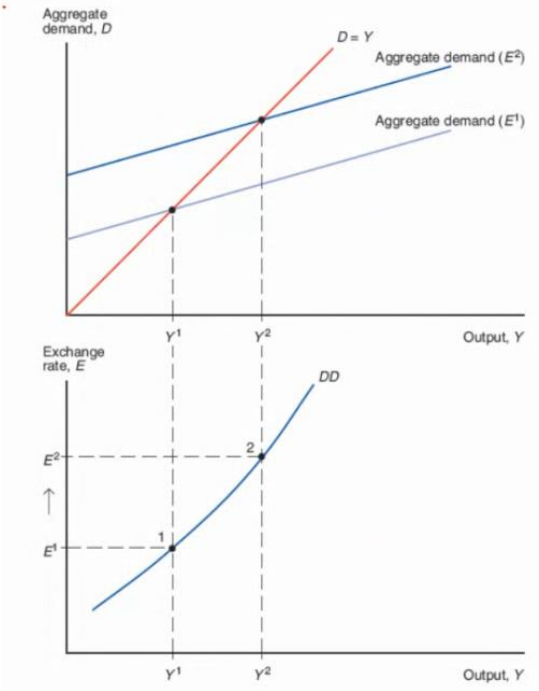
$$Y = D\left(\frac{EP^*}{P}, Y - T, I, G\right)$$

  - The labor market equilibrium condition states that output equals households' income
  - Note that we ignored the difference between GNDI and GDP by assuming that NIFA=NUT=0

- The relationship $Y = D\left(\frac{EP^*}{P}, Y - T, I, G\right)$ can be represented using a graph called **Keynesian Cross**:



The DD schedule

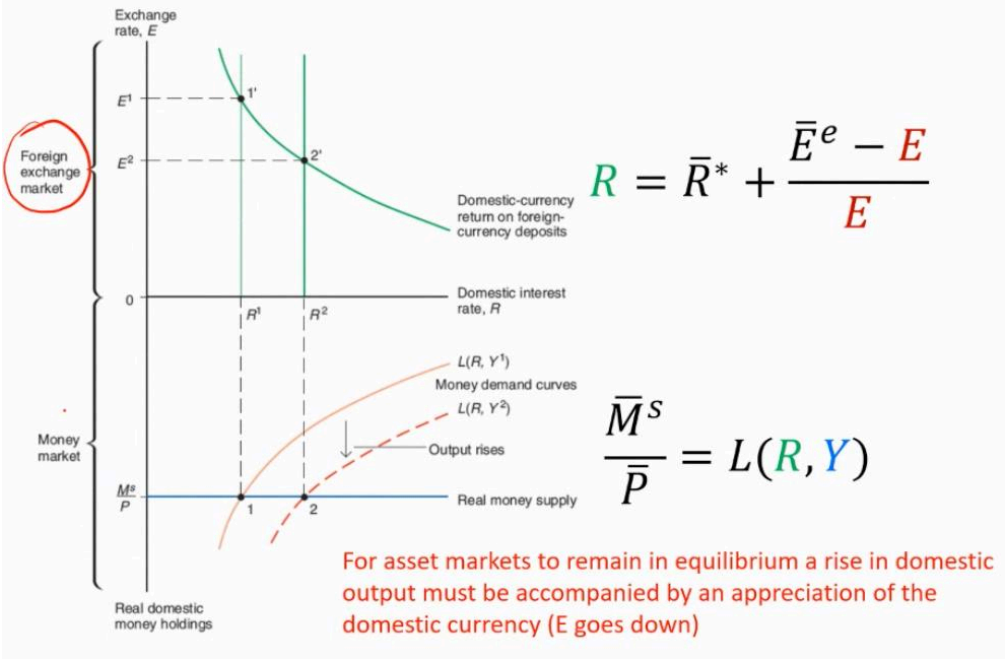


- The graph shows the effect of a depreciation on output:
  - The increase in the exchange rate causes a real depreciation of national currency
  - This leads to an improvement in Net Exports, which shift up the Aggregate Demand

The AA schedule

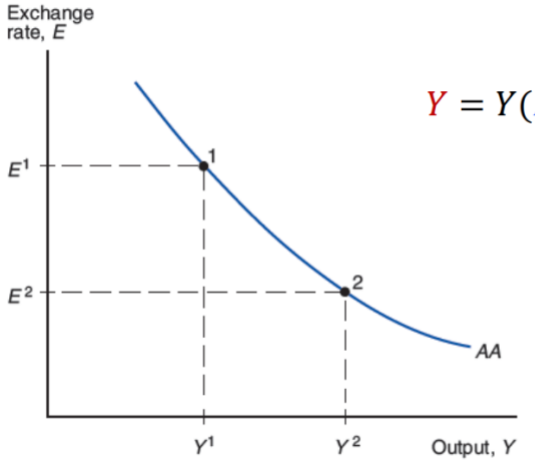
- Since the DD schedule only links Output to the Exchange Rate, we need one more relation to solve for Y and E

➔ The **AA schedule** shows all combinations of exchange rate and output that are consistent with equilibrium in the domestic money market and the foreign market



- The AA schedule tells us that, after an increase in output in the short run, money demand will increase:
  - Since money supply is fixed in the short-run, after the increase in money demand, nominal interest rates will increase
  - The increase in nominal interest rates reduce the exchange rate and trigger an appreciation of the currency

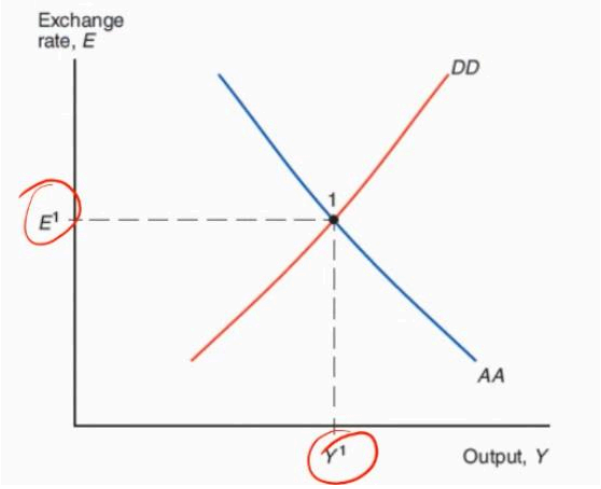
- Therefore, the **AA schedule** can be represented in a graph of exchange rates as a function of output:



$$Y = Y(E, E^e, R^*, P, M^s)$$

Short-Run Equilibrium

- By combining together the AA schedule and the DD schedule, we can create a model for the short-run equilibrium for the economy as a whole:

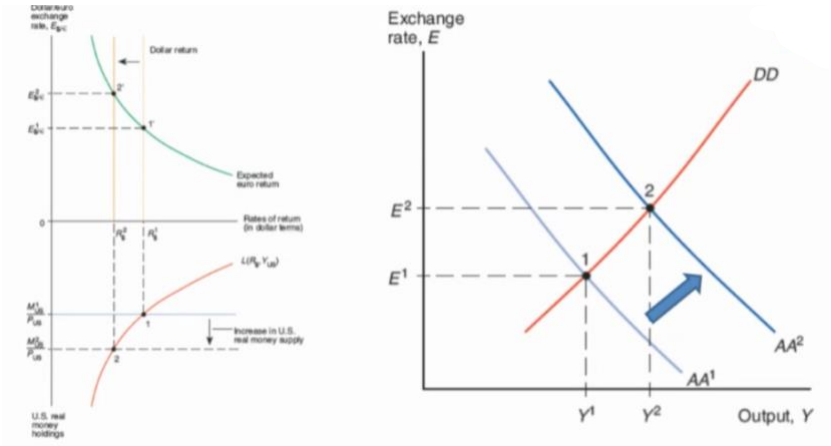


  - The model is similar to the IS-LM model, but it is an open version of it
  - The only difference with the IS-LM is that, instead of putting *r* on the Y-axis, we are using the exchange rate
  - Therefore, the AA-DD model is an IS-LM model applied to an open economy, using as key assumptions the stickiness of prices in the short-run and the fact that aggregate demand determines output

Temporary Changes in Monetary and Fiscal Policy

- The main <u>assumptions</u> are that temporary policy changes don't affect:
  - The Expected Exchange Rate (E^e)
  - Foreign variables (R^* and P^*)
  - The domestic price level (P)

1) *Temporary Increase in Money Supply*

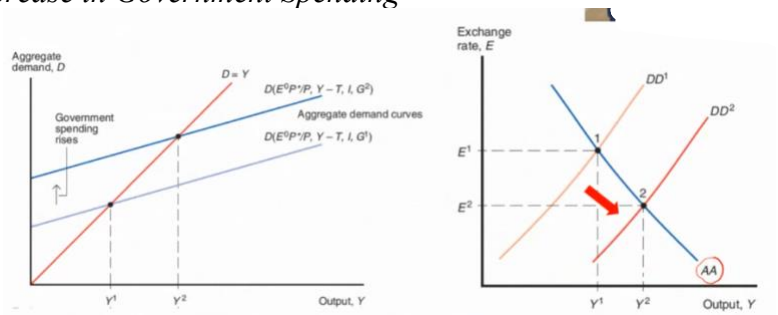


- An increase in the money supply leads to a reduction in the nominal interest rate, since there will be and excess supply for a given money demand
- The reduction in the interest rate leads to a depreciation of the currency (which means that E increases) and an expansion in Output since Net Exports will improve

➔ Therefore, the AA schedule will shift to the right

- The DD schedule does not shift because none of its determinants are directly affected by the increase in money supply

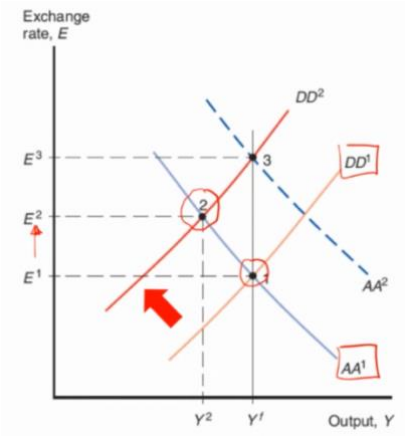
2) *Temporary Increase in Government Spending*



- Following an increase in G, the Aggregate Demand curve in the Keynesian Cross shifts upwards to a new higher aggregate output equilibrium
- Therefore, the DD curve will shift to the right to a higher output level, assuming the Exchange Rate remains fixed
- However, the actual result will be more modest since, after an increase in output, money demand will increase, and monetary policy will remain unchanged
- Therefore, interest rates will increase, and the currency will appreciate (E falls), thus reducing the trade balance

Business Cycles Stabilization

- Temporary disturbances that lead to recessions can be offset through monetary and fiscal policy
  - A fiscal expansion can offset a recession by shifting the AA schedule to the right
  - A monetary expansion can offset a recession by shifting the DD schedule to the left



- Assume a temporary money demand increase:
  - This will lead to an increase in interest rates, and appreciation of the currency, and finally a fall in aggregate output
  - Therefore, the AA curve will shift to the left

➔ In order to avoid a recession:

- The government could carry out a fiscal expansion by increasing government spending or reducing taxes
  → This will shift the DD curve to the right

- The central bank could carry out a monetary expansion in order to bring the AA curve back to its original point

- In the same way, temporary disturbances that lead to overemployment can be offset through contractionary monetary or fiscal policies

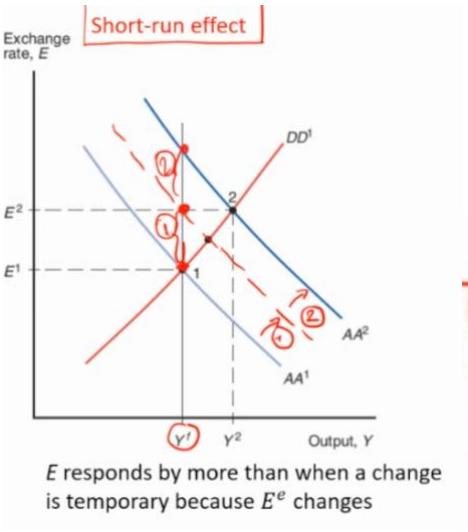
Permanent Policy Changes

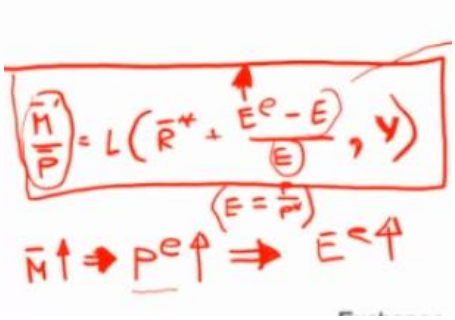
- A permanent policy shift affects not only the current value of the government's policy shift, but also the *long-run* exchange rate:
  - This, in turn, affects expectations about future exchange rates
  - These changes in expectations will have influence on the exchange rate prevailing in the short run

➔ Therefore, since expectations are involved, the effects of a permanent policy shift differ from those of temporary shifts

1) *Permanent Increase in Money Supply*

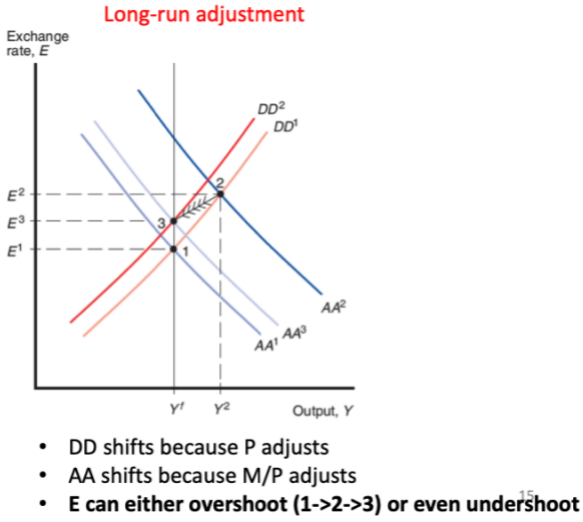
- In the **short-run**, when prices are sticky, an increase in money supply will increase aggregate output by more than a temporary increase in money supply:
  - Indeed, the interest rate will fall, thus triggering a depreciation of the currency
  - Furthermore, since the change in money supply is permanent, prices are expected to go up in the future
  - Hence, also future expected exchange rates increase since the currency is expected to depreciate in the future, thus shifting further to the right the AA curve
  - Therefore, as the currency depreciates, Net Exports will improve, thus increasing aggregate output





- In the **long-run**, since output is now above its full-employment level, upward pressure on the price level develops as workers demand higher wages and producers raise prices to cover their increasing production costs:
    - A rising domestic price level causes the DD curve to shift leftward because higher P makes domestic goods more expensive relative to foreign goods, thus discouraging exports and encouraging imports
    - Since a rising price level steadily reduces the real money supply over time, also the AA schedule will shift to the left
    - The AA and DD curves will stop shifting only when they intersect at the full-employment output level, which is the long run equilibrium

➔ At the new equilibrium, the exchange rate and the price level have increased in proportion to the increase in money supply, as required by the long-run neutrality of money



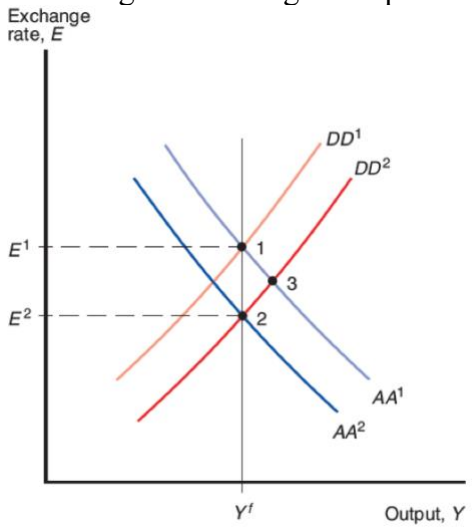
- We can notice that along the adjustment path between the initial short run equilibrium and the long run equilibrium, the domestic currency appreciates, following its initial sharp depreciation
    - This exchange rate behavior is an example of **overshooting**, since the initial response of the exchange rate to some change is greater than its long-run response
    - **Undershooting** may occur if the DD curve is very elastic to changes in the price level and the AA curve is not sensitive to changes in money supply, but quite sensitive to changes in the nominal interest rate

2) *Permanent Fiscal Expansion*

- A permanent fiscal expansion has an immediate impact on both the:
  - **Output market**
  - **Long-run exchange rate expectations**

- The direct effect of this rise in G on aggregate demand causes a rightward shift to the DD curve:
  - Because the increase in government spending is permanent in this case, it will lead to a long-run appreciation of the currency
  - Higher Expected Exchange Rate pushes the AA schedule downward

➔ Therefore, in the short-run equilibrium, the currency has appreciated from its initial level while output has remained unchanged at its long-run equilibrium



- When a fiscal expansion is permanent, the additional currency appreciation caused by the shift in exchange rate expectations reduces the policy's expansionary effect on output:
  - Without the additional effect due to the permanence of the fiscal change, the new short-run equilibrium would present higher output and a smaller appreciation

➔ We can conclude that a fiscal expansion has no effect on the long-run output level

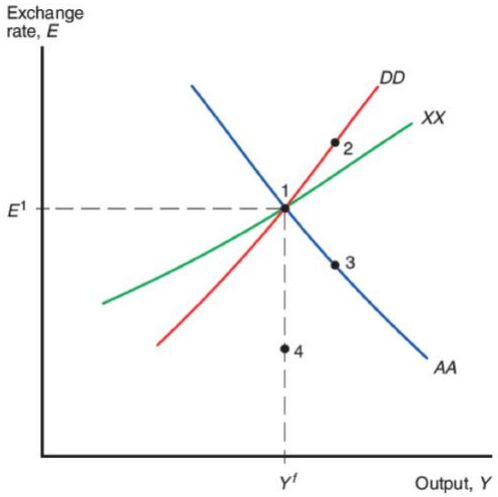
Policy and Trade Balance

- Policy makers are often concerned about the level of the current account:
  - This is because an excessive imbalance in the current account may have undesirable long-run effects on national welfare
  - Furthermore, large external imbalances may generate pressures for governments to impose restrictions on trade

- A useful tool to understand the current account is the **XX schedule**:

$$X = NX\left(\frac{EP^*}{P}, Y - T\right)$$

  - This is similar to a topographical map that shows level of constant elevation
  - It is a control curve that gives all the Output-Exchange Rate Combinations that keep NX constant



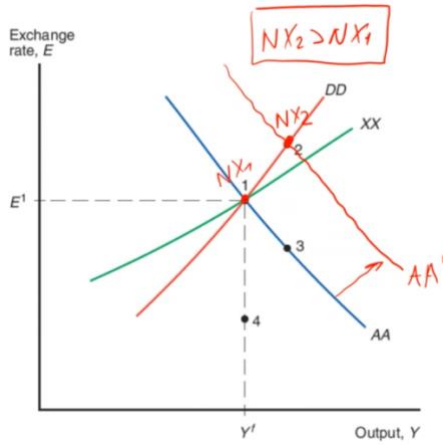
- The *curve slopes up* because, other things equal, a rise in output encourages spending on imports and thus worsens the Current Account:
  - Therefore, an increase in output must be accompanied by a currency depreciation if we want to keep the current account constant

- The XX schedule is *flatter* than the DD schedule because, as we increase Y in moving along the DD curve, the domestic demand for domestic output rises less than one-to-one with the output itself:
  - Since *aggregate demand must equal aggregate supply* along the DD curve, to prevent an excess supply of home output, the exchange rate must rise enough along the DD to make export demand rise faster than import demand

➔ Net foreign demand must rise sufficiently along the DD as output rises to take up the slack caused by domestic saving

- All the points above the XX schedule have a positive trade balance, while all the point below the XX schedule have a negative one:
  - NX>X lies above the XX schedule
  - NX<X lies below the XX schedule

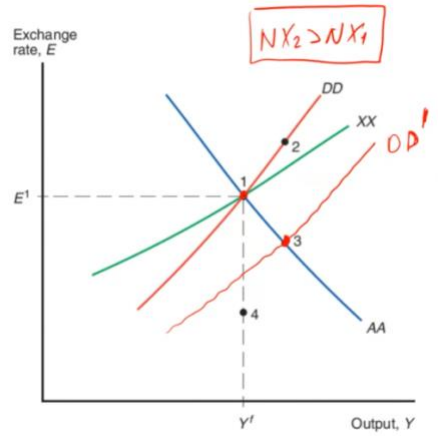
Monetary Expansion



A monetary expansion will shift the AA schedule to the right:

- The policy change improves net exports and therefore income
- Indeed, from the XX schedule we can see that at the new short-run equilibrium the country is running a trade surplus

Fiscal Expansion



A temporary fiscal expansion makes the DD schedule shift rightward:

- The fiscal expansion will increase output, and, at the same time, it will appreciate the currency, thus causing a fall in NX
- Indeed, from the XX schedule, we can see that, since the new equilibrium is now below the XX schedule, the current account must have worsened

Liquidity Trap

- It is also known as the zero-lower-bound on nominal interest rate:
  - A liquidity trap is a trap because, once an economy's interest rate hits zero, the Central Bank will face great difficulty in reducing it further by increasing the money supply
  - The reason is that, at negative nominal interest rates, people would find money strictly preferable to bonds, and bonds would therefore be in excess supply

- Even if a zero-interest rate situation may benefit borrowers, who can borrow for free, policy makers are trapped in a situation where they may no longer be able to steer the economy through conventional monetary expansion
  - Even if it is very difficult to reduce nominal interest rates to zero, starting from 2014, several major Central Banks started to push the interest rates in negative territory
  - They did so by charging Commercial Banks on the cash they held at the Central Bank
  - However, even with negative interest rates, some individuals avoided holding cash because of storage costs, and therefore accepted negative interest rates

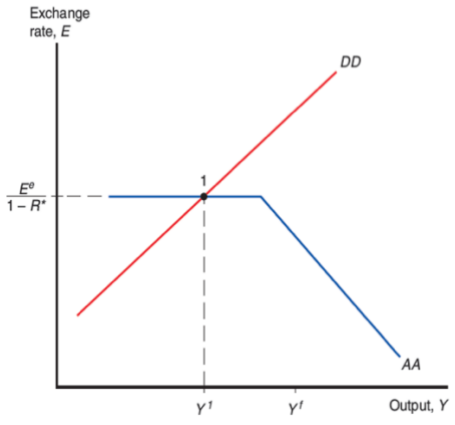
➔ Since we consider of negative interest rates, nowadays economists refer to the *effective lower bound* rather than the zero-lower-bound

- During a liquidity trap, the Uncovered Interest Parity condition becomes:

$$UIP = R = R^* + \frac{E^e - E}{E} = 0$$

  - We can easily see that exchange rates will not depend anymore on monetary policy

$$\boldsymbol{E = \frac{E^e}{1 - R^*}}$$



The AA-DD schedule has important implications when the economy is in a liquidity trap:

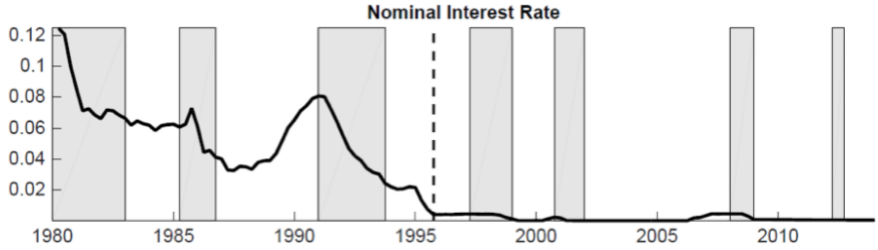
- A temporary monetary expansion, which would shift the AA curve to the right, is ineffective since the intersection is on the flat part of the AA curve

- A permanent monetary expansion, if believed, can shift the AA schedule up and help exit the liquidity trap

- Another way to exit from the liquidity trap is fiscal expansion:
  - An increase in government spending or a reduction in taxes can shift the DD curve to the right
  - Hence, if the shift is quite substantial, the fiscal expansion can shift the DD curve back on the downward sloping part of the AA curve, where monetary policy works again

The Japanese Case

- Japan has been in a liquidity trap since 1994



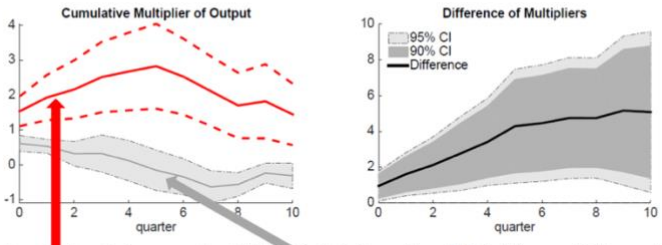
- The Fiscal Multiplier is $\frac{dY}{dG}$
  - It tells by how much output changes following a change in fiscal policy

➔ A study by Sergeyev shows that the fiscal multiplier is higher during a liquidity trap than outside of it

- In normal times, when the government carries a fiscal stimulus, central banks tend to rise the nominal interest rates more than one to one in order to avoid inflation (Taylor's Principle). Therefore, in normal times, a fiscal stimulus does not, on average, increase aggregate output

- During liquidity traps, on the other hand, central banks are not concerned with inflation and therefore, they do not increase the interest rates after an increase in inflation. For this reason, the fiscal multiplier in liquidity traps is strictly positive and higher than that in normal times

FIGURE 6. OUTPUT MULTIPLIERS AND THE DIFFERENCE IN THE MULTIPLIERS



Note: Output multipliers during normal and ZLB periods (left panel), and their difference (right panel). The borders around point estimates on the left panel are one-standard-deviation error bounds.

Source: Miyamoto, Nguyen, Sergeyev (2018)

- The multiplier is higher in the liquidity trap than outside of it

Producer-Currency Pricing, Local-Currency Pricing, and Dominant Currency Pricing

- The classic view of exchange rates is that an exchange rate depreciation will boost demand for domestically produced goods (*expenditure switching effect*)

- Goods can be priced internationally using different currencies:
  - Producer-Currency Pricing
  - Local-Currency Pricing
  - Dominant Currency Pricing

- Considering the trade between the Eurozone (home) and the UK (foreign country), we can define the Eurozone net exports as:

$$\mathrm{NX} = \mathrm{Ex}\left(\frac{\mathrm{P}^*}{\mathrm{P}^{\text{IM from EU in £}}}\right) - \frac{\mathrm{P}^{\text{IM from UK in €}}}{\mathrm{P}} \times \mathrm{Ex}^*\left(\frac{\mathrm{P}}{\mathrm{P}^{\text{IM from UK in €}}}\right)$$

  - The formula tells us that, when the price of British goods increase compared to the price of European goods, exports will increase since it will be more convenient for UK citizen to purchase European goods
  - We can use this formula with different assumptions for PCP, LCP, and DCP

- Keep in mind that, even if this is a general formula, it still is a simplification because:
  - It does not consider that the price of home consumption basket *P* can differ from the price of domestically produced goods
  - The home price of domestic goods that are sold abroad can differ from the price of all domestically produced goods

➔ In this way, we can avoid talking about *Terms of Trade*, which are the relative price of exports in terms of imports. Here we simply assumed that:

$$Terms\ of\ Trade = \frac{\mathrm{P}^{\text{IM from UK in €}}}{\mathrm{P}}$$

Producer Currency Pricing

- In producer currency pricing, producers set prices of exports in their domestic currency:
  - Traded goods prices are **sticky** in producers' currency:

$$P^{IM\ from\ EU\ in\ £} = \frac{P}{E}$$
$$P^{IM\ from\ UK\ in\ €} = P \times \mathrm{E}$$

  - In this case, the **bilateral exchange rate pass through** is **1** because a 1% change in the exchange rate will result in a 1% change in imported goods prices, both for imports and exports

$$NX = Ex\left(\frac{P^*E}{P}\right) - \frac{P^*E}{P}Ex^*\left(\frac{P}{P^*E}\right)$$

Domestic Monetary Expansion

- After a domestic monetary expansion, the exchange rate will depreciate:
  - Hence, exports will increase because domestic goods will become cheaper than foreign goods
  - If the volume effect $\left(\frac{P}{P^*E}\right)$ prevails on the value effect $\left(\frac{P^*E}{P}\right)$, then a depreciation of the exchange rate will make imports more expensive

➔ In conclusion, a domestic monetary expansion increases exports and reduces imports, thus improving the trade balance

Foreign Monetary Expansion

- After a foreign monetary expansion, the exchange rate will appreciate:
  - Indeed, a monetary expansion in the UK will reduce the interest rate and depreciate the currency, thus making British exports more attracting to foreign buyers
  - Furthermore, since the Pound is now weaker, the UK will reduce its imports

➔ In conclusion, a foreign monetary expansion increases domestic imports and reduces exports, thus deteriorating the domestic trade balance

Local Currency Pricing

- In Local Currency Pricing, producers set prices of exports in the consumers' currency:
  - We say that traded goods prices are sticky in consumers' currency
  - In this case, the **bilateral exchange rate pass through** is **0**, because exchange rates do not affect how producers set their prices in consumers' countries

Dominant Currency Pricing

- In Dominant Currency Pricing, producers set prices in a small set of dominant currencies, mostly US dollars:
  - We say that traded goods are sticky in a small set of dominant currency:

$$P^{IM\ from\ EU\ in\ £} = P^{IM\ from\ EU\ in\ \$} \times E_{£/\$}$$
$$P^{IM\ from\ UK\ in\ €} = P^{IM\ from\ UK\ in\ \$} \times E_{€/\$}$$

$$\mathrm{NX} = \mathrm{Ex}\left(\frac{\mathrm{P}^*}{\mathrm{P}^{\mathrm{IM\ from\ EU\ in\ \$}} \times E_{£/\$}}\right) - \frac{\mathrm{P}^{\mathrm{IM\ from\ UK\ in\ €}} \times E_{€/\$}}{\mathrm{P}} \times \mathrm{Ex}^*\left(\frac{\mathrm{P}}{\mathrm{P}^{\mathrm{IM\ from\ UK\ in\ \$}} \times E_{€/\$}}\right)$$

- In this case:
  - The **bilateral exchange rate pass through** is **zero**, because exchange rates between domestic and consumers' currencies do not affect how producers set their prices in consumers' countries
  - The **dollar exchange rate pass through** is **one**, because a 1% change in the exchange rate between the dollar and the country of export/import will result in a 1% change in the price of exported/imported goods

Government Policies in the DCP World

- *Domestic Policies*:
  - A policy that depreciates domestic currency does not have a direct effect on exports but can influence imports
  - Indeed, a euro depreciation will not improve exports, but it will decrease imports because the euro depreciates against the dollar
  - Therefore, the benefits of a currency depreciation are not as big as under Producer Currency Pricing

- *Foreign Currency Pricing*:
  - A policy that depreciates foreign currency does not have a direct effect on domestic imports, but it can affect domestic exports
  - Indeed, a Pound depreciation would reduce domestic exports, while keeping imports constant
  - Therefore, a depreciation of the foreign exchange rate worsens the domestic trade balance less than it would do under Producer Currency Pricing, because exports decrease but imports stay constant (they do not increase)

- *US policies*
  - Monetary policy of the dominant currency country affects trade balance between the Eurozone and the UK
  - A dollar appreciation reduces Eurozone exports to the UK and imports from the UK to the Eurozone (assuming that the volume effect prevails on the value effect)
  - A dollar appreciation will increase both domestic exports and imports

➔ The effect on NX is ambiguous because it depends on the sensitivity of each exchange rate to a change in the US monetary policy

Explanations of the DCP

1) *Forex risk in supply chain*

- A lot of international trade is in intermediate goods
- If a firm uses intermediates that are priced in dollars, then it has incentives to set and keep prices sticky in dollars as well
- This reduces exchange rate risk

2) *Strategic complementarities in price setting*

- If a firm's competitor sets prices in dollars, the firm has incentives to also set prices in dollars
- This is done in order to avoid unwanted fluctuations of prices relative to competitors' prices
- Another reason is that, after WWII, Europe started to have close trade ties with the US, so many of the transactions were denominated in US dollars

3) *Finance*

- The demand for $ denominated safe assets in the world is very large
- Therefore, the return on these assets is very low
- Hence, if a firm sets prices in $, it can benefit from low interest rates and reduce its exposure from exchange rate risk, so that it has an easier time paying off the debt

Fixed Exchange Rates

- A *managed floating* is an exchange rate regime adopted by most countries, through which Central Banks smooth short-run fluctuations in the FX market
    - This is done because the FX is determined in financial markets
    - Therefore, if speculation occurred, it could have bad effects on the economic activity of a country, and therefore the monetary authority has incentive at fixing the exchange rate (e.g., Switzerland during the global financial crisis)

- *Regional Currency Arrangements* are exchange rate mechanisms on which countries agree on:
    - European Exchange Rate Mechanism (1979-1999)
    - European Union Exchange Rate Mechanism (Denmark)

- *Developing Countries* and countries in transition usually fix their currencies against the dollar or the euro
    - When developing countries fix their exchange rate with a developed one, they practically import the foreign monetary policy
    - This can have both positive and negative effects on the developing economies

- The fixed exchange rate is only a type of monetary policy, which the IMF has classified in different ways:

1) *Exchange Rate Anchor*
    - The monetary authority commits to maintain the exchange rate fixed at a predetermined level or within a range
    - The exchange rate thus serves as a nominal anchor or intermediate target of monetary policy

2) *Monetary Aggregate Target*
    - The monetary authority uses its instruments to achieve a target growth rate for the money supply, which becomes the nominal anchor or the intermediate target of monetary policy

3) *Inflation-Targeting Framework*
    - This involves public announcement of numerical targets for inflation, with an institutional commitment by the monetary authority to achieve these targets
    - Monetary policy decisions are often guided by the deviation of forecasts of future inflation from the announced inflation target
    - In this case, inflation forecasts act as the intermediate target of monetary policy

4) *Other*
    - The country has not explicitly stated nominal anchor, but rathe monitors various indicators in conducting monetary policy

- About 40% of all countries in the world target their Foreign Exchange rate, but these can be classified in different way according to their strength:

Exchange rate arrangement (number of countries)	Monetary Policy Framework: Exchange rate anchor: US dollar (39)		Euro (25)		Composite (9)	Other (9)
No separate legal tender (13)	Ecuador El Salvador Marshall Islands Micronesia	Palau Panama Timor-Leste	Kosovo Montenegro	San Marino		Kiribati Nauru[5] Tuvalu
Currency board (11)	Djibouti Hong Kong SAR **ECCU** Antigua and Barbuda Dominica Grenada	St. Kitts and Nevis St. Lucia St. Vincent and the Grenadines	Bosnia and Herzegovina Bulgaria			Brunei Darussalam
Conventional peg (43)	Aruba The Bahamas Bahrain Barbados Belize Curaçao and Sint Maarten Eritrea	Iraq Jordan Oman Qatar Saudi Arabia Turkmenistan United Arab Emirates	Cabo Verde Comoros Denmark[3] São Tomé and Príncipe **WAEMU** Benin Burkina Faso Côte d'Ivoire Guinea Bissau Mali Niger Senegal Togo	**CEMAC** Cameroon Central African Rep. Chad Rep. of Congo Equatorial Guinea Gabon	Fiji Kuwait Morocco[4] Libya	Bhutan Lesotho Namibia Nepal Swaziland
Stabilized arrangement (24)	Angola (04/16) Guyana Lebanon	Maldives Trinidad and Tobago[9,10] (12/15)	Croatia (4/16) FYR Macedonia		Singapore Vietnam[6]	

No separate legal tender means that a country completely abandons its own currency to adopt the foreign currency. In this case, the exchange rate is fixed by design, but countries have to abandon their monetary policy.

Currency Board means that the Central Bank backs all of its newly issued currency with foreign currency. This is a strong commitment to fix the exchange rate to the foreign country, because the country will always be able to exchange the domestic currency to the foreign one.

Conventional Peg means that the Central Bank fixes the exchange rate to a foreign currency. However, it does not ensure full convertibility of the domestic currency with the foreign one. This is the most used form of fixed exchange rate.

Stabilized Arrangements means that Central Banks allow currencies to appreciate or depreciate over time, but in a very smooth way. This form is between fixed and flexible exchange rates.

Central Bank Interventions

- In the Central Bank Balance Sheet, Total assets must be equal to the sum of total liabilities and net worth:

Assets		Liabilities	
Foreign assets	$1,000	Deposits held by private banks	$500
Domestic assets	$1,500	Currency in circulation	$2,000

  - Reserves are deposits made by Commercial Banks into Central Banks
  - In this case, we assume that Net Worth is zero

➔ The assumption of zero capital is reasonable because Central Banks, unlike Commercial Banks, are not forced to go bankrupt if they end up with negative net worth:

  - Indeed, they are part of the government
  - Hence, if a Central Bank makes profit from signorage, for instance, it will devolve it to the Ministry of Finance
  - In the same way, the Ministry of Finance will cover any losses borne by the Central Bank
  - We can say that CB and Finance Ministry have *consolidated balance sheet*

- Therefore, assuming that net worth is constant, then:
  - Any central bank purchase of assets automatically results in an increase in the domestic money supply
  - Any central bank sale of assets automatically causes the money supply to decline

Central Bank Balance Sheet

Assets		Liabilities	
Foreign assets	$1,000	Deposits held by private banks	$500
Domestic assets	$1,500	Currency in circulation	$2,000

Central Bank Balance Sheet after $100 Foreign Asset Sale (Buyer Pays with Currency)

Assets		Liabilities	
Foreign assets	$900	Deposits held by private banks	$500
Domestic assets	$1,500	Currency in circulation	$1,900

- However, Central Banks may decide to carry out equal foreign and domestic asset transactions in opposite directions to nullify the impact of their foreign exchange operations on the domestic money supply:
  - This kind of policy is called **sterilized intervention**
  - This change will not impact currency in circulation and will keep the size of the Balance Sheet constant

Central Bank Balance Sheet before Sterilized $100 Foreign Asset Sale

Assets		Liabilities	
Foreign assets	$1,000	Deposits held by private banks	$500
Domestic assets	$1,500	Currency in circulation	$2,000

Assets		Liabilities	
Foreign assets	$900	Deposits held by private banks	$500
Domestic assets	$1,600	Currency in circulation	$2,000

- In the Balance of Payments, the sum of Financial Account, Current Account, and Capital account must sum up to zero:
  - The Financial Account can be divided into *CB* and *no CB* financial accounts
  - *CB Financial Account* is a financial account balance coming from the central bank
  - *no CB Financial Account* is a financial account balance coming from the Central Bank

➔ If we rearrange the equation $FA_{no-CB} + FA_{CB} + CA + KA = 0$, we get:

$$FA_{no-CB} + CA + KA = -FA_{CB} = \Delta \boldsymbol{OR}$$

- Hence, we can easily see that the variation of the Central Bank Financial Account is equal to the variation of the Official Reserves of a country
- The Central Bank Financial Account enters the equation with a negative sign because an increase in foreign asset holdings enters in the balance of payments with a negative sign

Fixing the exchange rate

- A Central Bank fixes the exchange rate by standing ready to buy or sell any amount of foreign or domestic currency at the announced exchange rate
  - This is the case assuming free capital mobility
  - This implies that, if $E = E^e$, then $R = R^*$

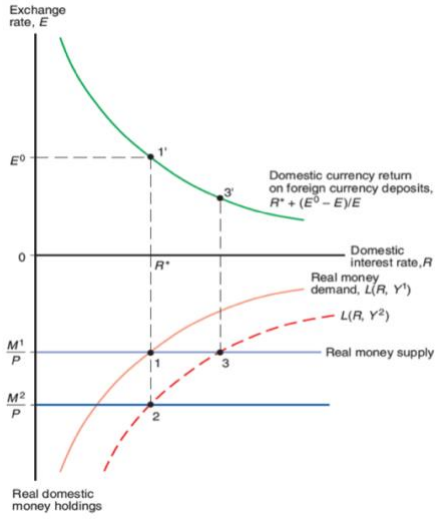
- In the Money Market:

$$\frac{M^s}{\bar{P}} = L(R, \bar{Y})$$

  - $\bar{P}$ is fixed in the shrot-run
  - $\bar{Y}$ is fixed for simplicitly

➔ In order to fix the exchange rate, the Central Bank must fix R by choosing M^s:

- Any change that affects money market must be accompanied by a change in money supply



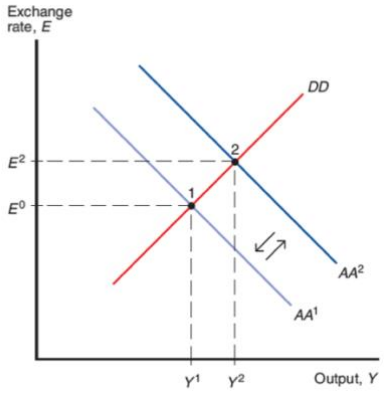
An increase in domestic output will increase money demand

Therefore, it must be met by an increase in the money supply through purchases of foreign and domestic assets, since they are assumed to be perfect substitutes in the model

Stabilization Policies

1) *Monetary Policy*

➢ Any attempt of stimulating the economy by an increase in money supply must be met by a decline in money supply to sustain the Foreign Exchange:



Hence, we can see that, under fixed exchange rates, countries adopt the foreign monetary policy

Therefore, monetary policy is no longer an instrument to stimulate the economy under fixed exchange rates

- Suppose that the Central Bank wants to increase output by increasing the money supply, and therefore starts purchasing domestic assets
- The result will be a currency depreciation
- In order to prevent it, the Central Bank will start to sell foreign assets for domestic currency in the FX market

➔ This will decrease money in circulation and shift the AA curve back to its original position, as the domestic money supply falls

➢ Hence, an increase in domestic money supply will cause the domestic currency to depreciate:

- Therefore, the Central Bank will start to sell foreign assets until money supply returns to its original level
- Similarly, an attempt to decrease the money supply through a sale of domestic assets would cause an equal increase in foreign reserves that would keep the money supply from changing in the end

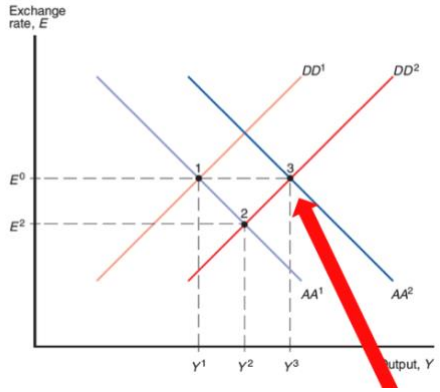
➔ Under fixed rates, monetary policy can affect the composition of the Central Bank's assets, but nothing more

2) *Fiscal Policy*

➢ A fiscal expansion will shift the DD curve to the right:

- The shift will both increase output, but also appreciates the domestic currency
- Therefore, the Central Bank will have to increase the money supply to bring the exchange rate to its original level (the AA schedule shifts right)
- In order to do so, the Central Bank will start to purchase foreign assets with money, thereby increasing the money supply and rebalancing the excess demand

➔ We can notice that, under fixed exchange rates, fiscal policy has a stronger effect on output rather than under flexible exchange rates



- At the new equilibrium, official international reserves and the money supply will be higher

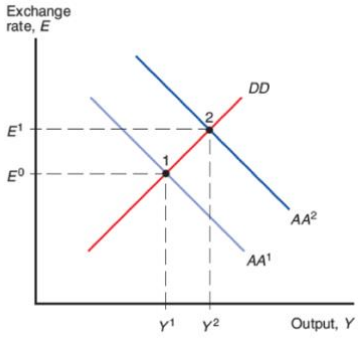
3) *Exchange Rate Policy*

➢ Notice that, under fixed exchange rates:

- A **devaluation** occurs when the Central Bank raises the domestic currency price of foreign currency (E increases)
- A **revaluation** occurs when the Central Bank lowers the domestic currency price of foreign currency (E decreases)

➔ All the Central bank has to do in order to devalue/revalue the currency is to announce the willingness to trade domestic against foreign currency, in unlimited amounts, at the new exchange rate

- If a country wants to increase its exchange rate, this will be a movement along the DD curve:
  - The movement along the DD increases output and consequently money demand will increase as well
  - If markets believe that this is a one-time devaluation, such that $\frac{E^e - E}{E} = 0$, then after the devaluation there will be an excess demand for money which will increase the interest rate
  - In order to maintain equilibrium in the foreign exchange market, the Central Bank must increase the Money supply by buying foreign assets in the FX market
  - This policy will shift the AA to the right, until it intersects the DD curve at the new equilibrium Exchange rate



- Therefore, we can see that a devaluation leads to:
  - A rise in output
  - An expansion in the money supply
  - A rise in official reserves if the government purchases foreign assets with new money

➔ Usually, governments choose to pursue a devaluation in order to:
  - Fight domestic unemployment
  - Improve the current account
  - Affect the Central Banks foreign reserves

Sterilized Intervention

- A sterilized intervention is a change in the composition of the asset size of the Central Bank, which however does not change the size of the balance sheet:
  - So far, we have been neutral about sterilized interventions because the composition of the Central Bank balance sheet was not considered, and only money supply mattered
  - The key assumption behind the discussion we have carried out so far is the **perfect asset substitutability**, which means that the foreign exchange market is in equilibrium only when the expected return on domestic and foreign currency bonds are the same

- With perfect asset substitutability in the FX market, the exchange rate is therefore determined so that the interest parity condition holds:
  - When this is the case, there is nothing the Central Bank can do through foreign exchange intervention that it could not do as well through purely domestic open-market operations

- In contrast to perfect asset substitutability, **imperfect asset substitutability** exists when it is possible for assets expected returns to differ in equilibrium:
  - The main factor that may lead to imperfect asset substitutability in the foreign exchange market is **risk**
  - If bonds denominated in different currencies have different degrees of risk, investors may be willing to earn lower expected returns on bonds that are less risky

- In a world of perfect asset substitutability, participants in the foreign exchange market care only about expected rates of return:
  - Since these rates are determined by monetary policy, actions such as sterilized intervention that do not affect the money supply also do not affect the exchange rate

➔ Under *imperfect asset substitutability*, both risk and return matter, so central bank actions that alter the riskiness of domestic currency can move the exchange rate when the money supply does not change

- There are two important channels for which sterilized interventions imply non-neutrality, and which are relevant for **quantitative easing**:
  - *Portfolio Balance Channel*
  - *Signaling Channel*

- **Quantitative Easing** is the purchase of MBS, long-term public bonds, and corporate bonds by Central Banks
  - It is also called *credit easing*
  - Not always QE is a sterilized intervention, because it may also expand the size of the balance sheet

Portfolio Balance Channel

- Domestic and foreign bonds are imperfect substitutes in reality because of differences in risk and market segmentation, since not everyone can trade foreign bonds:
  - By changing the supply of government bonds available to private agents, the central bank can influence the interest rate and, hence, the exchange rate

- If two bonds are perfect substitutes, then the UIP will hold:

$$R = R^* + \frac{E^e - E}{E}$$

- In reality, risk plays a role, and therefore bonds are not perfectly substitutable:

$$R = R^* + \frac{E^e - E}{E} + \rho$$

  - ρ is a wedge that represents differences in the amount of risk in domestic and foreign bonds
  - The risk premium on domestic assets rises when the stock of domestic government bonds available to be held by the public rises and falls when the central bank's domestic assets rise

➔ The reason behind the rise of the risk premium when the stock of domestic government bonds available for sale rises is that Private Investors become more vulnerable to unexpected changes in the home currency exchange rate as the stocks of domestic government bonds they hold rises

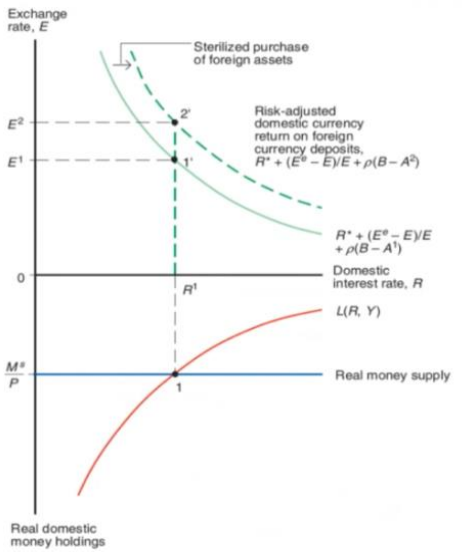
- Indeed, investors will be unwilling to assume the increased risk of holding more domestic government debt unless they are compensated by a higher expected return on domestic currency assets
- An increased stock of domestic government debt will therefore raise the difference between the expected returns on domestic and foreign currency bonds
- Similarly, when the central bank buys domestic assets, the market does not need to hold them any longer. Hence, private vulnerability to home currency exchange rate risk is thus lower, and the risk premium on home currency assets falls

- Therefore, the risk premium depends positively on the stock of domestic government debt (**B**), less the domestic assets of the central bank (**A**):

$$\rho = \rho(Stock\ of\ Domestic\ Government\ debt - Domestic\ assets\ of\ the\ CB) =$$

$$= \rho(B - A)$$

- The interesting thing about risk-premium is that it gives policy makers one more degree of freedom:
  - Indeed, it is possible to depreciate the currency without resorting increasing money supply, but only by changing the composition of the balance sheet



A sterilized purchase of foreign assets leaves the money supply unchanged

However, it raises the risk-adjusted return that domestic currency deposits must offer in equilibrium

As a result, the return curve in the upper panel shifts up and to the right

Therefore, other things equal, a sterilized central bank purchase of foreign assets under imperfect substitutability depreciates the currency

- With Quantitative Easing, the economy was in a liquidity trap, and Central Banks started to purchase Mortgage-Backed Securities from the market:
  - Hence, they effectively reduced the net supply of MBS in the market, thus managing to reduce the risk premium in the market

Derivation of ρ

- Total demand for domestic bonds can be written as:

$$B^d = B^d\left(R - R^* - \frac{E^e - E}{E}\right)$$

- The bonds market equilibrium will be given in the form *supply=demand*

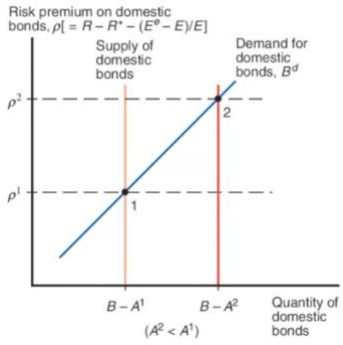
$$B - A = B^d\left(R - R^* - \frac{E^e - E}{E}\right)$$

  - B is the total supply of government bonds
  - A is the amount of government bonds held by the central bank
  - $(B - A)$ is the net supply of government bonds

➔ Hence, assuming that $\rho = (B^d)^{-1}$, we can therefore derive:

$$\rho(B - A) = R - R^* - \frac{E^e - E}{E}$$

- For instance, a sale of domestic public bonds by the central bank increases the risk premium (ρ):



Signaling Channel

- When market participants are unsure about the future direction of macroeconomic policies, sterilized interventions may give an indication of where the central bank expects the exchange rate to move:
  - This **signaling effect** of foreign exchange intervention can alter the market's view of future monetary or fiscal policies and cause an immediate exchange rate change, even when bonds denominated in different currencies are perfect substitutes
  - The signaling effect is even *more effective* when the government is unhappy about the unhappy with the current exchange rate level and publicly declares that it will implement fiscal and monetary policy to vary it
  - By simultaneously intervening on a sterilized basis, the Central Bank sometimes lends credibility to this announcement

- For instance, a Sterilized Purchase of foreign assets is interpreted as a **signal** of the central bank's intent to *depreciate* the exchange rate in the future via a standard money supply increase:
  - Future expected depreciation causes depreciation today because of expectations

- These purchases make commitment to depreciate FX in the future more credible:
  - The central bank will get a profit on its portfolio of foreign assets if the exchange rate depreciates
  - The signal can be credible because if an appreciation occurs, the bank will lose money
  - In the case of losses, the Finance Ministry should cover them, but since many Central Banks want to remain independent, they will try to make profits

- However, notice that if governments do not follow up on their exchange market signals with concrete policy moves, the signals soon become ineffective:
  - Thus, intervention signaling cannot be viewed as a policy weapon to be wielded independently of monetary and fiscal policy

Evidence about sterilized interventions

- Economists disagree on whether this policy works because it is difficult to interpret existing estimates for different reasons:
    - There is also an issue of *reverse causality* which introduces *negative bias*, since central banks purchase foreign bonds when the FX appreciates
    - Bond markets in developed countries are very large, thus making it hard to influence the interest rate through purchases, while this is not the case for developing countries

- Recent evidence indicates however that sterilized interventions are indeed effective:
    - Domiguez-Fatum-Vacek (2013)
    - Chamon-Garcia-Souza (2017)

Balance of Payments Crisis

- So far, we have assumed that when a country fixes its exchange rate, the expected exchange rate is the same as the current exchange rate:

$$E^e = E$$

  - However, if E^e suddenly changes, investors may doubt central bank's ability and desire to maintain the fixed the Exchange Rate in the future

➔ The result is a **balance of payments crisis**, which is a sharp change in official foreign reserves sparked by a change in expectations about the future value of the exchange rate

First Generation models – Bad Fundamentals

- These theories derive inspiration from the collapse of the Bretton-Woods system, the 1980s crises in Latin America, and the Mexico crisis of 1994
  - The reasons behind these crises are to be found in *bad macroeconomic policies*
  - Krugman (1979) and Flood-Garber (1984) wrote papers in which the key idea was that a fixed exchange rate contains inflationary pressures, which ultimately explode in a sudden balance-of-payments crisis that frees the currency to depreciate

- The main assumptions are:
  - Output is fixes and $\bar{Y} = \overline{Y^*}$
  - Foreign monetary policy is fixed ($\overline{M^*}$, $\overline{R^*}$)
  - The Forex exchange rate is determined as in the monetary approach:

$$E_t = \frac{P_t}{P^*}$$

  - Initially, the FX is fixed at E_0
  - The foreign exchange is fixed if and only if the Central Bank has reserves and, vice versa, the foreign exchange is floating if and only if the Central Bank has no reserves. →This is why countries increase the exchange rate in order to avoid floating the currency, so that they can increase their reserves.

➔ These assumptions imply that the money supply must be constant when the Exchange Rate is credibly fixed

- The FX equilibrium (UIP) implies that:

$$R_t = \bar{R}^*$$

- The Money Market equilibrium implies that:

$$E_t = \frac{P_t}{P^*} = \frac{\frac{L(\bar{R}^*, \overline{Y^*})}{\overline{M^*}}}{\frac{L(R_t, \overline{Y^*})}{M_t}} = \frac{M_t}{\bar{M}^*}$$

➔ When the exchange rate is fixed, money supply is constant:

$$M_t = E_t \bar{M}^* = E_0 \bar{M}^*$$

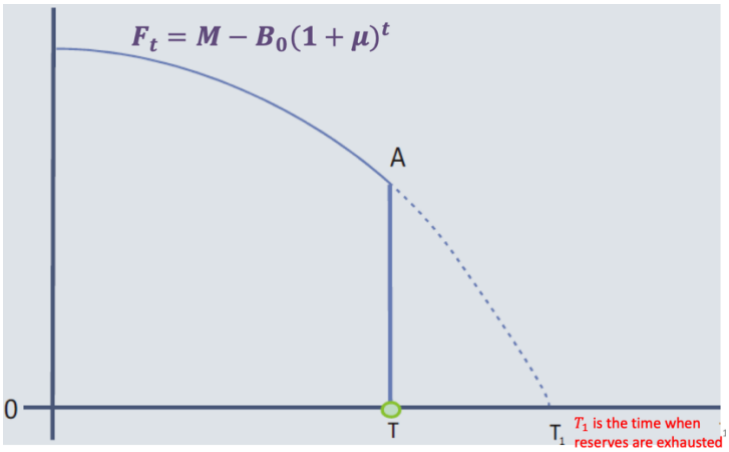
- Also assume that:
  - The central bank buys domestic government bonds B_t at a rate $\mu > 0$ forever, for instance in order to finance a fiscal deficit (G>T)
  - Before the bank runs out of reserves, its balance sheet is:

$$F_t + B_t = M$$

  - Investors are forward looking, and we assume *perfect foresight*

➔ Therefore, our model predicts that reserves will shrink according to the relationship:

$$F_t = M - B_0(1+\mu)^t$$



- According to the models, however, the crisis will not occur at T_1, when the bank runs out foreign reserves, but it will start earlier when reserves are still positive:
  - This is due to speculative or currency attacks
  - When the crisis hits, the Central Bank will be forced to let the FX float

- In order to better understand when the attack occurs, we should compute the exchange rate after the crisis:
  - The balance sheet without reserves will be $B_t = M_t$
  - Money, prices, and the exchange rate will all grow at the rate μ
  - Therefore, according to the UIP condition, the interest rate will be:

$$R_t = \bar{R}^* + \mu$$

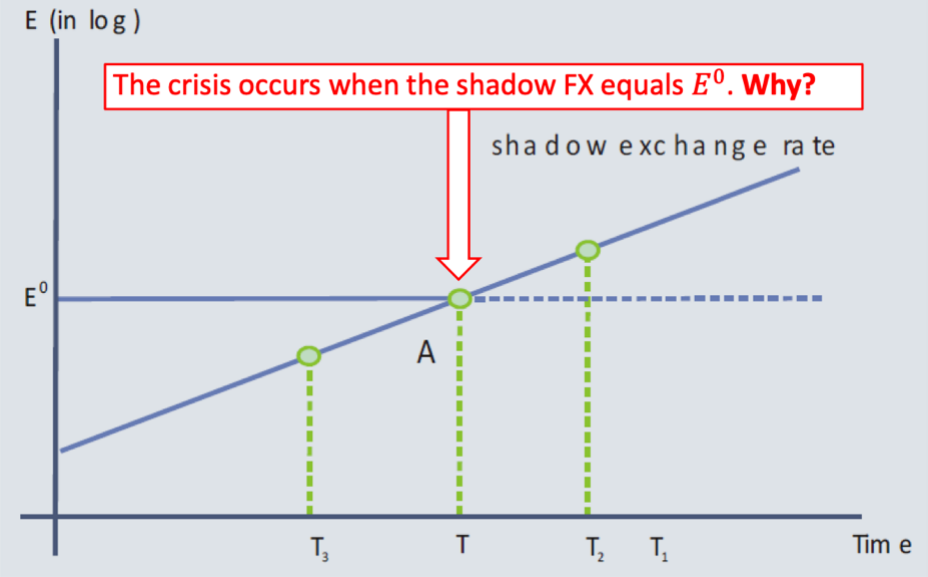
  - Consequently, money demand will also be:

$$L(\bar{R}^* + \mu, \bar{Y})$$

➔ However, we should also consider the **shadow interest rate**, which does not show itself up before the crisis, but becomes effective right after the exchange rate starts floating:

$$\boldsymbol{E_t = \frac{P_t}{P^*} = \frac{B_t}{\bar{M}^*} \times \frac{L(\bar{R}^*, \bar{Y}^*)}{L(\bar{R}^* + \mu, \bar{Y})}}$$

  - Basically, the shadow exchange rate is the actual free-market exchange rate that we would have, assuming that the exchange rate was not fixed
  - The Shadow Exchange Rate is proportional to B_t



- From the graph above, we can see that the crisis will occur when the shadow exchange rate equals the fixed exchange rate E_0, and here below we explain why it cannot happen neither before nor after T, which is the Nash Equilibrium:

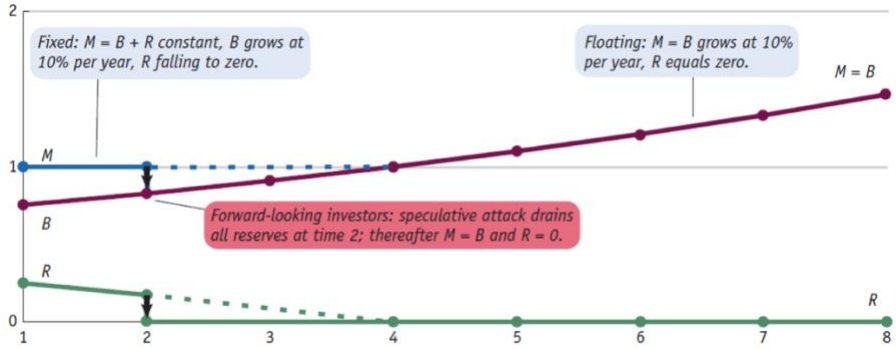
1) Assume that the crisis occurs at *t,* such that $T < t < T_1$
   - Then, knowing that the domestic currency will abruptly depreciate in the near future, a *forward-looking investor* anticipates it
   - Therefore, he will start borrowing domestic currency that he will use to purchase currency before *t*, in order to profit from the future anticipated depreciation
   - Assuming that all investors are *forward-looking*, central bank's reserves will drop to zero before *t*:

➔ Hence, we can conclude that *t* such that $T < t < T_1$ cannot be the time of the attack

2) Assume that the crisis occurs at *t*, such that $t < T$
   - Then, the currency will appreciate abruptly, since the fixed exchange rate is higher than the shadow exchange rate at time t$< T$
   - Therefore, a *forward-looking* investor will be better off not attacking the currency

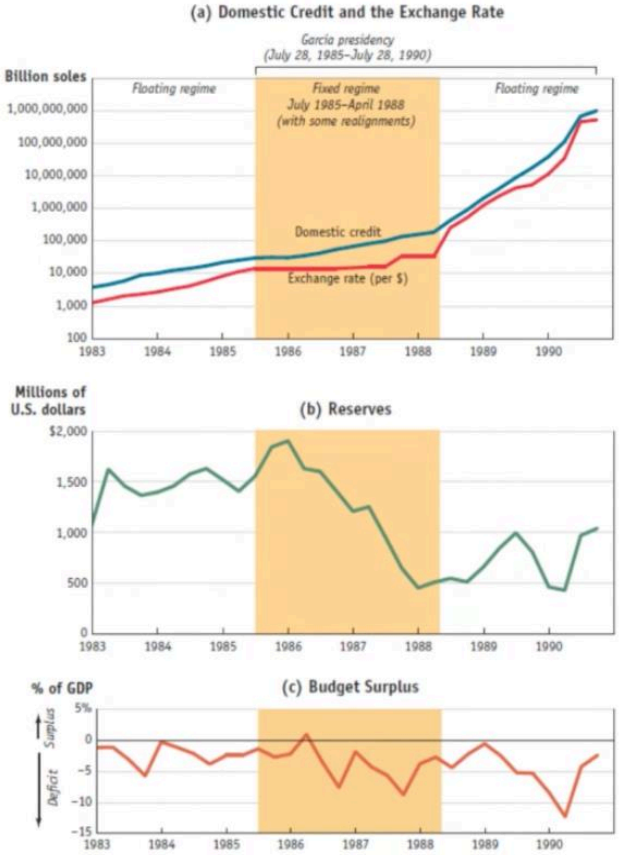
➔ Hence, we can conclude that *t* such that $t < T$ cannot be the time of the attack

- Therefore, we can develop a model to explain how reserves, debt, and money supply evolve before, during, and after the crisis:



- Reserves (R) fall gradually before the crisis, but drop during the crisis
- Also, money supply drops during the crisis because of bank runs

The Peruvian Crisis of 1986



During the '70s, Peru experienced a period of social unrest and military rule, during which external public debt got very high

In the early '80s, Peru defaulted on its debt, and the Central Bank started monetizing its large deficits, thus leading to hyperinflation

In 1985, the Peruvian government imposed a fixed exchange rate regime, however it did not sole the deficit problem

Hence, the Central Bank continued to monetize the budget deficits, thus reducing exponentially its foreign reserves

In conclusion, the Central Bank could not sustain the peg anymore and was forced to let the exchange rate float after it lost two-thirds of its reserves

- The **bad fundamentals theory** has some key implications that is worth mentioning:

1) Crises are predictable since they are preceded by bad policies

2) Furthermore, crises also depend on the expectations that policies will be bad:
   - Indeed, governments could be punished for actions they don't intend to commit, but that markets expect they will do

3) Reserves, Money Growth, and Fiscal Policy need to be monitored in order to prevent a currency crisis

4) The model predicts a collapse in reserves, however, it does not predict any jump in the FX market:
   - Indeed, the model fits well the collapse of the B-W system, and the 1994 Mexico Crisis
   - On the other hand, empirical evidence shows that the FX often depreciates in other BoP crises

2nd Generation Models – Self-Fulfilling Expectations

- The models were inspired by the 1992 Exchange rate mechanism crisis:
  - Before the introduction of the Euro, and after the end of the B-W system, European countries decided to create the Exchange Rate mechanism
  - Countries were fixing their Exchange Rate to the German Mark
  - Even though most of the countries were fiscally sustainable, with low deficits and no monetization of budget deficits, several central banks were attacked by investors (Soros attack of the British Pound and Italian Lira)

➔ The 2nd generation models were therefore based on the concept of *self-fulfilling expectations*, introduced by Obstfeld (1986)

- The key idea is that of multiple Nash equilibria

- Main framework:
  - Assume that investors suddenly start to expect that the government will devalue the exchange rate: $E^e > E$

➔ In such case, the Central Bank will face the cost of defending the exchange rate

- This will lead to either a decline in reserves, as the Central Bank will need to sell them in order to sustain the peg
- Or a tightening in monetary policy, which squeezes the economy, but favors the access of foreign capital:

$$R = R^* + \frac{E^e - E}{E} > R^*$$

- If investors doubt that the Central Bank is fully committed to the fixed Exchange rate, they will all start attacking the currency:
  - Hence, even if fundamentals are sound, the Central Bank may decide not to defend the currency due to the high cost of doing so
  - In conclusion, the attack will succeed, thus validating the initial beliefs

Example

- Assume that the main actors are the Central Bank, and two FX traders
  - Any trader can either hold 6 units of foreign currency, or sell it
  - If the trader sells, he will have to pay 1 unit as transaction costs

- The Central Bank has R units of foreign currency:
  - If the Central Bank loses all of its reserves, it will have to let the Exchange Rate float
  - Otherwise, if it has enough reserves, the Central Bank will split them equally across traders who attach

- The exchange rate will be fixed at 1 if the attack fails, or will increase to 1.5 in case of success

Case 1

- CB has a high level of reserves (R=20)

Trader 1 \ Trader 2	Hold	Sell
Hold	0 , 0	0, -1
Sell	-1 , 0	-1, -1

Holding is always a dominant strategy

In this case, the CB has a large number of reserves, larger than the amount of the two traders combined

Hence, the only Nash Equilibrium is Hold-Hold, because the Central Bank is able to completely exchange the traders' units of domestic currency without shrinking its holding of foreign currency

Traders will make a loss if they sell due to Transaction Costs

Case 2

- CB has a low level of reserves (R=6)

Trader 1 \ Trader 2	Hold	Sell
Hold	0 , 0	0, 2
Sell	2 , 0	0.5, 0.5

Selling is always a dominant strategy

In this case, the CB is weak, and even if only one person tries to sell its units of domestic currency, it wipes out all of its foreign reserves

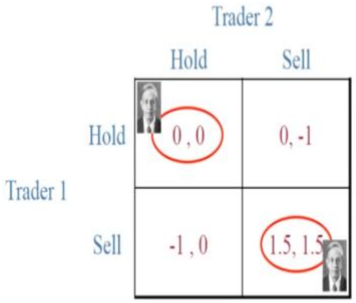
If only one trader decides to sell and the other one holds, then he will manage to force the CB to depreciate, and will make a profit of 2

However, if both manage to sell, they will together manage to force the bank to leave the peg, and they will both make a profit of 2

Hence, Sell-Sell is the only Nash Equilibrium

Case 3

- CB has an intermediate level of reserves (R=10)



- Two Nash equilibria
  - Attack successful if believed to be successful

In this last case, the bank has a moderate level of foreign reserves, such that no trader alone is capable of force it to leave the peg

Hence, in this particular gain there are two Nash equilibria

If one sells and the other doesn't, hence one trader will get a loss, while if the other does not sell, he will make 0

Therefore, in this last case, expectation play a fundamental role

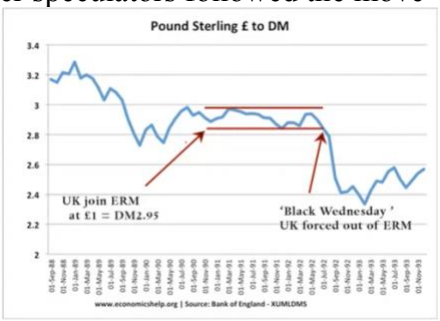
- According to the Self-Fulfilling Expectations theory, not only fundamentals, but also fundamentals matter, which are divided in:
  - *Safe Zone*, which has strong fundamentals where no attack can occur, regardless of beliefs
  - *Crisis Zone*, which has weak fundamentals and where attacks always occur
  - *Danger Zone*, where an attack can be fulfilling

➔ For instance, if an economy is in a *Crisis Zone*, what will really matter will be the expectations about the others

British Currency Attack

- The UK started to fix the British Pound to the Deutesche Mark in 1990, right after Germany had to increase its interest rate after the 1989 unification, in order to fight the inflation caused by the fiscal expansion
  - Since, when a country fixes the exchange rate with another one, it basically adopts its monetary policy, investors started to doubt if the UK wanted to increase the policy rate
  - Indeed, it was not in the UK interest raising the rates

➔ This is when Soros made the large bet against the British Pound and forced it to depreciate, after also after speculators followed the move



- Another reason why a country may be forced to abandon the fixed exchange rate is **bank runs**:
    - The reason is that, if all depositors run, you have incentive to run as well, and the bank will go bankrupt
    - However, since there is deposit insurance guaranteeing the banks with liquidity, bank runs disappeared after the Great Recession

- In conclusion, the second-generation model is related mainly to two phenomena:
    - From the **Finance** perspective, bank runs are relevant because, if all investors run, you also have incentive to run, and hence the bank goes bankrupt
    - From the **Game Theory** perspective, Balance of Payments crises may be triggered by games of regime changes. For instance, if everyone protests, you too have incentive to protest, and therefore a dictator may be overthrown

3rd Generation Models: Banking Sectors

- The Emerging market crises of 1997-2001 inspired these 3rd generation models:
  - These markets were characterized by sound monetary and fiscal policy before the Balance of Payments crises
  - However, the main issues were in the banking sector

- The main papers that inspired this model were:
  - Diaz-Alejandro (1985)
  - Burnside, Eichenbaum & Rebelo (2001, JPE)
- The key idea is that deposit insurance is ineffective in preventing bank runs if all depositors try to withdraw their deposits at the same time:
  - In the case of news about future problems in the banking sector, this may create expectations about higher deficits in the future
  - Indeed, a weak banking sector is an implicit liability to the government since, if deposit insurance becomes ineffective, the government must bail the banks out
  - The only way the government has to bail the banks out is either by printing money, or by issuing public debt, if investors are willing to buy government bonds
  - However, when investors do not want to buy government bonds, the government will have to monetize its debt by printing money

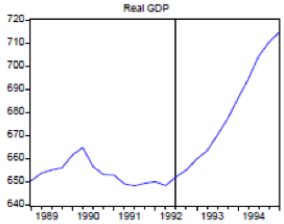
➔ This will lead to an expected devaluation of the currency, which puts pressure on the fixed exchange rate

- In the 1st generation model, the Balance of Payments crisis was triggered because investors expected the government to run deficits both in the present and in the future:
  - On the other hand, the 3rd generation model relates to the 1st generation one because investors expect the government to run deficits in the future

Contractionary Depreciations

During the Korean Currency Crisis (1997), the real exchange rate depreciated by 30%

This large depreciation caused a big drop in Real GDP, which declined by roughly 10%



During the UK currency crisis caused by the coordinated currency attack, even though the currency depreciated substantially, Real GDP did not drop

<u>The reason behind this is in the valuation effect</u>

- The **valuation effect** states that the Net International Investment Position is equal to the difference between foreign assets and foreign liabilities, which could be denominated either in domestic or foreign currency:

$$NIIP = (A_H + EA_F) - (L_H + EL_F)$$

  - A_H are foreign assets denominated in domestic currency, while L_H are foreign liabilities denominated in domestic currency
  - A_F are foreign assets denominated in foreign currency, while L_F are foreign liabilities denominated in foreign currency
  - Both A_F and L_F must be converted using the nominal exchange rate E in order to compute the NIIP

➔ A depreciation of national currency will *increase* the NIIP only if foreign currency assets exceed foreign currency liabilities (if $A_F - L_F > 0$)

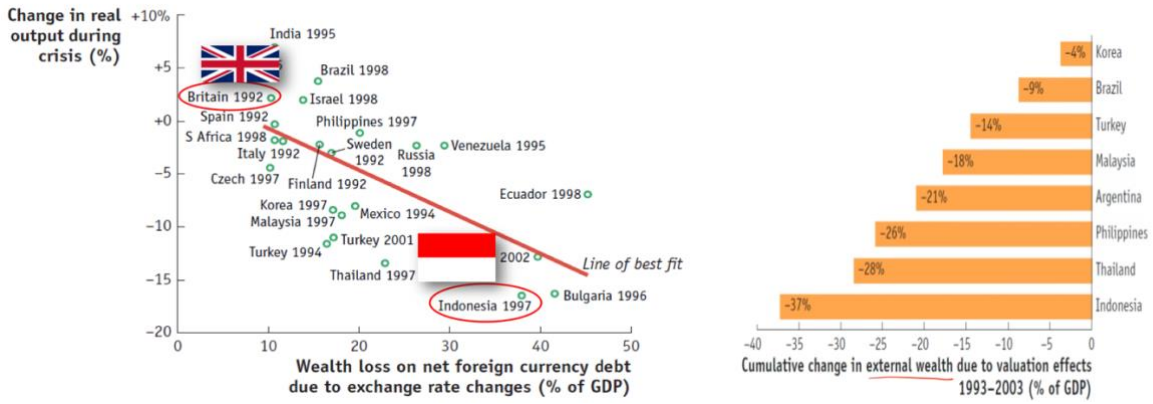
➔ On the other hand, a depreciation will reduce NIIP if foreign currency liabilities exceed foreign currency assets (if $A_F - L_F < 0$)

- Our previous discussion about aggregate demand considered only output as a determinant of consumption:
  - However, the NIIP affects aggregate demand because it is directly proportional to investments and consumption:

$$AD = C(Y - T, NIIP) + I(NIIP) + G + NX\left(\frac{EP^*}{P}, Y - T\right)$$

  - The presence of the NIIP in the aggregate demand has an extremely important effect on emerging markets, where in many cases $A_F - A_L < 0$
  - Hence, a currency depreciation in an emerging country will have a negative effect on the NIIP, and will therefore contract aggregate demand

➔ Therefore, a negative NIIP turns upside down the discussion done so fare, in which we assumed that a depreciation of domestic currency improves NX and therefore aggregate demand



- The regression above shows that developing countries are those that lost the highest amount of wealth after a depreciation of the exchange rate, thus causing a loss in output:
  - Emerging countries usually borrow more cheaply in foreign currency because investors are able to reduce the exchange rate risk and therefore demand a lower risk premium (**original sin problem**)
  - Thus, these countries are more exposed to depreciations of the exchange rate, which will shrink their NIIP and therefore their output

- The horizontal bar chart shows that the wealth of different developing countries dropped dramatically after an exchange rate depreciation:
  - This is mainly because large fraction of their external debt was denominated in foreign currency, and all suffered the effects of the valuation effects, causing their external wealth to fall

Policy Goals in an Open Economy

- There are two group of goals that policy makers want to achieve:
  - *Internal Balance*, which refers to stabilizing prices and output at full employment output and
  - *External Balance*, which refers to avoid having excessive imbalances in international payments

Internal Balance

- CBs and Governments try to target *full employment*:
  - At full employment, workers are neither under- nor over-employed
  - This has indeed a direct effect on well-being, and an indirect effect on price stability

- CBs want to achieve price stability by targeting a low level of inflation (usually 2%)
  - CBs usually want to target a 2% inflation rate because it allows to reduce real wages while keeping nominal wages constant, and also provide for greater flexibility in monetary policy
  - Furthermore, the 2% rate is chosen as target inflation rate because the Bank of New Zealand was the first one to target inflation to that rate, even though the target lacked any solid reason
  - When other CBs started to target the inflation rate, they simply chose the same target rate chosen by the New Zealand CB

➔ Recently, economists are arguing that 2% is too small of a rate, and are proposing of raising the target inflation rate:
  - The main issue however is about expectations, because the market will perceive that the CB will change the targeted inflation rate anytime

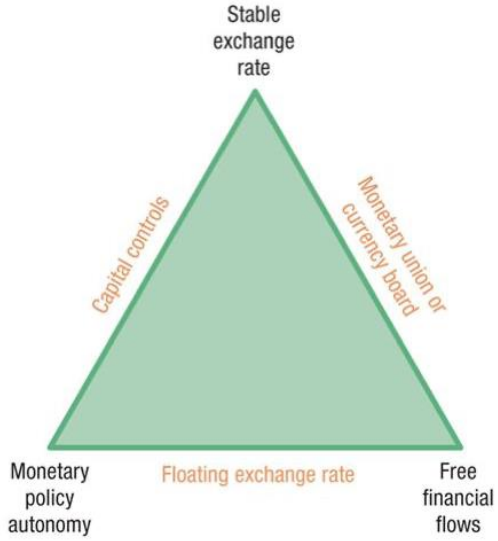
External Balance

- Since there is no concept about an optimal level of Current Account or Net Exports, CBs try to target a **sustainable current account**:
  - This means avoiding extremely large deficits or surpluses

- *Extreme Deficits* make a country accumulate foreign debt very fast
  - This may rise the risk of a **sudden stop** in debt financing, and hence a fast reversal of capital flows

- *Extreme Surpluses* make a country accumulate foreign assets very fast, and this may lead to different issues such as:
  - Foregoing domestic investments, because no physical capital is invested in the domestic country, thus deteriorating the country's productive capabilities
  - Risk of default on foreign assets
  - Great political target for import barriers (Trump vs China)

The Monetary Trilemma



- The Monetary Triangle gives an idea of the tradeoffs that policy makers need to make:
  - By choosing one side of the triangle, they get the two near corners, but must give up the opposite one

1) A **Stable Exchange Rate** can be obtained by either imposing *capital controls*, or by joining a *monetary union* or creating a *currency board*:
   - Stable Exchange rates permit predictable planning because it facilitates trade
   - On the other hand, they create the risk of a balance of payments crisis

2) **Monetary Policy Autonomy** can be obtained by either *floating the exchange rate*, or imposing *capital controls*:
   - Independent monetary policy allows for controls on local inflation
   - Furthermore, the CB can actively react to the local business cycle
   - On the other hand, the most important risk is that of a bad monetary policy

3) **Free Financial Flows** can be obtained by either *floating the exchange rate*, or by joining a *monetary union* or adopting a *currency board*
   - Free financial flows are useful because they allow a country to have a level of investment different from that of savings thanks to borrowing
   - However, they may be subjected to a sudden stop in the case of financial crises

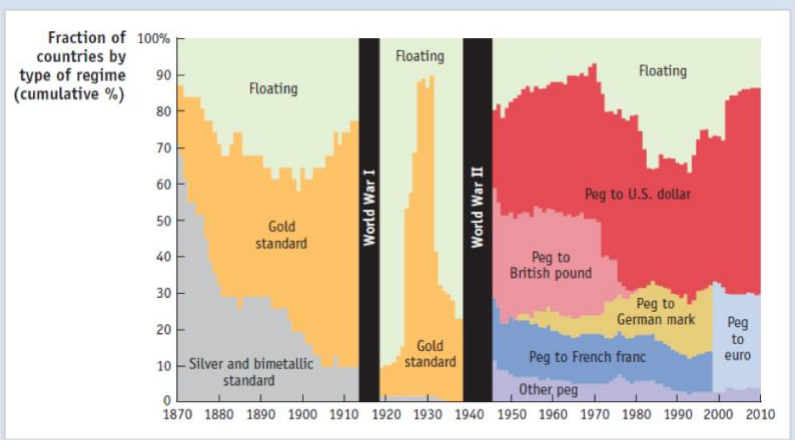
- *Italy* joined the Eurozone:
  - This allowed it to benefit from free capital flows and from stable exchange rates within the euro area
  - However, in order to do so, Italy had to give up on monetary policy, since it is centralized in the hands of the ECB
  - Indeed, the ECB decides on the monetary policy and tries to smooth the EU wide business cycle, but does not focus on single countries

- The *US* and *Japan* decided to adopt a floating exchange rate:
    - Many developed countries like the US decided to float their exchange rate in order to have an autonomous monetary policy, and benefit from free capital flows
    - However, the US had to give up on a stable exchange rate

- *China* was a country that managed to maintain a fixed exchange rate to the US dollar, while at the same time having its own monetary policy:
    - They could do it because they imposed capital controls, so that capital could not freely enter the country to exploit the arbitrage opportunity created by the fixed FX and the independent monetary policy
    - As of today, China is relaxing capital controls and is trying to move over a floating exchange rate

Historical Overview of International Monetary Systems

- So far, our analysis has treated the *rest of the world* as an *exogenous* variable:
  - However, domestic policies affect the rest of the world in ways that are shaped by *international monetary systems*
  - International monetary systems are a set of monetary, foreign exchange, and financial arrangements between different countries



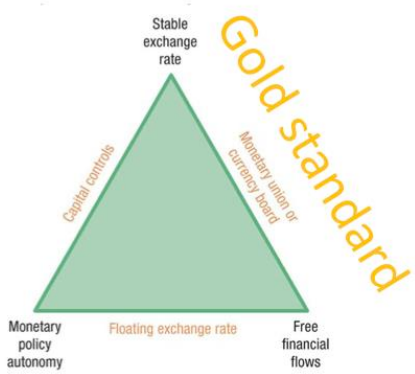
Exchange Rates Regimes of the World, 1870–2010 The shaded regions show the fraction of countries on each type of regime by year, and they add up to 100%. From 1870 to 1913, the gold standard became the dominant regime. During World War I (1914–1918), most countries suspended the gold standard, and resumptions in the late 1920s were brief. After further suspensions in World War II (1939–1945), most countries were fixed against the U.S. dollar (the pound, franc, and mark blocs were indirectly pegged to the dollar). Starting in the 1970s, more countries opted to float. In 1999 the euro replaced the franc and the mark as the base currency for many pegs.

Sources: Christopher M. Meissner, 2005, "A New World Order: Explaining the International Diffusion of the Gold Standard, 1870–1913," Journal of International Economics, 66(2), 385–406; Christopher M. Meissner and Nienke Oomes, 2006, "Why Do Countries Peg the Way They Peg? The Determinants of Anchor Currency Choice," Cambridge Working Papers in Economics 0643, Faculty of Economics, University of Cambridge, and later updates; and extended with Ethan Ilzetzki, Carmen M. Reinhart, and Kenneth S. Rogoff, 2010, "Exchange Rate Arrangements Entering the 21st Century: Which Anchor Will Hold?" unpublished.

Gold Standard

- Gold was used as money for millennia, but Britain was the first country to institutionalize it at the beginning of the 19th century with the Gold Standard:
  - The British economic success prompted other countries to copy this arrangement
  - Furthermore, the increasing level of globalization raised benefits of having fixed exchange rates

- The Gold Standard effectively fixed the exchange rates of participating countries:



  - With the Gold Standard, the key objective of policy makers was to keep the financial account of the Central Bank equal to zero:

$$FA(no\ CB) + CA + KA = -FA(CB) \approx 0$$

- As of today, Central Banks do not try to keep the financial account of the central bank equal to zero:
  - From an **external balance** perspective, the Gold Standard did not avoid extreme value of Current Account
  - From an **internal balance** perspective, monetary policy was constrained by the fixed exchange rate, hence price stability and full employment were not achieved

- The Gold Standard **rules of the game** was a short-run mechanism through which Central Banks stabilized the level of gold reserves artificially:
  - This means that Central Banks would artificially manage the interest rates in order to stop gold outflows or inflows and maintain the gold reserves constant and the currency always convertible
  - An increase in the interest rate would increase gold inflows, while a decrease in the rate would increase gold outflows

- Furthermore, the Gold Standard was characterized by the **Price-Specie-Flow Mechanism**, developed by David Hume:
    - This was a long run mechanism that made the Gold Standard a self-stabilizing system, without the intervention of Central Banks

  Assume that in a country, $CA > 0$, such that $FA(CB) < 0$:
    - This means that a country is accumulating gold reserves because, for instance, a positive current account means that other countries are purchasing domestic goods with gold
    - The accumulation of gold reserves makes the money supply expand domestically, and contract abroad
    - Therefore, the domestic price level increases, while the foreign one drops
    - This leads to an appreciation of the real exchange rate, which deteriorates current account and leads to cash outflows

➔ Hence, according to Hume's theory, the appreciation of the real exchange rate deteriorates the CA until it brings the Central Bank Financial Account back to zero again

- The main advantages of the Gold Standard were:
    - Symmetry, because no country stands as central (<u>even though I think it's wrong</u>)
    - Gold standard placed a limit on money supply growth, and hence inflation

➔ On the other hand, the main drawbacks of the Gold Standard were that:
    - It constrained the prudent use of monetary policy, because fixed exchange rates did not leave central banks the possibility to stabilize the business cycle using monetary policy
    - The global gold supply affected price levels around the world, indeed the price level would rise dramatically when new gold reserves were discovered
    - The gold production was concentrated in the hands of a few countries, which could influence the world supply
    - With fixed gold supply, global growth led to deflation since, by the money market equilibrium condition, if money demand increased with a fixed money supply, the price level must necessarily decrease:

$$\frac{\overline{M}}{P \downarrow} = L \uparrow (\bar{R}, Y \uparrow)$$

The Interwar Years: 1918-1939

- During WWI, countries started to print money in order to monetize their debt, because they needed financing for the war:
  - Therefore the Gold Standard was virtually suspended
  - This significantly increased the money supply, and made the gold standard not sustainable anymore, since gold was no longer convertible

- After WWI, countries wished to return to the Gold Standard, but the main issue was about the rate at which adopting it:
  - If the price of gold was set too high, this would translate into a monetary expansion, because one ounce of gold would buy more units of currency
  - If the price of gold was set too low, this would translate into a monetary contraction, because one ounce of gold would buy less units of currency

British Example

- In Great Britain, Norman and Keynes clashed about what rate re-establishing the Gold Standard:
  - Norman, the governor of the Bank of England, argued that any deviation from the pre-war price level would undermine trust in Britain's financial system
  - Keynes, on the other hand, argued that a return to pre-war gold price would generate a very costly recession, and that the Gold Standard was already a *barbarous relic*

➔ Churchill decided to return to the pre-war gold price in 1925, even if the price level was much higher after WWI:
  - This led to a monetary contraction and, consequently, to a severe recession, which was reinforced by the effects of the Great Recession
  - Investors lost confidence that Britain could maintain the Gold Standard and therefore, they started to run on the Bank of England
  - This force Britain to abandon the Gold Standard in 1931

- After the UK in 1925, many countries decided to restore the Gold Standard, but the incentives to keep it were very small:
  - Indeed, international trade in the period was very limited, hence the incentive to fix the exchange rate were very low
  - Furthermore, there was the need to respond to the Great Recession, which required more expansive monetary policies

➔ Evidence shows that countries that abandoned the Gold Standard later, or that did not change the targeted price of gold suffered much more than those who abandoned the Gold Standard earlier

The Great Depression

- The explanations of the Great Depression were mainly two:

    1) On the one hand, the Great Depression was caused by a stock market crash in the US in 1929, which led to a wave of bank failures that resulted to a large decline in GDP and increase in unemployment
        - The logic is that, if wealth falls, Consumption, Investments, Aggregate demand, and in the end Output fall

    2) The second explanation focuses on the quick spread of the Depression from the US, to the rest of the world, which is blamed on the Gold Standard
        - After the large growth of the 20s, France and the US experienced high inflation
        - Therefore, in order to fight inflation, both countries started to increase the interest rate
        - However, under Gold Standard rule, they were inundated of gold until they got 70% of the world reserves
        - At this point, other countries had to increase their interest rates to fight the gold outflows and maintain convertibility of the currency

➔ Ultimately, this created a world-wide recession, since the higher interest rates did not stimulate the economy

The Great Depression Experience

1) Countries that left the Gold Standard earlier had smaller recessions than those that left gold later
2) World trade collapsed because countries tried to keep aggregate demand at home by imposing huge import tariffs (*beggar-thy-neighbor*)
3) Runs on central banks led to capital controls in some countries (Germany), and to floating exchange rates in others (UK)
4) Government defaulted

➔ The Great Depression led to a **closing** of the world, which lasted until after WWII

The Bretton-Woods System (WWII-1973)

- The Bretton-Woods system led to the creation of the *International Monetary Fund* and the *World Bank*
  - The goal of the Bretton-Woods monetary conference was to design a monetary system that would target external and internal imbalances
  - This led to the creation of a **gold exchange standard**

- In the Gold Exchange Standard, participating countries fixed their currency to the US dollar, which was a reserve currency, and held dollars and gold reserves:
  - The FED was obliged to exchange dollars for gold at 35$/ounce if participating countries demanded so
  - Therefore, under the Bretton-Woods system, the US dollar was the only currency that had to maintain the exchange rate fixed to gold
  - Furthermore, the System solved the problem of shortages of dollars, since CBs could hold as reserves both gold and dollars

➔ The main difference with the Gold Standard is that the Bretton-Woods system moved the international monetary system from a monetary union to a system based on Capital Controls

- Under Bretton-Woods, countries could benefit from *Stable Exchange Rates* and *Monetary Policy Autonomy*:
  - However, they had to give up Free capital flows
  - This implied that currencies were no longer convertible, except for the US dollar
  - Moreover, the IMF would help countries in need, and eventually help them devalue in case of fundamental disequilibrium

- To be able to trade, currencies must be freely **Convertible**:
  - However, in order to keep CAs balanced and prevent accumulation of foreign assets, currencies under the Bretton-Woods system were not convertible and had to be exchanged back to the country they come from
  - The only convertible currency was the US dollar, which CBs were willing to exchange because it was used as national reserve
  - This is why the US dollar became the dominant currency

- However, even though capital controls did not allow for currency speculation, large volumes of trade in goods and services made it easy to overcome these controls:
  - This is because, when countries trade largely in goods, they can either *delay* payments, or pay *in advance*
  - If an importer pays for goods in advance, it can invest foreign assets for a while
  - Similarly, if an importer pays for goods after shipment, it effectively borrows from foreign currencies for a while

- This flaws in the Bretton-Woods system made it shift over time to a typical fixed exchange rate arrangement without any monetary policy autonomy, which made the system fragile and exposed to currency accounts:
    - Countries with persistent CA deficits started losing reserves, and hence they may opt for depreciation in the future
    - When investor expect in advance future depreciation, they run on central banks and wipe out all the reserves
    - This issues mainly affected countries at the periphery

- The **Triffin's Dilemma** pointed out that the flaw was also in the US policy:
    - Since the world stock of gold may not keep up with economic growth, the world's supply of money is constrained

➔ Hence, there are 2 ways out according to Triffin:

1) Do nothing and experience painful deflation

2) The US can increase the supply of Dollars, however this might let investors think that the US does not have enough gold reserves to back the dollars
    - Hence, printing more dollars may expose the currency to speculative attacks, which is exactly what happened

Flexible Exchange Rate Regimes

- Floating exchange rates allow countries to have an autonomous monetary policy and benefit from free financial flows, but they need to give up stability in the exchange rates

- International Trade is negatively affected by floating exchange rates:
  - The impact of floating exchange rates on a country depends on the amount pf international trade a country carries on
  - The higher the volume of international trade, the higher the incentive to adopt a fixed exchange rate regime

- Under fixed exchange rate, expectations about future devaluations may lead to currency attacks, which are very destabilizing for the economy:
  - Hence, if a CB is not very stable, it may prefer having floating exchange rates in order to avoid currency attacks

- Flexible exchange rates allow countries to have monetary policy autonomy:
  - When countries are stagnating or in large recessions, autonomous monetary policy can significantly help the economy to survive, since it allows for lower interest rates and currency devaluation
  - If a country has fixed exchange rates, however, it completely gives up any kind of monetary policy

- Under flexible exchange rates, countries can benefit from a symmetric monetary order:
  - The reason is that, under fixed exchange rates, a few countries have a strong influence on the rest of the world

Automatic Stabilization (Robert Mundell)

- Flexible exchange rate act as stabilizers of shocks to the Goods Market:
  - For instance, after a reduction in investment demand under fixed exchange rates, output is going to drop more than under flexible exchange rates
  - On the other hand, fixed exchange rates insulate the economy against money supply shocks

➔ Hence, policy makers must understand if the economy is more subject to money supply or goods market shocks before choosing whether to fix or float the FX

Large and Persistent CA prevention

- Flexible exchange rates avoid CAs from being large and persistent:
  - When CA are negative, a country is generating liabilities it has to repay in the future with positive CAs
  - Therefore, since countries have their own budget constraint, in order to compensate the past negative current accounts with positive ones, countries will have to depreciate the currency under flexible FX

➔ Since markets will anticipate the depreciation needed to respect the government budget constraint, the currency should depreciate now, and therefore, this can potentially increase the CA today

- In reality, some countries exhibited large and persistent variations in CA, even under flexible exchange rates (US):

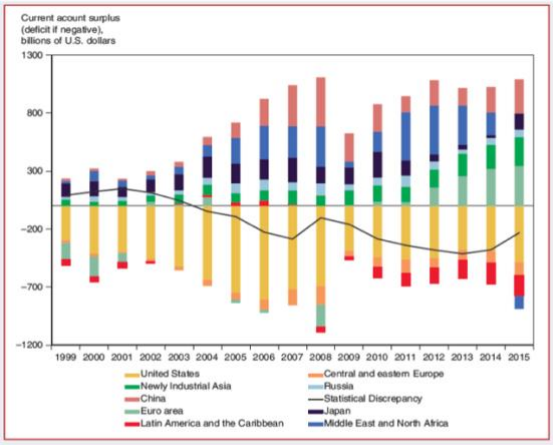


FIGURE 19-8
Global External Imbalances, 1999–2015
During the first half of the 2000s, the large increase in the U.S. current account deficit was matched by increases in the surpluses of Asian countries (notably China), Latin America, and oil exporters. After 2008 the imbalances shrank temporarily, but have since increased again.

Policy Coordination

- Under fixed exchange rates, no policy coordination is allowed:
  - Indeed, fixers simply mimic foreign monetary policy, while foreign monetary policy could be se disregarding international concerts

- Under floating exchange rates, domestic policies can have international spillovers:
  - Countries might adopt policies without considering their possible *beggar-thy-neighbor* aspects (externalities)

- Assume that countries try to reduce their inflation by slowing money growth:
  - A tighter monetary policy appreciates the foreign currency and increases the price of imported goods at home
  - Hence, the home country will need to tighten monetary policy even more

➔ In the end, this may result in deeper international recession without a reduction in inflation (Prisoners' dilemma)

Flexible Exchange Rate Period (1973-today)

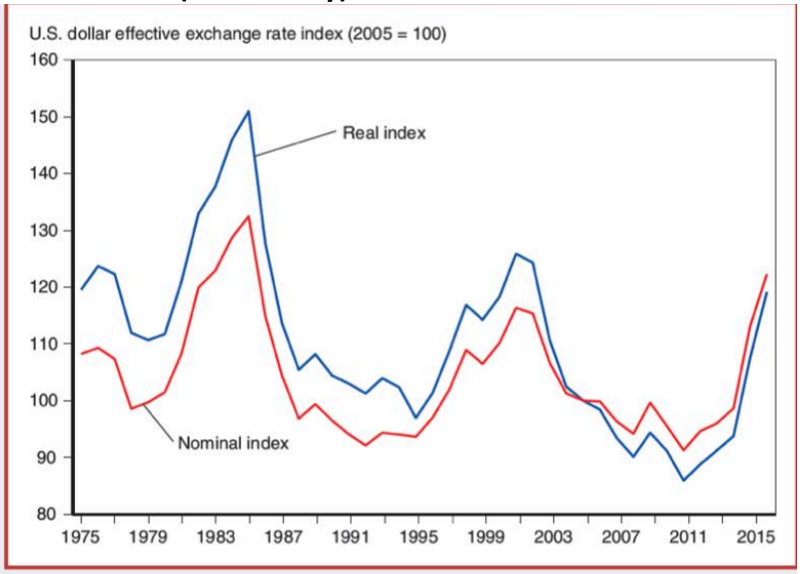


FIGURE 19-6

Nominal and Real Effective Dollar Exchange Rate Indexes, 1975–2016

The indexes are measures of the nominal and real value of the U.S. dollar in terms of a basket of foreign currencies. An increase in the indexes is a dollar appreciation; a decrease, a dollar depreciation. For both indexes, the 2005 value is 100.

Source: Bank for International Settlements.

- The stagflation after the 1973-1974 oil price increases was a classic aggregate supply shock that increased both unemployment and inflation:
  - The US started to loosen its monetary policy to fight unemployment, thus the dollar sharply depreciated
  - Furthermore, Germany and Japan tightened their monetary policy to fight inflation, thus depreciating even more the US dollar

- Volcker Shock in 1979 tightened monetary policy in order to fight inflation, and was accompanied by a fiscal stimulus by Reagan:
  - The exchange rate sharply appreciated again until foreign countries started to attempt to *depreciate* the US dollar by selling dollar reserves
  - With the 1985 Plaza accord it was stabilized until 1995, when the Dotcom bubble started to form, until it burst in 2003, with a large depreciation

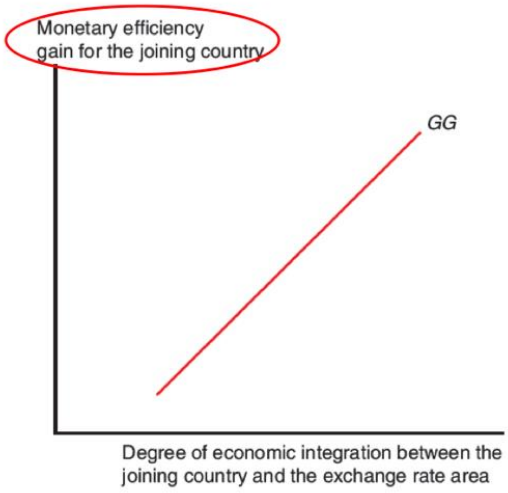
The Theory of Optimum Currency Areas

- A *Currency Area* (*Currency Union* or *Monetary Union*) is an economic area that uses a single currency
    - **Robert Mundell** won a Nobel Prize for his theories about the Optimal Currency Areas
    - The key prediction of the theory is that fixed exchange rates are most appropriate for areas closely integrated through international trade and factor movements

Benefits of joining a Monetary Union

- **Monetary Efficiency Gains** arise from avoiding uncertainty, confusion, and transaction costs that arise when exchange rates float:
    - Indeed, monetary efficiency gain is higher when the degree of economic integration between member countries is higher
    - For economic integration, we mean international trade in goods and labor capital mobility

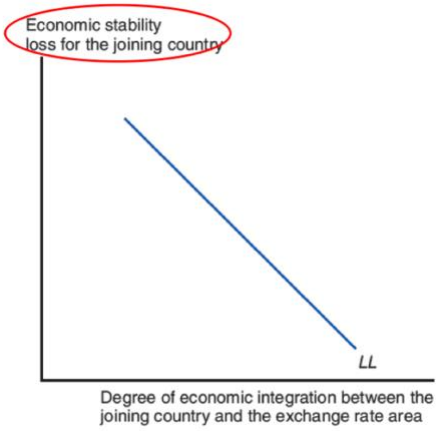
- The **GG schedule** shows the potential gain of a country from joining the currency union as a function of its trading link with that union:



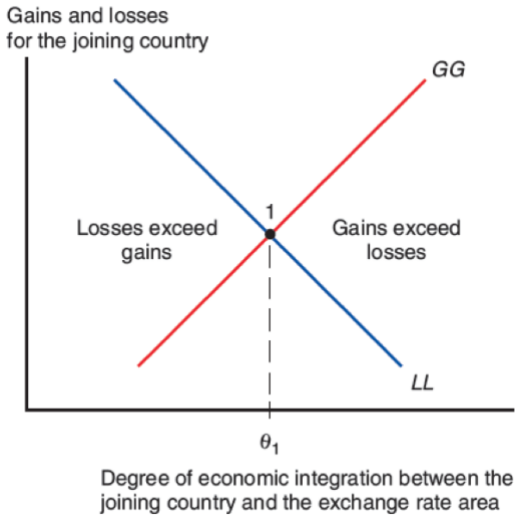
Costs of joining a Monetary Union

- **Economic Stability Loss** due to asymmetric shocks arises from inability of the exchange rate and monetary policy to stabilize output and prices:
  - Indeed, economic stability loss is lower when the degree of economic integration between a country and the fixed exchange rate area that it joins is higher, since asymmetry of shocks is lower with higher integration
  - If shocks are asymmetric between the members of the monetary union, then the countries affected will suffer more, since the monetary union monetary policy will not be adjusted for the interests of only one member

- The **LL schedule** shows the relationship of the country's economic stability loss from joining as a function of the degree of economic integration:

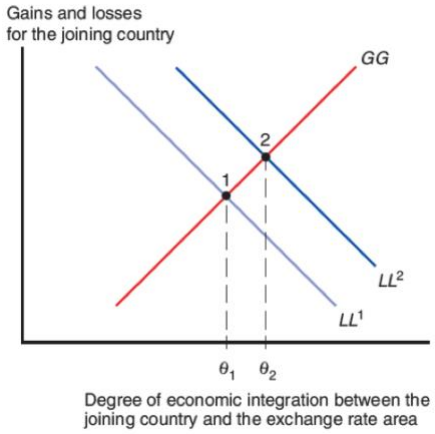


When it is optimal to join the Monetary Union



- Assume an increase in the Output Market Variability caused by an increase in the size and frequency of the DD curve changes, which increases the costs of fixing the exchange rate:
    - Recall that fixed exchange rate arrangements amplify DD curve shifts
    - This kind of scenario moves the LL curve up since, given any level of integration between the joining country and the monetary union, the losses from not having an autonomous monetary policy becomes higher with the fluctuations in the goods market

➔ Therefore, in this case joining the Union would be rationale only with a higher level of economic integration



- Even though the key prediction of the theory is that a fixed exchange rate area will best serve the economic interests of each of its members if the degree of output and factor trade between them is high, there are other considerations to take into account to assess whether a region is an optimal currency area:

1) *Similarity of Economic Structure*
    - The idea is that in extreme situations when countries are identical, there is not much scope for asymmetric shocks
    - Therefore, a single monetary policy can achieve internal balance in all countries
    - For instance, Eurozone countries have a lot of similarities in the manufacturing production, but the labor force is very different between center Eurozone and periphery countries

2) *Fiscal Federalism*
    - The idea is that it is easier to cope with asymmetric shocks when fiscal transfers between different regions are present
    - For example, the US treasury automatically reduces taxes and increases transfers to US states in recessions
    - However, this has never happened in Europe before COVID-19

3) *Banking Union*
   - In the case of Bank Runs in which deposit insurance is unable to cover the full amount, it was necessary to have a Lender of Last Resort, which would provide struggling banks with the necessary liquidity
   - Central Banks play the role of Lenders of Last Resort when crises strike, and deposit insurance is unable to prevent bank runs

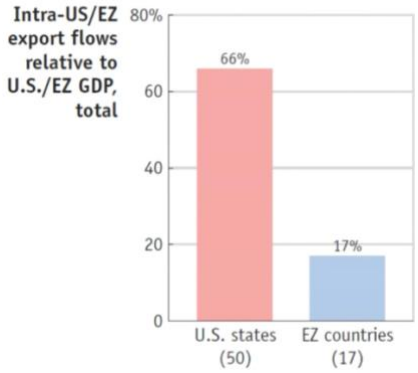
➔ The main issue in Currency Areas is that it was not clear who the lender of last resort was:
   - In Europe, the ECB had to conduct monetary policy but was not formally a lender of last resort
   - Therefore, it is necessary to have in monetary unions a union-wide Lender of Last Resort-Monitor-Regulator, which would smooth regulations among countries, monitor how banks in the union are interconnected, and serve as a Lender of Last Resort in case of trouble
   - Differences in regulations between countries in a Monetary Union can lead to *regulatory arbitrage*, in which countries with softer regulations will have an advantage on countries where regulations is tighter

The Euro Area

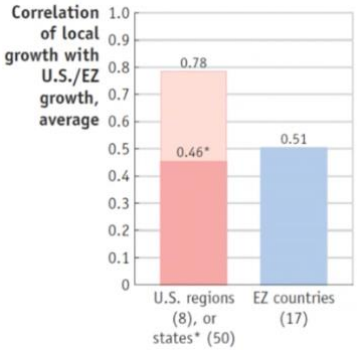
➢ It is hard to come up with a single statistic to assess whether the Eurozone is an Optimal Currency Area:
   - We can carry out a comparative analysis between the US and the Eurozone
   - In order to do so, we should compare different parameters between the two currency areas

1) Goods Market Integration is much higher for the US than for the Eurozone:
   - Even though the level of trade in the Eurozone is high, it is much higher for the US
   - The reason behind this is that Eurozone countries are much more self-sufficient than in the US, thus making the amount of trade in the Eurozone lower

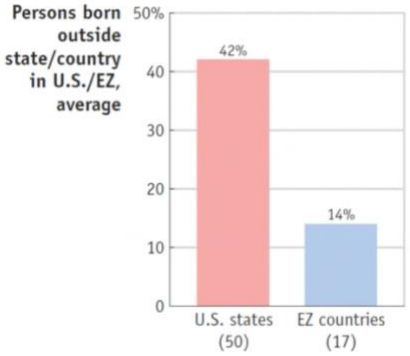
➔ This parameter makes the US a better currency area than the Eurozone from a Goods Market Integration perspective



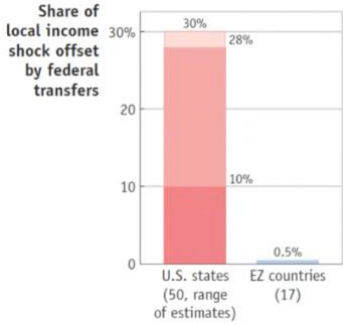
2) **Correlated Shocks** between countries in the US and countries in the Eurozone seems to be quite similar:
    - However, if we aggregate US states into regions, a large part of the idiosyncratic component fades out, and the correlation of shocks between US countries jumps
    - Notice that the measure of average correlation can mask individual differences, since individual countries may be differently correlated with the monetary union



3) **Labor Market Integration** gives an idea about the regional migration within the countries in a monetary union:
    - The labor market integration is much higher for the US than for the Eurozone
    - The reasons behind this are languages and cultural barriers, but also unions and regulations barriers



4) **Fiscal Union** was virtually absent in the Eurozone, while is quite high in the US:
    - In the US, the central government tries to smooth the overall business cycle by taxing more countries in a boom, and redistributing the tax gains to struggling countries



5) **Banking Union** is very strong in the US, but is still a work in progress in the Eurozone:
    - The US has had a set of policies to arrest banking crises starting from the 1930s
    - On the other hand, the Eurozone has started to have a banking union in 2012, with the introduction of the *European Stability Mechanism*, the *Single Supervisory Mechanism*, and the *Single Resolution Mechanism*

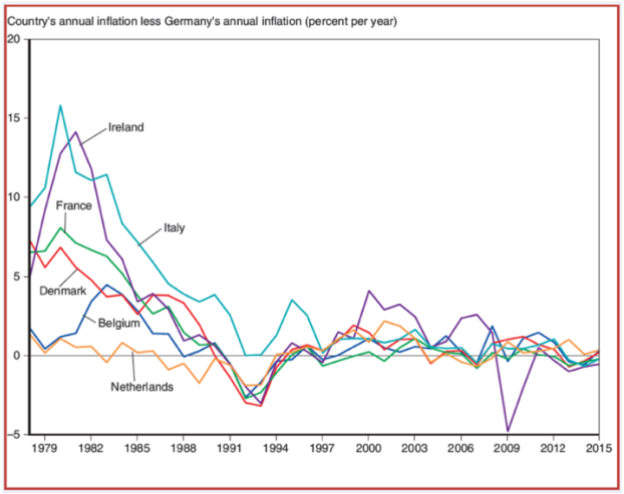
Reasons behind the creation of the Eurozone

- European Countries have always fixed the exchange rate between 1870 and 1973, with the exception of the two world wars and the Great depression

- The main reason for fixing the exchange rate were:
    - Coordination of the monetary policy to respond to self-interested US monetary changes and to avoid coordination failure
    - Enhancement of the European trade, which was part of the broader goal to avoid future wars
    - Import of the German monetary policy

- In March 1979, France, Germany, Italy, Belgium, Denmark, Ireland, Luxembourg, and the Netherlands started fixing their exchange rates through the Exchange Rate Mechanism:
    - The *European Monetary System* was a safety valve designed to avoid currency crises
    - The system allowed exchange rates to fluctuate up to 2.25%
    - Furthermore, it introduced reciprocal credit facilities that allowed CBs to borrow from each other, so that each CB could have a credit facility with the others in order to avoid currency attack and never run out of foreign reserves
    - Currency realignments and capital controls were also introduced by the ERM

- The main outcome of this policy was a convergence in the inflation rates of the member countries to the inflation rate in Germany:



- In 1989, the Delors report laid the foundations for the *Economic and Monetary Union*:
    - This was a European Union in which national currencies are replaced by a single EU currency managed by a sole Central Bank that operates on the behalf of all EU members

- **Delors Plan** developed the shift from the EMS to the EMU in three stages:

    1) All EU members were to join the Exchange Rate Mechanism
    2) Exchange rate margins were to be narrowed and certain macroeconomic policy decisions were to be placed under more centralized EU control
    3) National Currencies were to be replaced by a single European Currency, and vesting all the monetary policy decision in a European Single Central Bank

- The main reasons behind the adoption of the European Monetary Union instead of just fixing the FX were:
    - The EMU removes the possibility of infrequent devaluations, thus facilitating trade even more and making currency attacks even less likely
    - The EMU reduces the Monetary Policy asymmetry of a fixed exchange rate system since, under the European Monetary System, German economic interest dominated monetary policy, but the ECB would care more about other countries
    - The EMU would create a strong symbol of European Unity

- The **Maastricht Treaty** of 1991 was fundamental to set out a roadmap for the transition process from the EMS fixed exchange rate system to the EMU, by adopting the euro in 1999:
    - The Treaty specified a set of macroeconomic convergence criteria that EU countries needed to satisfy for admission to the European Monetary Union:
        - *Price Stability*, which imposed countries a limit on the maximum inflation rate they could have
        - *Exchange Rate Stability*, which imposed countries not to devalue and to keep a stable exchange rate within the union
        - *Budget* Discipline, with Maximum public-sector *deficit* of 3% of GDP and Maximum Public Debt of 60% of GDP

    - Furthermore, the Treaty included steps towards harmonizing social policy within the EU and toward centralizing foreign and defense policy decisions

- In 1997, Germany signed the *Stability and Growth Pact* in order to convince German voters to support the Euro:
    - The pact demanded tighter fiscal requirements
    - It required the medium-term fiscal surplus to be around zero or positive and imposed financial penalties on countries that failed to correct excessive deficits and debt promptly enough

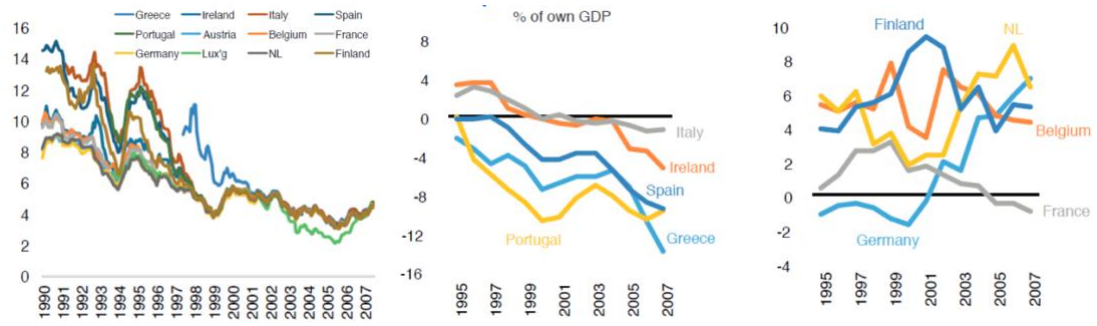
➔ However, Germany was itself one of the first countries to violate the Stability and Growth Pact, and was followed by many other countries which violated several times the limitations of the Maastricht Treaty

European Debt Crisis

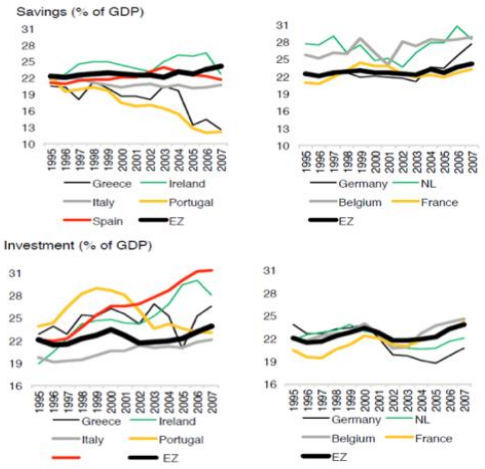
Eurozone Before the Crisis

1) The introduction of the single currency in the Eurozone removed any exchange rate risks and shaped expectations of sovereign debt guarantees:
- As a result, public debt interest rate converged across countries
- Private borrowers interest rate also converged, but to a lesser extent

➔ Therefore, lower interest rates encouraged private and public borrowing in countries at the periphery, which previously had high interest rates, from core countries, thus making them run large current accounts deficits

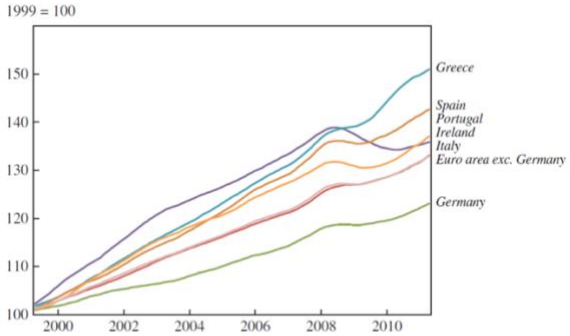


2) Since the current account is equal to the difference between savings and investment, and country at the periphery were running increasingly lower current accounts, we can see that core countries had been saving more for investment than countries at the periphery:
- This looks like a catch-up growth as in the Solow model
- The core countries are in a steady state, while the periphery ones are transitioning
- Indeed, the Marginal Product of Capital was higher in periphery countries relative to core ones, hence the capital flows concentrated to countries with the higher returns



3) As capital flowed in periphery countries, prices started to inflate, and the exchange rate appreciated:

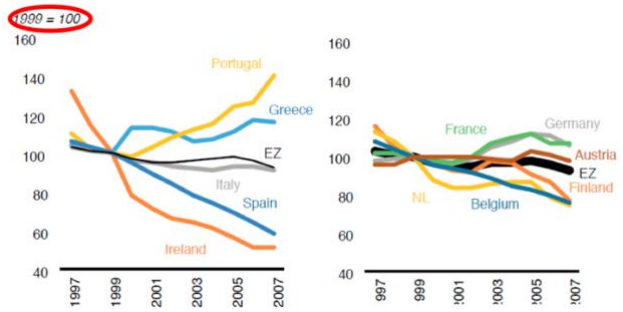
- The appreciation of the exchange rate made periphery countries less competitive with respect to core countries
- However, the appreciation is unlikely to have been important during the European debt crisis because:
  - the crisis developed much faster than this effect
  - the magnitude of the fall in GDP during the crisis was much higher than the fall caused by the reduction in NX



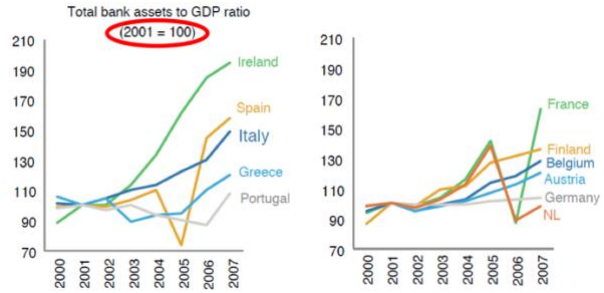
Source: Eurostat.
a. Rolling 12-month averages of harmonized consumer price indexes.

4) What we can notice is that pre-crisis public debt does not line up with the countries experiencing the biggest problems:

- Public debt was low in Spain and Ireland, high in Portugal and Greece, and rising in Germany and France
- In particular, Spain and Portugal did not have very large public debts, but still experienced some of the largest problems during the crisis



5) Private Debt increased before the European Debt Crisis since bank lending and borrowing increased in most countries:
    - In the periphery, bank lending increased at a faster pace than in core countries, probably due to the secular decline in the interest rate



➔ A large share of the current account imbalances before the crisis were channeled through the banking sector, which mostly lent to the construction sector
    - Core countries were lending to periphery countries mainly through banks
    - When borrowers at the periphery started to default on their debts during the debt crisis, the problems in periphery countries started to affect also core countries, thus spreading the European debt crisis

Theoretical Preliminaries

➢ Banks suffer what is called a *maturity mismatch*, since bank liabilities are deposits, while bank assets are longer term loans (*bank borrows short and lends long*):
    - Hence, no bank can repay all depositors at once
    - If a depositor fears that other depositors start withdrawing deposits, he would run to withdraw as well (multiple equilibria)
    - For this reason, the government provides insurance that prevents bank runs, in the form of deposit insurance and lender of last resort

➢ A *public debt spiral* is a self-fulfilling government default that occurs when investors start to think that the government will be unable to meet its obligations, and thus start to demand a higher interest rate on debt:
    - The higher interest rates make it harder to service the debt with higher interest, therefore making the government more likely to default
    - This leads to multiple equilibria

➔ When **Bank Runs** and **Public Debt Spiral** happen together, we see happening the so called **Diabolic** (**doom**) **loop**

- One of the basic facts behind the European Debt Crisis is that Private Banks hold a large portion of domestic public debt, and governments usually guarantee to rescue banks:
  - When there are problems in the banking industry, public debt will increase
  - The higher public debt leads to fears of public default, thus government debt prices will fall
  - The capital losses on government debt investments reinforce bank problems

➔ This vicious circle repeats continuously, but the loop can either start with the banking sector or the government

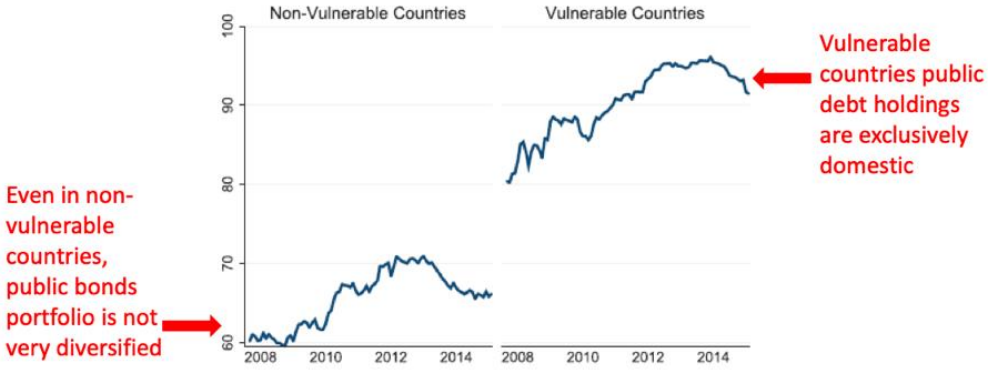
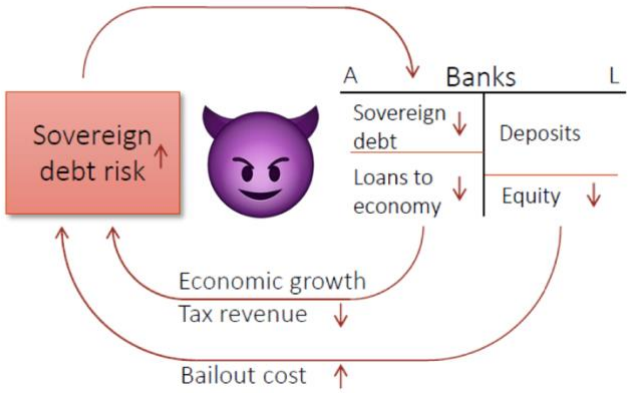


Figure 1. Mean of banks' domestic sovereign bond holdings as a percentage of their total holdings

- There are different reasons behind the Home-bias in Public Debt Holdings:
  - **Bank Regulation** treated public debt of all Eurozone countries as identically safe, hence not giving many incentives to diversify
  - **Local Governments** can put pressure on local banks to purchase local public bonds, for instance in the case of state-owned banks
  - **Banks** may fear that governments have incentives to first default on foreigners, and for this reason it is better for banks to hold only domestic debt (**fear of selective default**)
  - Because of **redenomination risk**, which is the risk that a country could exit the Eurozone and convert bank deposits and public bonds in a new currency, holding local public bonds hedges this risk

The Doom Loop: Good and Bad Equilibria



- The banking sector has in its assets both sovereign debt and loans to the economy, while in the liabilities it has deposits and equity:
  - In does not matter if the crisis starts with an increase in the sovereign debt risk, or in a loss of value in the assets of banks due to higher defaults
  - For instance, in Greece problems started when new information released that the public debt in the country was actually higher than what officially reported
  - Investors started to fear that Greek debt was unsustainable, thus requiring a higher interest rate and making the value of the sovereign debt held by Banks drop

- As the Banks' balance sheet contracted, the value of equity also dropped because of the loss:
  - When the government started to help the banking sector, it started to face bailout costs, which made its fiscal position even worse, and increased further the losses on the sovereign debt held by banks

- When assets shrink, banks start to cut back on loans, since loans are illiquid and can be liquidated only for fire-sale price:
  - Since banks cut back on loans, economic growth slows down and so do tax revenues
  - Lower tax revenues cause further problems to the public sector, which is reflected in a further increase in the risk of sovereign debt

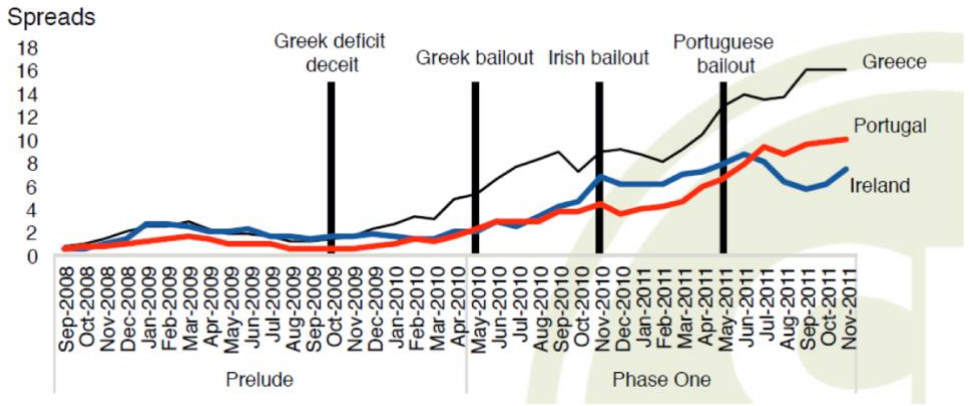
➔ The Loop continuous indefinitely, until investors change their expectations and the economy stabilized in multiple positive equilibria

Eurozone during the crisis

- The Global Financial Crisis started in 2007, when the housing market crashed:
  - The Eurozone unemployment rose from 8% to 10%
  - However, it had a very limited effect on the sovereign debt market

- The first country that started to experience problems was Greece in 2009, when the new government announced that the Public deficit was higher than what previously declared by the old government:
  - As soon as investors perceived that the public debt in Greece was on an unsustainable path, investors started to fear default and demand higher interest rates
  - International capital flows suffered a sudden stop

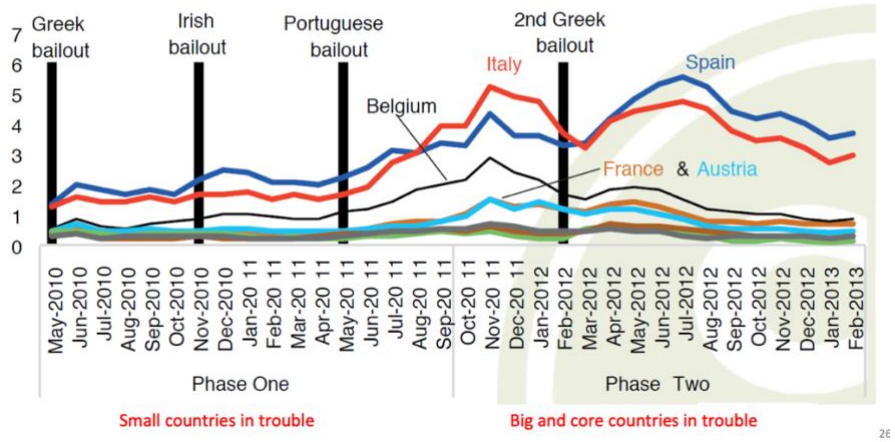
1) *Phase one of the crisis*:



- In October 2019, the Greek deficit deceit is revealed, and Greece started to try to solve its problems relying on austerity:
  - However, by May 2010, Greece agreed on a bailout
  - Markets were disappointed by this bailout, and started to worry about other countries that could be in similar condition to Greece

- The investors disappointment translated into a *sudden stop* in international lending to other countries in a situation similar to the Greek one:
  - By November 2010, Ireland had to be bailed out because of the huge public debt it took on after rescuing its banks in 2008
  - In July 2011, Greece announce a second bail out, and this involved imposing losses on private debt holders

2) *Phase two of the crisis*



- Eventually, investors start to turn their attention to Spanish and Italian public debt, with effects on the private bank sector (**dome loop**)
    - In October 2011, the failure of the Belgian bank Dexia due to Greek public debt exposure made investors worry about the Belgian public debt as well

➔ In July 2012, Draghi announced that the ECB would do whatever it takes to preserve the euro, announcing the creation of the **Outright Monetary Transactions** scheme:

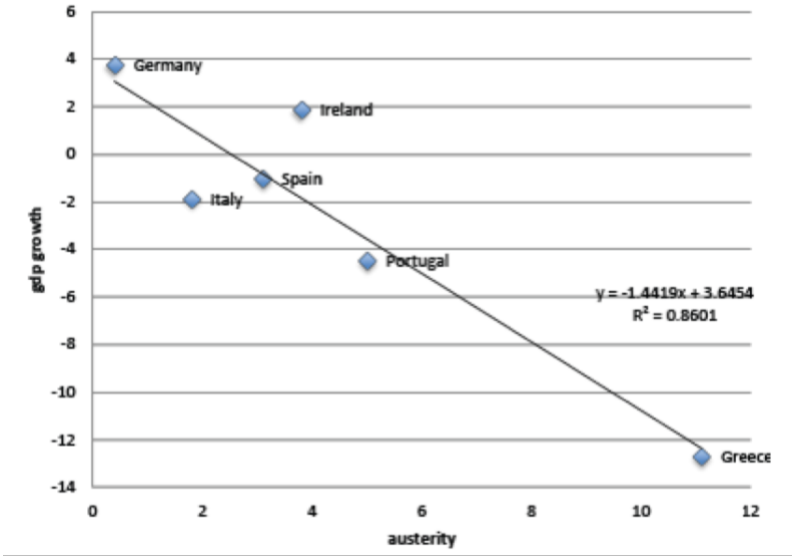
- This mechanism permitted the ECB to purchase any amount of public debt, but it was never used
- This is evidence in favor of the multiple equilibria nature of the Doom loop, since the credible announcement moved the equilibrium back to a good one

- What Draghi did was a **typical forward guidance**, which basically is the management of expectations through the announcement of the trajectory of a policy instrument:
    - The speech underlined that the monetary policies undertaken will lead to a certain sure outcome, which in this case was the preservation of the Euro
    - What remains an open question is what type of announcement works best and when

Austerity

- Austerity is a fiscal policy in which the government tries to cut government spending or increase taxes in order to run a current surplus and reduce government debt:
    - The output reaction to these changes can be big when the exchange rate is fixed

- However, since fiscal austerity contracts both public debt and output, it is ambiguous if it has a positive effect or not on the debt/GDP ratio:
    - Indeed, empirical evidence taken from the 2011-2012 crisis shows that the higher the austerity, the lower the GDP growth for the period
    - Some scholars point out that the fall in GDP was not only attributable to the Doom Loop, but also to the excessive austerity that reduced significantly output



Possible Policies

- One possible policy to prevent Doom Loops is the creation of a **fiscal union**:
    - This consists in fiscal transfers from boom to recession regions, similar to what the federal government does in the US

- Another possible policy to reduce or break the Doom Loop would be the separation of banking and sovereign risk that could be attempted through:
    - A *Banking Union* that would create an international deposit insurance scheme
    - *Diversification,* which would be an attempt to reduce home bias in public debt holdings
    - *European Safe Bonds,* which would be a bundle of regional government bonds. Investors that demand safer asset could avoid creating *sudden stops* in periphery countries by just purchasing European Safe Bonds, instead of buying only safe countries bonds

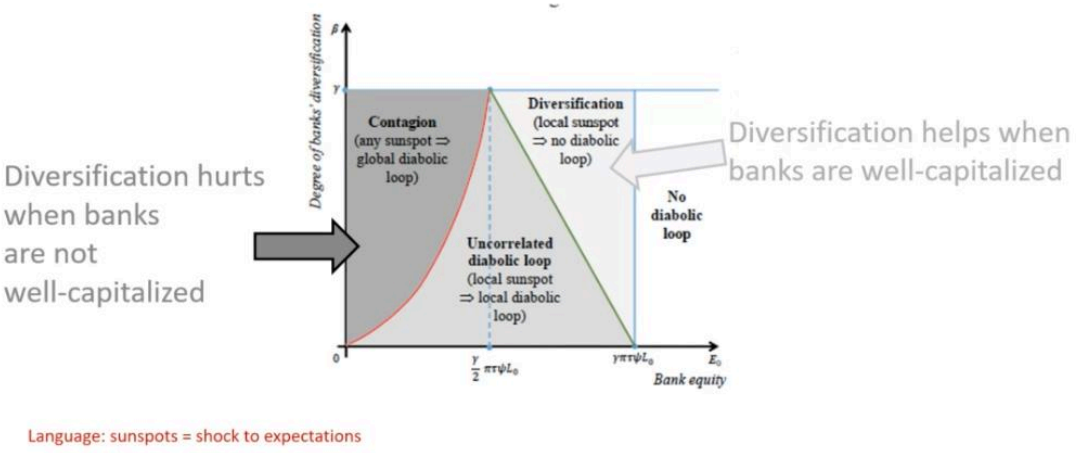
Proposal 1

- **Eurobonds** rely on the idea that European country can issue jointly bonds that are backed from tax collection from all countries:
  - The Next Generation EU fund is an example, where the European Commission issues public bonds that are backed by tax collections from each country
  - In order to avoid the home-bias, financial regulation should be changed so that individual bonds are not treated as perfect substitutes

- Some Eurozone countries oppose Eurobonds by arguing that this arrangement will create free riding (*moral hazard*) problems
  - This is because richer countries don't believe that poorer countries will collect enough taxes to support the repayments of the debt
  - However, we COVID hit, this argument did not hold anymore

Proposal 2

- **Diversification** could reduce the exposure to local public bonds by diversifying public bonds portfolios
  - However, diversification could prevent domestic Doom Loops, but not aggregate Eurozone Doom Loops



Language: sunspots = shock to expectations

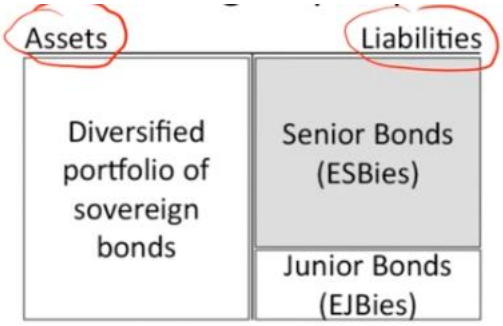
- Given a fixed degree of banks' diversification, if banks are very highly capitalized, they can protect themselves from both local Diabolic Loops caused by local sunspots, but also Global Diabolic Loops in the whole Eurozone:
  - As the amount of capitalization decreases, banks become more expose to local sunspots, which can lead to uncorrelated diabolic loops (middle region of the graph)
  - Uncorrelated diabolic loops occur when portfolios are still skewed towards domestic public bonds
  - When there is a problem in the economy, the shock is sufficient to bring the domestic bank down, but is not enough to bring down also foreign banks that have invested in Italian bonds

- When the level of bank equity is very low, any small shock can create **contagion**:
    - This means that any local or international sunspot can lead to a global diabolic loop, which brings down not only national banks, but also foreign ones

Proposal 3

- **European Safe Bonds** are bundles of regional government bonds that could be used to avoid Doom Loops when a country runs into trouble and investors start to fly away
    - The main principle is to combine diversification with tranching that can be performed either by government agencies or private financial firms

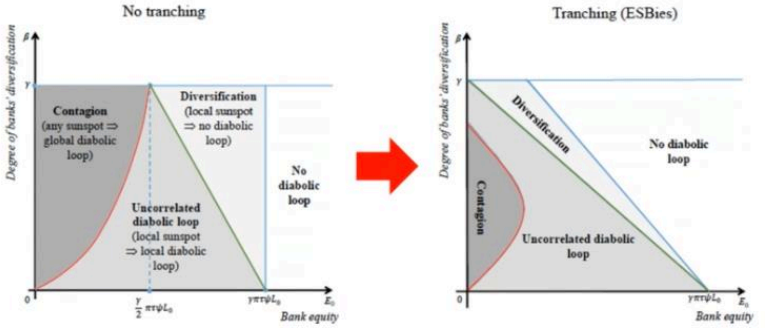
➔ Tranching allows to attain diversification without great risk of contagion because it shifts public default risk outside of banks to junior European Safe bondholders



- If the value of the diversified portfolio of sovereign debt falls after a shock, only Junior Bondholders will suffer a loss
    - This could actually work since on the market there are participants who are more prone to risk and would be willing to buy this junior bonds
    - If the Junior Bonds tranche is high enough, Senior Bondholders will never lose anything
    - Furthermore, in the case of financial difficulties, investments will shift from junior to senior bonds, thus always leaving the government some financing

- A key feature of European Safe Bonds is that they will not be subject to free-riding:
    - Every government is responsible for its own debt, and therefore governments are not required to pool their resources
    - What European Safe Bonds have on the asset side is simply a diversified portfolio of sovereign bonds

- With tranching, diversification is attained without great exposure to contagion risk because tranching shifts the public default risk outside banks to junior European bondholders



Public Debt Sustainability

- The Classic Debt Sustainability analysis was developed by Buiter and Blanchard in the '80s, and it is part of the public debt assessment toolkit at the IMF:

$$B_t = (1 + r_t)B_{t-1} - (T_t - G_t)$$

  - This relationship tells us that the current public debt is determined by last period's public debt level, multiplied by $(1 + r_t)$, minus the government primary surplus, or plus the government primary deficit for the period

- If we express the above equation in terms of Debt-over-GDP, and we rearrange it, we end up with the relationship:

$$\frac{B_t}{Y_t} - \frac{B_{t-1}}{Y_{t-1}} = (r_t - g_t)\frac{B_{t-1}}{Y_{t-1}} - \frac{(T_t - G_t)}{Y_t}$$

  - The change of Debt-over-GDP in a given period is given by the previous period debt-over GDP ratio, multiplied by the difference between the interest rate and the growth rate of the economy, minus the primary surplus for the period

- Blanchard and Buiter tried to compute the steady state of GDP level that would be sustainable, keeping the primary balance, the growth rate, and the interest rate constant:
  - Assume that $\frac{B_t}{Y_t} = b = constant$
  - Assume that $\frac{(T_t - G_t)}{Y_t} = primary\ balance = constant$
  - Assume that r_t and g_t are constant

➔ Then, the steady state of debt-over-GDP will be the primary balance, discounted by the difference between the interest rate and the growth rate of GDP

$$b = \frac{pb}{r - g}$$

- The IMS uses the *Exceptional Fiscal Performance Approach* to compute the **sustainable level of government debt**:
  - This level equals the maximal sustainable primary surplus discounted with reasonable estimates of the interest rate and GDP growth

➔ Therefore, assuming that the debt-over-GDP ratio is constant, the current primary balance that keeps debt constant will be:

$$\frac{(T_t - G_t)}{Y_t} = (r_t - g_t)\frac{B_{t-1}}{Y_{t-1}}$$

  - Actually, a country may need several years to smooth its fiscal adjustment to stabilize its debt-to-GDP, but this requires assumptions about the future

- If we assume that $r_t - g_t < 0$, so that the growth rate of the economy is higher than the interest rate, we see that the country must need to run a deficit in order to keep the debt/GDP ratio constant:
  - The first implication of this assumption is that countries can run a fiscal deficit, and still keep the debt-to-GDP ratio constant
  - The second implication is that the higher the debt-to-GDP ratio, the easier it is to keep it from increasing when $r_t - g_t < 0$, because the country is allowed to run bigger deficits

- Empirical evidence shows that many countries actually present $(r_t - g_t)\frac{B_{t-1}}{Y_{t-1}} < 0$, and therefore they need to run budget deficits to keep the debt-to-GDP constant:

Japan has an incredibly large public debt, but in order to stabilize the level of public debt-to-GDP, the government has to run a deficit of 3%

Italy and other countries affected by the European Debt Crisis have still low growth rate, hence they must run positive primary surpluses in order to maintain the debt-to-GDP ratio constant

For the US, evidence suggests that the country has had a negative r-g starting from WWII, and therefore it can freely run primary deficits to keep the debt-to-GDP ratio constant over time

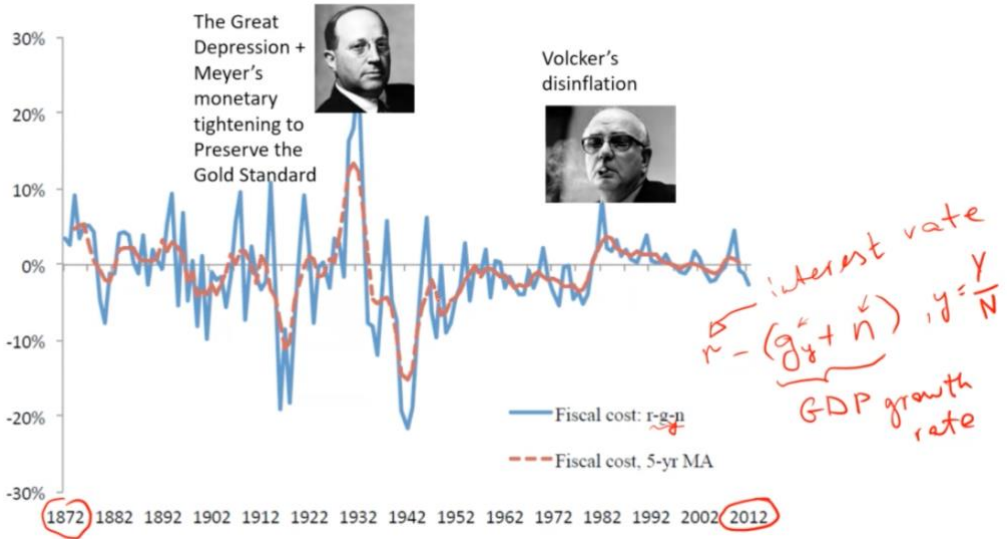
Overall, Eurozone countries also have faced a situation similar to that of the US, with the exception of some countries

- **Blanchard**'s proposal is that negative r-g indicates that there is no fiscal cost of borrowing, and therefore it is a good time for borrowing wisely:
  - Countries with negative output gap can use borrowing to boost aggregate demand
  - Countries with stabilized output gap can finance infrastructure projects that increase future output

- There are many counterarguments to Blanchard's hypothesis:
    - If politicians could borrow without constraint, they would do so in order to increase recklessly government spending and facilitate their re-election
    - Debt is already large, hence taking on more debt would amplify any potentially negative effect of debt that may come up in the future
    - Increasing debt means that investor must buy it, thus subtracting capital to potentially good capital investments
    - Rollover Risk is based on a multiple equilibria situation such as in public debt spirals
    - **The risk of an increase in interest rates can make r-g become positive and large**

- In order to assess the risk of shifting from a negative to a positive r-g, we can use different approaches:
    - Look at historical data and assume that the future will look like the past
    - Look at financial asset prices
    - Look at structural factors behind low interest rates

Historical Perspective



- The blue line in the graph shows r-g for the US:
    - If we compute the mean of the blue line, we will get a number slightly below zero, meaning that on average the US faced a negative r-g in the past 140 years
    - The only time r-g went considerably up after WWII was in the 80s, when Volcker started fighting inflation in the US by increasing the nominal interest rate to 20%

Beliefs from Asset Prices

- Blanchard published a paper in 2019 in which he tried to assess what would be the behavior of interest rates in the future:

Probabilities that short-term rates will be less than some threshold over the next 5 and 10 years

Currency	Expiry	Probability that 3-month Libor rates will be:				
		<0%	<1%	<2%	<3%	<4%
US dollar	5 years	12%	27%	52%	78%	92%
Euro	5 years	52%	83%	94%	98%	99%
British pound	5 years	26%	56%	80%	92%	97%
US dollar	10 years	15%	25%	43%	65%	82%
Euro	10 years	35%	59%	78%	88%	94%
British pound	10 years	32%	51%	69%	82%	90%

Note: These probabilities are calculated by estimating a stochastic volatility SABR model using Bloomberg data on interest rate caps and floors (option contracts where the premium depends on interest rates staying below or above a predefined level, respectively) for each of the currencies.

  - Blanchard looked at the short-term interest rates over the next five and ten years in three areas: US, Eurozone, and UK
  - Then, he calculated the probability that short term interest rates will be lower than a certain threshold
  - The evidence shows that market did not expect that interest rates would move up much in the next five or ten years

Structural Factors

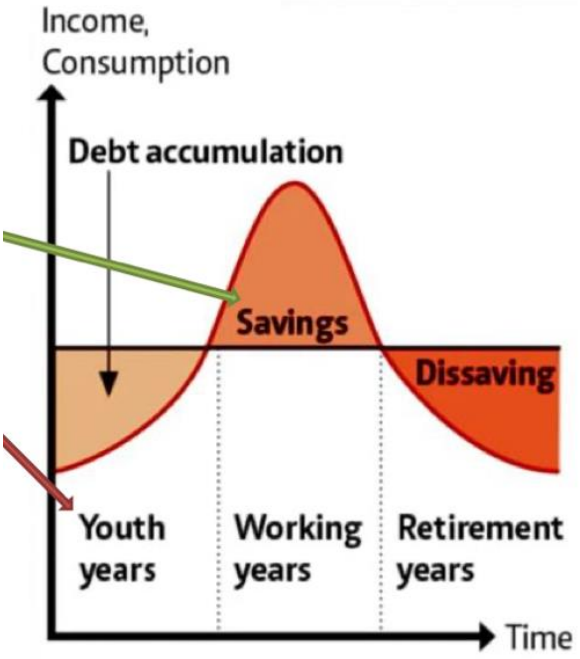
- The main fundamental factors behind low or negative r-g are mainly three:
  - Demographic changes such as population aging and population growth slowdown affect r-g because, as life expectancy increases, individuals start to save for retirement by purchasing long term debt securities that push interest rates down
    ➔ This factor is likely to persist over time because demographic trends are very slow moving

  - Developed countries have seen a slowdown in productivity growth in the last three decades. The main effect of this slowdown is that interest rates decline, since interest rates are positively correlated with the growth rate
    ➔ It is uncertain if the decline in productivity growth will persist, nonetheless an increase in productivity growth will partly offset an increase in r

  - An increase in expected risk leads to preferences over safe securities rather than riskier equity securities. Therefore, this leads to a decline in the interest rates
    ➔ Changes in risk are hard to predict, but low risk premium implies high assets prices, high investment, and high growth

- All these structural factors point to the fact that r-g will continue to be negative in the future

- As we said before, population growth affects the interest rate:
  - A theory by Milton Friedman and Modigliani underlined that population growth affects the ratio between the young, who borrow, and the middle aged, who repay their borrowing and save for retirement, when they start to dissave
  - Lower population growth reduces the share of the young relative to the middle aged
  - Therefore, the safe securities supply by the young drops relative to the demand by the middle aged
  - Hence, price of these securities increases, and the interest rate drops



Additional Important factors for Public Debt Sustainability

1) *Currency Composition*

2) *Maturity Structure*

- The longer the maturity on debt, the easier it is to avoid the bad equilibrium outcome on this debt
- Indeed, if the maturity is very low, the country must rollover this debt very frequently, and this accentuates the multiple equilibria problem
- Therefore, if investors start to worry about solvency, then they will not rollover the debt and the country will therefore be unable to cover its debt, interest rate will skyrocket, and ultimately the country may default

3) *Ownership of Debt*

- Debt may be hold either by domestic or foreign residents, or by financial institutions
- Financial Institutions are very careful on what is going on in the bond market, thus they will be able to coordinate in the case of bad outcome
- If residents hold the bonds, they are less aware about signals in the bond market, thus there is less room for coordination of action of normal people
- This condition explains why Japan manages to hold such a high level of debt, and this is because a huge part of the debt is held by regular Japanese citizens

4) *Type of Debt Contract*

The Ruble during the war

- The Ruble suddenly depreciated after the beginning of the war, but then this depreciation was completely reversed

1) *Depreciation*

- The reason behind the large depreciation of the Ruble after the beginning of the war is that investor started to expect a lower demand for foreign currency:
  - Hence, since investors started to believe that the exchange rate would depreciate in the future, the currency depreciate
  - Furthermore, investors started to expect that the country could only finance itself by monetizing its debt, thus printing money, increasing inflation, and depreciating the currency

- Another reason is that net foreign assets were frozen:
  - This made the currency depreciate because Russia could not anymore sell its net foreign reserve to buy rubles and stop the depreciation of the currency

2) *Re-Appreciation*

- The first reason behind the currency appreciation was the imposition of capital controls and financial repression:
  - Firstly, Russian CB increased the nominal interest rate from 7-8%, to 20%
  - Then, capital controls, even though they were not total and did not shut down trade, allowed the country to use monetary policy to affect the exchange rate

- Then, another reason behind the currency appreciation was the increase in energy prices:
  - This triggered a higher foreign currency inflow to Russia who could sell its resources for much higher prices
  - Then, using the foreign currency coming from resources exports, the CB could repurchase Rubles in the open market, thus reappreciating the currency

- Furthermore, sanctions on imports helped to appreciate the currency:
    - This is because, when a country imports goods, it needs to pay them in foreign currency
    - This means that it needs to sell domestic currency in order to buy foreign currency for the transaction
    - Sanctions on imports reduces sales of domestic currency, thus helping it to appreciate

- Lastly, the real exchange rate played a role in appreciating the currency:
    - The idea is that sanctions will hurt Russian economy in the future, thus reducing the relative supply of Russian goods abroad
    - Assuming that the demand abroad for Russian goods stays the same, then the prices of Russian goods will increase, thus appreciating the real exchange rate
    - A decline in the real exchange rate will reduce the nominal exchange rate, keeping the price levels constant

➔ In the end, Russian CB managed to bring the value of the Ruble back to the level it was before the war began