Chapter 19: Quantity Theory, Inflation, and the Demand for Money

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Chapter 19： Quantity Theory, Inflation, and the Demand for Money

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Quantity theory of money supply

Quantity theory of money supply

- Irving Fisher: the link between **money supply** and **nominal GDP** is **velocity of money**
- velocity of money: the average number of times per year (turnover) that a dollar is spent
- **velocity of money**: $V = \frac{P \times Y}{M^s}$
  - V: velocity
  - P: price level
  - Y: aggregate output
  - M^s: money supply
  - $P \times Y$: nominal GDP

Quantity theory of money supply

- $V = \frac{P \times Y}{M^s}$
- Example: if nominal GDP $P \times Y$ in a year is 10 trillion, and the quantity supplied of money M^s is 2 trillion
- then $V = 5$
- $V = 5$: the average dollar is spent five times in purchasing final goods and services in the economy

Quantity theory of money supply

- **equation of exchange**: $M^s \times V = P \times Y$
- the quantity of money multiplied by the number of times this money is spent in a given year must equal the total nominal amount spent on goods and services in that year
- the quantity of money multiplied by the number of times this money is spent in a given year must equal the nominal GDP in that year

Quantity theory of money supply

$M^s \times V = P \times Y$

- If people use more credit cards to conduct transactions: M falls relative to $P \times Y$, and $V = \frac{P \times Y}{M^s}$ rises
- if people use more cash, checks, or debit cards: $V = \frac{P \times Y}{M^s}$ falls
- Fisher: velocity is **constant** in the short run
  - institutional and technological features of the economy affect velocity slowly over time
  - denote: $V = \bar{V}$, V is a constant
  - $M^s = \frac{1}{\bar{V}} \times PY$

Quantity theory of money supply

- **Quantity theory of money supply**: $P \times Y = M^s \times \bar{V}$
- nominal income $P \times Y$ is determined **solely** by movements in the quantity of money (money supply M^s)
- when the quantity of money (money supply M^s) doubles, so must the value of **nominal** income
  - this happens when the vertical M^s shifts to the right, engineered by the Fed

Quantity theory of money supply

- Example: assume velocity is 5, nominal GDP $P \times Y$ is initially 10 trillion, and the money supply M^s is 2 trillion
- If the money supply M^s doubles to 4 trillion, the Quantity theory of money supply suggests that nominal GDP $P \times Y$ will double to 20 trillion

Quantity theory of money supply and Price Level

- if aggregate output Y constant, denoted as $\bar{Y}$
- **Quantity theory of money supply**: $P = \frac{M^s \times \bar{V}}{\bar{Y}}$
- Example: if aggregate output $\bar{Y}$ is 10 trillion, velocity $\bar{V}$ is 5, and the money supply M^s is 2 trillion, then the price level P equals 1
- When the money supply M^s doubles to 4 trillion, the price level P must also double to 2
- **changes in the quantity of money lead to proportional changes in the price level**

Quantity theory of money supply and Inflation

- change in level: Δ
- percentage change: $\%\Delta$
- percentage change in x: $\%\Delta x$
- percentage change in y: $\%\Delta y$
- percentage change in $x \times y$: $\%\Delta(x \times y)$
- a mathematical fact: $\%\Delta(x \times y) = \%\Delta x + \%\Delta y$

Quantity theory of money supply and Inflation

- **equation of exchange**: $M^s \times V = P \times Y$
- $\%\Delta(M^s \times V) = \%\Delta(P \times Y)$
- $\%\Delta M^s + \%\Delta V = \%\Delta P + \%\Delta Y$
- inflation rate π: $\pi = \%\Delta P = \%\Delta M^s + \%\Delta V - \%\Delta Y$
- V is constant: $\%\Delta V = 0$
- **theory of inflation**: inflation rate = $\pi = \%\Delta M^s - \%\Delta Y$

Quantity theory of money supply and Inflation

- percentage change $\%\Delta$: also means growth rate
- $\pi = \%\Delta M^s - \%\Delta Y$: **inflation rate equals the growth rate of the money supply minus the growth rate of aggregate output**
- Example: if the aggregate output is growing at 3% per year and the growth rate of money supply is 5%, then inflation is 2% (= 5%-3%)
- If the Federal Reserve increases the money supply growth rate to 10%, then the quantity theory of inflation indicates that the inflation rate will rise to 7% (= 10%-3%)

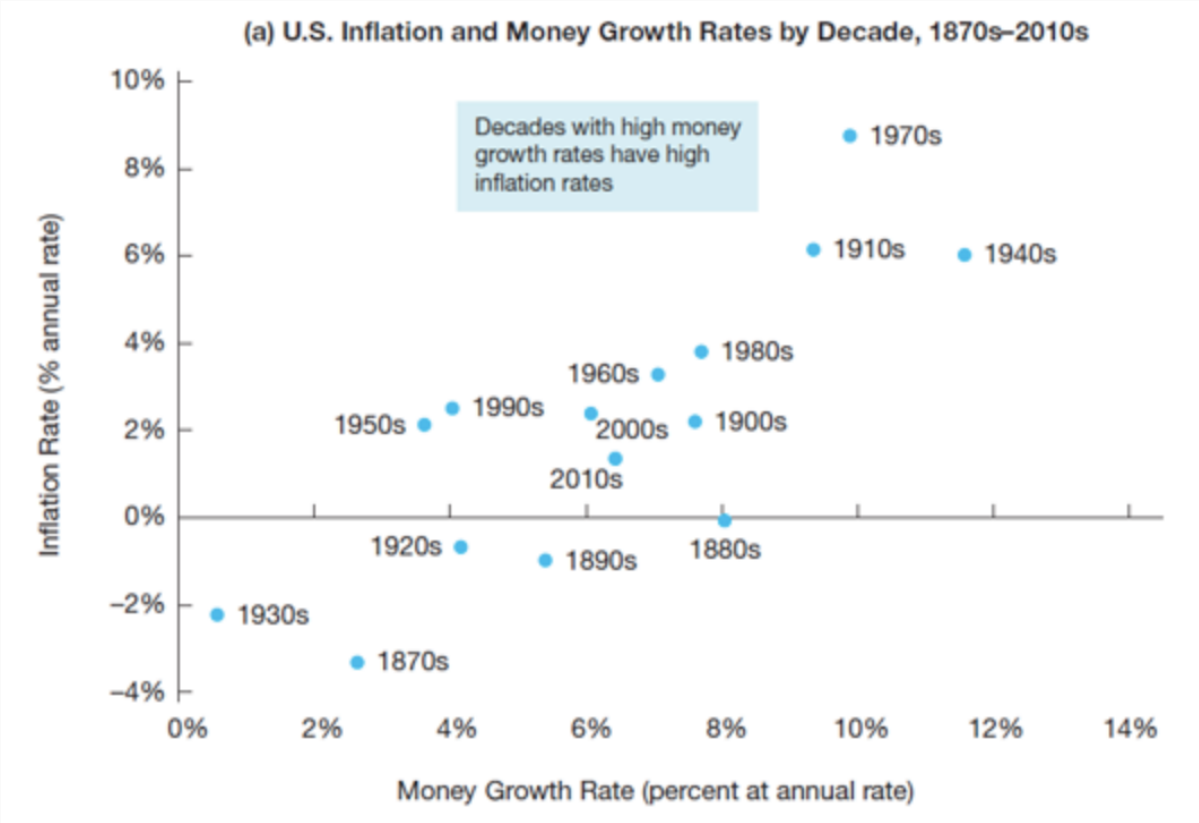
The Quantity theory of money supply in the Long Run

- In U.S: growth rate of aggregate output Y over 10 years does not vary very much, which can be seem as a constant
- quantity theory of inflation: $\pi = \%\Delta M - constant$
- a positive relationship should exist between inflation and money growth rates

Application: Testing the Quantity Theory

The Quantity theory of money supply in the Long Run

- a positive relationship should exist between inflation and money growth rates



The Quantity theory of money supply in the Long Run

- countries with high money growth rates, such as Russia and Turkey, tend to have higher inflation rates

Application: Testing the Quantity Theory

The Quantity theory of money supply in the Short Run

- The relationship between inflation and money growth on an annual basis is not strong
- in U.S: money growth was high but inflation was low: 1963-1967, 1985-1986, 2003-2005, 2010-2011, 2013-2015

Budget Deficits and Inflation

- Govt pays for spending in 3 ways:
  - raise revenue by levying taxes
  - go into debt by issuing government bonds
  - create money and use it to pay
- **govt budget constrain**: $DEF = G - T = \Delta MB + \Delta B$
  - ΔMB: change in the monetary base
  - ΔB: change in govt bonds held by the public
  - G: govt spending
  - T: tax revenue

Budget Deficits and Inflation

a $G = 100$ million supercomputer

- **Solution 1**: govt convinces the electorate that such a computer is worth paying for
  - $T = 100$
  - $\Delta MB = 0$: no issue of money
  - $\Delta B = 0$: no issue of bonds
  - $DEF = G - T = \Delta MB + \Delta B = 0$
- if govt deficit is financed by **raising taxes**: no effect on the monetary base MB and no effect on the money supply M^s
  - $M^s = MB \times m$

Budget Deficits and Inflation

- **Solution 2**: selling 100 million of new government bonds to **the public**
  - $T = 0$
  - $\Delta B = 100$
  - $\Delta MB = 0$
  - $DEF = G - T = \Delta MB + \Delta B = 100$
- if govt deficit is financed by an increase in **bond holdings by the public**: no effect on the monetary base MB and no effect on the money supply M^s

Budget Deficits and Inflation

- **Solution 3**: create 100 million of currency
  - $T = 0$
  - $\Delta B = 0$
  - $\Delta MB = 100$
  - $DEF = G - T = \Delta MB + \Delta B = 100$
- if the deficit is not financed by increased bond **holdings by the public**, both the monetary base MB and the money supply M^s increase

Budget Deficits and Inflation

Solution 3: create 100 million of currency, ΔMB = 100

- How to create 100 million of currency?
- if a govt's treasury has the legal right to issue currency, then **print** 100 million of currency
  - $\Delta C = 100$, and $\Delta R = 0$
  - $MB = C + R$
  - $\Delta MB = \Delta C + \Delta R = 100$

Budget Deficits and Inflation

Solution 3: create 100 million of currency, ΔMB = 100

- In U.S.: treasury has NO legal right to issue/print currency to pay for gov't debt
  - $\Delta C = 0$
  - ΔR has to be 100 in order for $\Delta MB = \Delta C + \Delta R = 100$
- paying off 100 million of gov't debt by increasing 100 millions of reserves: **monetizing the debt**

Monetizing the Debt, $\Delta R = 100$

- Step 1: gov't **newly** issus 100 million bonds to **the public**
  - both nonbank public and banks can buy these newly issued bonds
- Step 2: **central bank** conducts an **open market purchase**
  - central bank buy bonds from nonbank public or banks
  - the newly issued govt bonds are not held by **the public**, but by central bank
- open market purchase $\Rightarrow$ reserves R in the public $\uparrow \Rightarrow$ because $MB = R + C$, monetary base $MB \uparrow \Rightarrow$ multiple deposit creation and money multiplier take effect $\Rightarrow$ money supply $\uparrow$ because $M^s = MB \times m$

- Fisher: **Quantity theory of money**
  - because in equilibrium, $M^s = M^d$
  - velocity is a constant, denoted by $\bar{V}$: $M^s = \frac{1}{\bar{V}} \times PY = M^d$
  - M^s or M^d is purely a function of **nominal** income $P \times Y$
  - interest rates have no effect on money supply M^s or the demand for money M^D
- Keynes: **Theories of Money Demand (liquidity preference theory)**
  - velocity is not a constant
  - interest rates have an effect on the demand for money M^d

Keynesian Theories of Money Demand

Keynesian Theories of Money Demand

Keynes presented 3 motives behind the demand for money:

- **transactions motive**: to hold money because it is a medium of exchange that can be used to carry out everyday transactions
  - transactions component is proportional to **income**
  - advanced payment technology advanced reduces money demand
- **precautionary motive**: people hold money as a cushion against unexpected opportunities
  - precautionary component is proportional to **income**

Keynesian Theories of Money Demand

- **speculative motive**: money earns no interest
  - i $\uparrow \Rightarrow$ opportunity cost of holding money relative to bonds $\uparrow \Rightarrow M^d$ falls

- After combining 3 motives for holding money, Keynes formulated his **demand-for-real-money** equation, in which **interest rates** enter

Keynesian Theories of Money Demand

- real money balance: $\frac{M^d}{P}$
  - the quantity demanded of money in real terms
- combining 3 motives for real money balance: $\frac{M^d}{P} = L(i, Y)$
- the real money balance is **negatively** related to the nominal interest rate i
  - $\frac{dL}{di} < 0$
- the real money balance is **positively** related to income Y
  - $\frac{dL}{dY} > 0$

Keynesian Theories of Money Demand

- velocity is not a constant but will fluctuate with changes in interest rates:
- $\frac{P}{M^d} = \frac{1}{L(i,Y)}$
- $V = \frac{PY}{M} = \frac{Y}{L(i,Y)}$
- i $\uparrow \rightarrow L(i,Y) \downarrow \rightarrow$ velocity $\uparrow$
- i undergo substantial fluctuations $\rightarrow$ V undergoes substantial fluctuations as well

Monetizing the Debt

- Hyperinflation (periods of extremely high inflation of more than 50% per month) occurs usually when governments spend more than they collect in taxes
- when the persistent govt deficit is financed by money creation, this will lead to sustained inflation
  - $R \uparrow \Rightarrow MB \uparrow \Rightarrow M^s \uparrow \Rightarrow \pi = \%\Delta M^s - constant$, inflation rate $\pi \uparrow$
- Examples of hyperinflation are years during the Civil War, Germany during the early 1920s, Argentina during the 1990s, and Zimbabwe in recent years

Monetizing the Debt

- Zimbabwean hyperinflation: agricultural output $\downarrow \Rightarrow$ Tax revenue $\downarrow$, public's trust of govt $\downarrow \Rightarrow$ govt financed expenditure by printing money $\Rightarrow$ money supply $\uparrow \Rightarrow$ price level $\uparrow \Rightarrow$ by 2008, Zimbabwe's official inflation rate was officially over 2 million percent

- German: Hyperinflation occurred in Germany during the early 1920s. The total number of German marks in circulation rose from 115 million in January 1922 to 1.3 billion in January 1923, and then to 497 billion billion in December 1923. The German price index rose to 126,160,000,000,000 in December 1923. In response, Deutsche Bank would make loans only to borrowers who would repay them in either foreign currencies or commodities.

Monetizing the Debt

- Hedge funds are betting that inflation will pick up as central banks and governments world-wide print and spend vast amounts of money to support jobs and businesses hit by the coronavirus pandemic
  - either printing monery so that $C \uparrow$
  - or monetizing the debt so that $R \uparrow$ (central banks essentially finance government spending)
  - in both cases, $R + C = MB \uparrow$
  - hence, $M^s \uparrow \Rightarrow \%\Delta M^s - constant = \pi \uparrow$

Monetizing the Debt

- Investors are pouring money into gold as a hedge against inflation on concerns that stimulus measures will lead to a surge in prices
- Gold, a classic inflation hedge, has surged 14% this year as investors fret that central banks will print a lot of money, debasing its value
- Some well-known hedge-fund managers are placing bets on gold because of the perceived inflationary risks
- Persistently high inflation can erode profits for companies that struggle to pass on price increases to customers, and leave consumers with less purchasing power if wages don't keep pace. Persistently high inflation can also make nominal interest rates being far below inflation rate, making savers forced to accept negative real interest rates (News source: Wall Street Journal)