Money and Inflation

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This Lecture

– We measured inflation in two different ways (CPI and GDP deflator) without defining inflation properly.

– To define inflation, we will first look more closely at what money is.

– We will see how the monetary system creates money and how monetary policy is implemented.

– Then we will link this to inflation, and its costs and benefits.

– I end with a brief discussion of the gold standard.

Outline

Outline

Overview

– Any money fulfills three functions:

  i. Medium of exchange.

  ii. Unit of account.

  iii. Store of value.

Medium of Exchange

– A medium of exchange is something that is widely accepted by buyers and sellers.

– Contrast with barter economy.

– U.S. dollar bills are "legal tender".

Unit of Account

– A unit of account is a unit of measurement.

– When you see different items advertised in dollars, you are able to compare them easily.

– A good unit of account also makes comparisons across time easier.

Store of Value

– A store of value is an item which can be used to transfer current purchasing power into the future.

– Ideally, a store of value maintains its value and is easily exchanged for future goods.

– Alternative stores of value: stocks, bonds, real estate, etc.

Outline

Commodity Money

– Commodity money is a money with *intrinsic* value.

– For example, gold cannot only be used as money but also in industrial applications or jewellery.

– Either exchange the commodity itself or certificates/paper money, which can be exchanged on demand.

– **Gold standard:** Monetary system based on gold.

Fiat Money

– By contrast, *fiat money* does not have intrinsic value.

– Instead, its value is derived from

    i. government decree,

    ii. expectations, and

    iii. social conventions.

The Money Stock

– How much money is in the U.S. economy?

– Currency is one type of money.

– However, other assets may be money if they fulfill all three functions of money.

– For example, demand deposits or savings deposits?

– Two measures of the money stock:

    i. **M1:** Currency, demand deposits, traveler's checks, and checkable deposits.

    ii. **M2:** M1, savings deposits, time deposits, money market mutual funds, etc.

– Credit cards or other debt-based payment schemes are **not** money.

Outline

Cryptocurrencies

– Are crypocurrencies money?

– **Medium of Exchange:**
Very few businesses accept Bitcoin payments.

– **Unit of Account:**
Very few businesses list prices in cryptocurrency. Difficult due to volatility.

– **Store of Value:**
Value is volatile and exchange to fiat currency is occasionally suspended.

Russia in the 1990s

– Recommendation: Planet Money podcast about Russia in the 1990s

– Bricks were used as a store of value.

– Gazprom veskels replaced rubel as the de facto currency.

Outline

Outline

The Federal Reserve

– The Federal Reserve is the *central bank* of the United States.

– A *central bank* has two domains:

   i. Bank regulation (*lender of last resort*), and

   ii. monetary policy (set *money supply*).

– Federal Reserve Board in D.C. and 12 regional Banks.

– Seven governors on Board with 14-year terms.

Monetary Policy

– Federal Open Market Committee (FOMC) decides on monetary policy every six weeks.

– Traditionally, *open market operations* implement changed to the money supply.

– *Open market operations:* Sale or purchase of U.S. government bonds.

– Sale of bonds *reduces* the money supply. Money moves from circulation onto Fed's balance sheet.

Outline

Banks' Role in Money Creation

– Demand deposits are held in banks.

– Banks' decisions on how they treat deposits affect the money supply.

– Fed's decisions on the money supply are mediated through the banking system.

Fractional Reserve Banking

	Assets		Liabilities	
Bank T-Account	Reserves	$10	Deposits	$100
	Loans	$90		

– *Fractional-reserve banking:* Bank have a *reserve ratio* (Reserves/Deposits) less than one.

– Suppose banks have deposits of $100 and lend out $90.

– Suppose further that the borrower deposits the loan at the same bank.

– Then, bank's deposit increase to $190—Money has been created!

– Note: No wealth created, just liquidity.

Money Multiplier

Suppose the bank keeps lending the new deposits, while maintaining 10% reserve ratio:

	Assets		Liabilities	
Bank T-Account	Reserves	$100	Deposits	$1000
	Loans	$900		

– Each time the new loan gets smaller as 10% is kept as reserve.

– Due to this, money supply approaches a limit.

– **Money multiplier:** Amount of money created for each unit of reserves.

– The money multiplier is equal to the **reciprocal of the reserve ratio**, e.g. Money multiplier = $\frac{1}{0.1} = 10$.

Outline

Leverage

Bank Balance Sheet

Assets		Liabilities	
Reserves	$200	Deposits	$800
Loans	$700	Debt	$150
Securities	$100	Capital	$50

– Bank capital = *Owner's equity*.

– *Leverage* is the use of borrowed money to supplement equity funding.

– *Leverage ratio* is the ratio of total assets to bank capital.

– **Example:** $1,000/$50 = 20 i.e. for every $20 of assets, there is $1 of equity.

Example

Suppose loans lose $50 of value:

Bank A's Balance Sheet

Assets		Liabilities	
Reserves	$200	Deposits	$800
Loans	$650	Debt	$150
Securities	$100	Capital	$0

Bank B's Balance Sheet

Assets		Liabilities	
Reserves	$200	Deposits	$800
Loans	$650	Debt	$100
Securities	$100	Capital	$50

→ Lower leverage is safer.   Capital requirements try to enforce low leverage.

Outline

Outline

Open-Market Operations

- As described above, Fed influences the money supply by buying and selling government bonds.

- Bond purchases increase the money supply as Fed gives money into circulation.

- Bond sales decrease the money supply as Fed takes money out of circulation.

- In reality, Fed targets *federal funds rate*, which is closely linked to the money supply.

- **Federal funds rate:** Interest rate on overnight loans between commercial banks.

Outline

The Discount Window

– The Fed can also increase money supply by lending to banks.

– **Discount window** is always available for banks to borrow at *discount rate.*

– Traditionally, banks avoid the discount window due to appearance of instability.

Outline

Reserve Requirements

– The Fed also regulates banks.

– How much reserves banks hold affects the money supply.

– The Fed can mandate **minimum reserve requirements**.

– Banking regulation is only rarely used for monetary policy.

Interest on Reserves

– Until 2008, the Fed did not pay interest on reserves (money banks keep on their account with the Fed).

– Since 2008, the Fed pays interest on reserves.

– An increase in the interest rate on reserves will lead to more reserves being held → lower money supply.

Outline

Confidence and Excess Reserves

- The Fed does not have full control over the money supply.

- Especially in crises, banks may decide to stop lending, in excess of minimum reserve requirements.

- Such **excess reserves** imply that the money supply may remain low, even when the Fed tries to increase it.

Bank Runs

– Bank runs are one drawback of fractional-reserve banking.

– If people want to withdraw more deposits than the bank has in reserves, the bank goes bankrupt.

– **Solution:** Deposit insurance. In the U.S., Federal Deposit Insurance Corporation (FDIC).

– **Example:** Silicon Valley Bank.
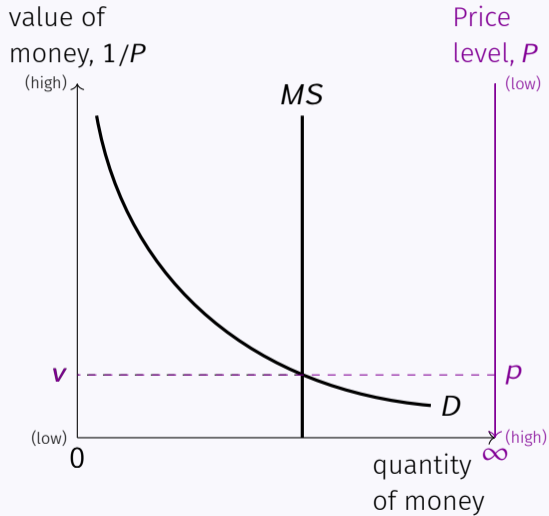
Outline

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The Value of Money and Prices

– Previously, we have looked at inflation as a change in the price of goods and services.

– Alternatively, we can view inflation as a decrease in the value of money.

– If prices of goods increase, you need more money to buy the same goods. Thus, each unit of money is worth less.

– If P is the overall price level, each unit of money buys $1/P$ units of goods and services.

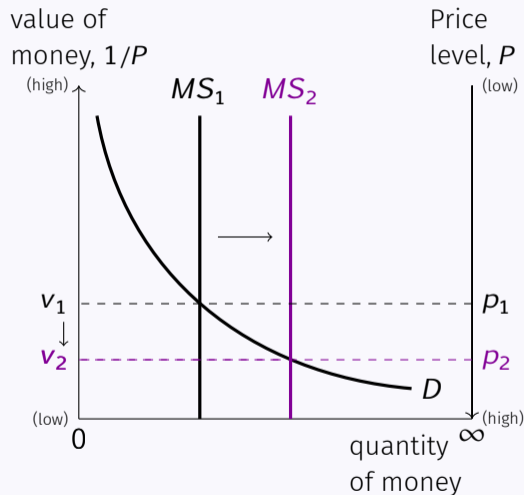– Thus, the value of money is $1/P$.

The Market for Money

– The **money supply** is determined by Fed + commercial banks.

– The **money demand** depends on people's need for liquid assets.

– Most important determinant of demand: P. The higher P, the more money is needed as medium of exchange.

– In the long run, money equilibrium is reached by adjustment of P.

– For instance, if the Fed supplies "too much" money, P will increase which, in turn, will raises demand for liquidity, balancing demand and supply.

Money Equilibrium

Purchase of Treasury Bonds

– If the Fed increases the money supply, MS shifts right ($MS_1 \to MS_2$).

– The value of money decreases ($v_2 < v_1$).

– The price level P increases ($p_2 > p_1$).

Quantity Theory of Money

– The view that the price level is determined by the quantity of money is called the **quantity theory of money**.

– The adjustment after a change in the money supply occurs due to *more money chasing the same number of goods.*

– Later, more discussion of short-term adjustment.

Outline

Classical Dichotomy

– *Classical dichotomy*: Economic variables are either *real* or *nominal*.

– *Nominal* variables are measured in terms of monetary units.

– *Real* variables are measured in terms of (physical) goods. They reflect the available resources and technology.

– **Note:** Relative prices (one good in terms of another) are real.

– **Examples:** Real wage, real GDP, real interest rate,...

Monetary Neutrality

– Monetary units are arbitrary.

– Consider Hume's thought experiment: What would change if all prices/wages/incomes doubled overnight?

– Nothing! We would still trade the same goods and have the same technology.

– **Monetary neutrality** is the view that changes to nominal variables do not affect real variables.

– This is probably true in the long run. But what about the short run?

Outline

Velocity of Money

– Alternative perspective: Accounting identities.

– How often is each unit of money used to buy new goods/services each year?

– **Velocity of money:**

$$V = \frac{P \times Y}{M}, \tag{1}$$

where Y is real GDP, P is the price level, and M is the quantity of money.

The Quantity Equation

- If we rearrange the definition of the velocity, we get

$$M \times V = P \times Y \tag{2}$$

$$M \times V = \underbrace{P \times Y}_{\text{Nominal GDP}} \tag{3}$$

- The quantity of money times its velocity equals nominal GDP.

- If $M \uparrow$, then either $Y \uparrow$, $P \uparrow$ or $V \downarrow$.

- Estimates of V suggest it's constant.

- Y is determined by resources and technology (in the long run).

- Thus, if $M \uparrow$, $P \uparrow$ (inflation) in long run.

Hyperinflations

- *Hyperinflation:* Inflation which exceeds 50% per month.
- To illustrate, with 50% inflation per month, $130 at the end of the year is worth as much as $1 at the beginning.
- **Famous Hyperinflations:**
    i. Germany in 1923:
       A loaf of bread cost 160 Marks in 1922 and 200 billion Marks by the end of 1923.
    ii. Zimbabwe in 2008:
       The peak *daily* inflation rate was 98%, i.e. prices doubled every day.
    iii. Venezuela since 2016:
       In September 2021, 1 USD would buy more than 10 billion times the amount of bolivares as in January 2018.[1]
- Hyperinflations are caused by large deficits financed by printing money.

[1]At official exchange rate and accounting for two redominations of the bolivare.

Outline

Inflation Tax

– Inflation works like a tax on everyone who holds money.

– By increasing the money supply, the government can increase its purchasing power at the expense of the existing money.

– This is the main cause for hyperinflations.

Fisher Effect

– The **Fisher Effect** (inflation ↑, nominal interest ↑) follows from the Fisher equation:

$$\text{Nominal interest rate } = \text{Real interest rate } + \text{Inflation rate.} \qquad (4)$$

– The nominal interest rate increases with inflation.

Outline

Inflation Fallacy

– A misconsception I have seen in Discussion 1 is that inflation is bad because everything gets more expensive.

– Inflation lowers the value of money and increases the price level.

– However, this also applies to wages and other incomes.

– Thus, purchasing power or living standards are not necessarily affected by inflation.

– However, there are some real costs to inflation.

Outline

Shoeleather Costs

– The inflation tax transfers resources from people to the government.

– **Problem:** People adjust their behavior to avoid "tax".

– In the past, this would mean going to the bank more often → literal shoeleather cost.

– These days, it is about loss of convenience and time due to changing prices.

Menu Costs

– In times of high inflation, firms need to adjust their prices more frequently.

– For restaurants, this may mean printing new menus frequently → literal menu cost.

– For all firms, higher cost of reviewing prices and communicating them to costumers.

Outline

Relative-Price Distortions

– Efficient allocation in market requires knowledge of the relative prices of goods and services.

– Inflation is never uniform. Some goods' prices may increase daily, others only annually.

– High inflation complicates price comparisons.

– Households and firms may make more mistakes in allocating scarce resources.

Tax Distortions

– The tax code is not fully indexed to inflation.

– If income thresholds etc. are not adjusted to inflation, their incidence may change drastically.

– Such changes may lead to further distortions in people's behavior, as they try to avoid the "new" taxes.

– Moreover, the changes occur in many places at once, leading to further relative price distortions.

– **Examples:** Income tax brackets and capital gains.

Outline

Redistribution of Wealth

– If inflation is above expectation, it will reduce the real value of debt.

– Borrowers/debtors do not need to repay as much in real terms if inflation has been unexpected.

– Redistribution of wealth from lenders/creditors to borrowers/debtors.

– **Problem:** Arbitrary by nature. Only happens when inflation is different from expectation.

– High inflation is usually more volatile/harder to predict.

Outline

Is It All Bad?

If inflation is so bad, why does the Fed not target 0% inflation?

Deflation

– Decreasing prices (deflation) is arguably worse than inflation.

– If consumers expect prices to decrease, they may delay their purchases.

– Low demand causes firms to cut prices further.

– Deflationary spiral (see Japan).

Quality Improvements

– Introducing new/higher-quality goods would be more difficult if prices never changed.

– Technological "churn" requires price changes.

Wage Stickiness

– Some cyclical unemployment could be prevented if wages were lowered in recessions.

– Decreasing nominal wages is very difficult.

– Inflation helps decrease real wages.

The Gold Standard

– One solution to inflation could be commodity money or a fiat money tied to e.g. gold.

– The value of gold is quiet stable over the long run, so money would lose less value.

– **Problems:**

    i. Fed would need to retain a sizable reserve of gold.

    ii. In the short term, gold price does vary due to e.g. new mines or new technology.

    iii. Greater incentive to mine gold → wasteful.

Conclusion

– Money has three functions: (i) medium of exchange, (ii) unit of account, and (iii) store of value.

– The money supply consists of any asset which satisfies these functions.

– The Federal Reserve and fractional-reserve banking determine an economy's money supply.

– The Federal Reserve affects the money supply through open-market operations and interest on reserves.

– The cost of high inflation are arbitrary and wasteful distortions. Low, stable inflation has some benefits to economic churn.

– **Next:** Trade and international financial flows.