International Money and Banking:
5. The Money Supply and Monetarism

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Part I

The Money Supply
What Is the Money Supply?

- Economists tend to use the term “money” differently than most people.
- While people may say a rich person “has a lot of money”, economists define money to mean only the most liquid part of a person’s assets, i.e. that part that can most quickly and easily be used to fund purchases of goods and services.
- Liquidity varies widely across assets from the most liquid asset (cash) to assets that are illiquid because selling them involves all sorts of transactions costs (e.g. a house).
- For this reason, economists have different definitions of money ranging from definitions including only the most liquid to others including things that can be sold reasonably quickly and turned into cash.
- The monetary base, also known as M0 (“M zero”) is defined as the sum of currency in circulation and reserves held at the Central Bank.
- The M1 definition of the money supply includes only currency and checking deposits: Both of these can be used directly to pay for goods and services.
- M2 equals M1 plus other assets such as savings deposits and money market mutual funds.
Central Banks and the Monetary Base

- Central banks can control the monetary base.

- The base has two components, currency and reserves. One might imagine that currency is the component Central Banks have the most control over. Central Banks are the sole providers of currency and when they supply it to a bank they deduct the same amount from the bank’s reserve account.

- However, in a modern economy, the amount of currency in circulation is driven by the public demand: The Fed or ECB are not going to refuse to provide currency to banks to keep their ATM machines running (provided the banks have sufficient credit in their reserve accounts).

- The next page provides two examples of large changes in the public demand for currency. In both situations, the central banks co-operated with these swings in demand.

- So the way that modern Central Banks control the monetary base is via controlling the quantity of reserves. These can be controlled via open market operations. By buying securities, they can increase the amount of bank reserves and by selling securities, they can decrease reserves.
Two Big Swings in Currency in Circulation

- The most interesting example occurred in the run-up to the euro changeover in 2002. It is well known that most of cash in circulation reflects “hoarded” cash that is generally of high denominations.

- Imagine yourself in 2001, with a huge pile of 500 Deutsche Mark notes because you run what we might call “an informal business.” Would you have fancied walking into a bank with in early 2002 to get the whole pile changed into euros?

- Hence, currency in circulation in the euro area gradually fell from €340 billion in January 2001 to €234 billion in December 2001 and then gradually recovered. Most of the cash taken out of circulation was deposited in banks.

- There was a big decline and then a big increase in the average value of banknotes in circulation. (See the article on the ECB webpage). The €500 note has been very popular with “informal” businesses.

- The second example occurred in the US around the turn of the millenium due to a (mistaken) fear of problems caused by the “Y2K bug’, when people feared ATM machines would not work. (The run-up during 2008/09 may reflect a loss of faith in the safety of bank deposits.)
Decline in Currency Prior to Euro Changeover (Millions of Euros)
And a Big Increase in Bank Deposits
Big Swings in Average Value of Banknotes

Average banknote value in the euro area
(in EUR)

Source: ECB; partly estimated.
Note: For the period before 2002, euro legacy banknotes have been converted into euro (with the fixed conversion rates) and aggregated. From 1 January 2002 onwards, only EUR banknotes are taken into account.
US Currency in Circulation

Shaded areas indicate U.S. recessions. Source: Board of Governors of the Federal Reserve System (US) myf.red/g/odpT
Increasing Usage of Cards Worldwide Hasn’t Killed Off Cash

Card payments and cash demand have generally increased since 2007\textsuperscript{1}

As a percentage of GDP

Graph 1

<table>
<thead>
<tr>
<th>Advanced economies</th>
<th>Emerging market economies\textsuperscript{2}</th>
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</thead>
<tbody>
<tr>
<td>JP</td>
<td>RU</td>
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<td>CH</td>
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<td>SA</td>
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<td>SE</td>
<td>KR</td>
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</tbody>
</table>

\textsuperscript{1} 2007–16 changes. The start/end of an arrow represents 2007/2016, respectively. \textsuperscript{2} For South Africa, 2009–16 change. Data for China are not comparable with other jurisdictions and thus are not shown. Data are not available for Hong Kong SAR.

Source: BIS Quarterly Review, March 2018.
Euro Banknotes in Circulation Growing Faster than GDP


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Transaction Usage Does Not Explain Amount of Banknotes in Circulation

- Some maths: €1,250,740 million in banknotes in circulation. Euro Area population is estimated at 342 million. That’s an average amount of banknotes per person of €3,657.

- Pretty clearly, people are not keeping that amount of money on hand for transaction purposes.

- And large notes (€100 or more) play a much greater role in the supply than you might imagine, accounting for about half the total value in circulation.

- ECB research (based on using information on how often notes are returned to the central bank) estimates that only a quarter of the total value of banknotes in circulation are being held for transactional purposes.

- They also estimate that around 30% of the total value of banknotes in circulation was held outside the euro area.

- Given these, ECB estimate that up to 45% of the value of euro bank notes are held as a “store of value” (i.e. “mattress money”).
Some “Currency in Circulation” Has Probably Been Destroyed or Lost

€350m worth of old punts still unclaimed, says Central Bank

The value of old Irish money that has not been swapped for euro since the change in currency equates to around €350m.

It is 18 years since the punt ceased to be legal tender in Ireland.

The Central Bank said over €224m in old Irish notes and more than €123m in old Irish coins is still unaccounted for.
Part II

Monetarism
Introducing Monetarism

- The rest of these slides will introduce a macroeconomic school of thought known as “monetarism”.

- Monetarism is associated with Nobel prize winner Milton Friedman (1912-2006). Friedman was an incredibly influential figure in academic economics and public debate on economic issues. He was both an outstanding academic and a gifted communicator of economics to popular audiences.

- The essence of Friedman’s monetarist thinking was that central banks should seek to control measures of the supply of money (such as M1) so that they grow in a steady predictable manner.


- The book documented that the Federal Reserve had allowed the money supply to significantly contract during the Great Depression. Friedman and Schwartz judged this to be the reason for the severity of the depression and thus wanted central banks to focus more on controlling the money supply.

- The next set of lecture notes will explain some important flaws in monetarist thinking. But we need to understand what it is before we can critique it.
Monetarists recommended that central banks should set targets for measures of the money supply, such as M1 (the sum of currency and deposits).

Central Banks do not have a direct control over these aggregates. Here we will describe how monetarists saw the relationship between the quantity of reserves and the M1 measure of the money supply.

Let’s start by considering a very simple world where all banks are just starting up in business and don’t yet have any sources of funds.

Now suppose the Central Bank conducts an open market operation, buying a security so that deposits rise by $100. When the cheque is deposited, the Central Bank increases the bank’s reserves by $100.

The bank’s balance sheet looks like this

<table>
<thead>
<tr>
<th>First Bank’s Balance Sheet</th>
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</thead>
<tbody>
<tr>
<td><strong>Assets</strong></td>
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<tr>
<td>Reserves</td>
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<tr>
<td>Loans</td>
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</table>

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Introducing Reserve Requirements

Suppose also that reserve requirements are 10% of deposits.

Let’s assume the bank only wants to keep the minimum required level of reserves and uses the rest of its available funds to make loans, which earn a higher rate of return.

The bank lends out $90 and keeps the remaining $10 in reserves.

The bank’s balance sheet now looks like this

<table>
<thead>
<tr>
<th>First Bank’s Balance Sheet</th>
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<tbody>
<tr>
<td><strong>Assets</strong></td>
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<tr>
<td>Reserves 10</td>
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<tr>
<td>Loans 90</td>
</tr>
</tbody>
</table>
Second Bank

- The person that received the $90 loan from the first bank deposits the funds at a second bank, which sees their deposits and reserves both credited by $90.

- This bank now starts life with a balance sheet that looks like this.

<table>
<thead>
<tr>
<th>Second Bank’s Balance Sheet</th>
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<tbody>
<tr>
<td><strong>Assets</strong></td>
</tr>
<tr>
<td>Reserves 90</td>
</tr>
<tr>
<td>Loans 0</td>
</tr>
</tbody>
</table>

Note now that there are still $100 of reserves in the system: $10 at Bank A and $90 at Bank B. Then Bank B decides to keep 10 percent of its deposits on reserves and loan out the rest, so its balance sheet looks like.

<table>
<thead>
<tr>
<th>Second Bank’s Balance Sheet</th>
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<tbody>
<tr>
<td><strong>Assets</strong></td>
</tr>
<tr>
<td>Reserves 9</td>
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<tr>
<td>Loans 81</td>
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</tbody>
</table>
You can probably see what’s coming next. The person that received the $81 loan from the second bank deposits these funds at a third bank, which sees their deposits and reserves both credited by $81.

This bank now starts life with a balance sheet that looks like this.

<table>
<thead>
<tr>
<th>Third Bank’s Balance Sheet</th>
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<tbody>
<tr>
<td><strong>Assets</strong></td>
</tr>
<tr>
<td>Reserves</td>
</tr>
<tr>
<td>Loans</td>
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<tr>
<td>Deposits</td>
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</tbody>
</table>

Note again there are still $100 of reserves in the system: $10 at Bank A, $9 at Bank B and $81 at Bank C. Then Bank C decides to keep 10 percent of its deposits on reserves and loan out the rest, so its balance sheet looks like

<table>
<thead>
<tr>
<th>Third Bank’s Balance Sheet</th>
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</thead>
<tbody>
<tr>
<td><strong>Assets</strong></td>
</tr>
<tr>
<td>Reserves</td>
</tr>
<tr>
<td>Loans</td>
</tr>
<tr>
<td>Deposits</td>
</tr>
</tbody>
</table>
And so on. When the process is finished, the addition of $100 of reserves (remember the increase in reserves was always $100) has been associated with an increase in deposits of

\[ 100 + 90 + 81 + \ldots = 1000 \]

How did I do that sum? How do I know the sequence adds to $1000?

Let \( r \) be the reserve requirement ratio. After an initial increase of 1 in the monetary base, the subsequent increases are \( 1 - r \), \( (1 - r)^2 \), \( (1 - r)^3 \) and so on. So the total increase in the money supply is

\[ 1 + (1 - r) + (1 - r)^2 + (1 - r)^3 + \ldots \]

Recall the multiplier formula. If \( |c| < 1 \) then \( 1 + c + c^2 + c^3 + \ldots = \frac{1}{1-c} \).

So, the increase in deposits is \( \frac{1}{1-(1-r)} = \frac{1}{r} \) times the initial increase.

We shouldn’t be too surprised. The Central Bank added $100 in reserves and each bank sets reserves equal to ten percent of deposits. The equilibrium involves an increase in deposits that is ten times the increase in reserves.
The Money Multiplier

- The **money multiplier** is the ratio of the money supply to the monetary base. In this simple example, it equals $\frac{1}{r}$.

- The money multiplier is often mis-interpreted.

- In our example, the central bank starts by increasing deposits by $100 and the actions of the banking system end up increasing deposits by $1000.

- People sometimes think that individual banks are somehow able to take in $100 and then make an additional $900 in loans from this, creating funds out of nowhere. This would be fraud—lending funds they didn’t have.

- That is not what happens. Go back and look at the example: In each case, banks lend 90 percent of their deposits and retain the rest. They don’t lend out amounts above those provided to them by depositors, which is their role as financial intermediaries.

- When a person deposits $100 in cash in a bank, that bank can lend at most an additional $100. However, the fact that we have a fractional-reserve system means that with a reserve requirement of 10 percent, reserves of $100 are consistent with total deposits of $1000. Remember, you knew this even before you saw the money multiplier.
Lending via Crediting Deposits Within the Institution

- In our example, the money the bank loans to people is directly deposited in a different bank.

- This is how some of the most important types of loans usually work.
  
  - **Mortgages**: When banks provide a mortgage loan to purchase a property, the money is usually sent to a third party who then ensures the seller obtains the funds and that the buyer obtains the legal deeds for the property. The terminology for this third party differs across the world: In Ireland or the UK it is a solicitor representing the buyer in the US it as an “escrow agent.”
  
  - **Car Loans** are commonly issued directly to dealerships selling the cars with the bank obtaining a title deed for the car.

- However, in some cases, such as personal loans, banks often issue the loans by crediting an account the borrower has with the bank issuing the loan.

- There has been some discussion—including a relatively well-known Bank of England paper—of whether this means the money multiplier story that we have just described is somehow invalidated by this. In reality, however, this point makes no real difference.
Balance Sheet with Deposits Staying Within the Bank

- In our previous example, the money the bank loans to people is directly deposited in a different bank. If the Bank A credited an account the borrower had with the bank, their balance sheet would become.

<table>
<thead>
<tr>
<th>First Bank’s Balance Sheet</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assets</strong></td>
</tr>
<tr>
<td>Reserves 100</td>
</tr>
<tr>
<td>Loans 90</td>
</tr>
</tbody>
</table>

- This looks different from before but the end outcome would be the same.

  - Most loans that are issued are for the purposes of spending on particular things: Why take out a loan just to leave it sitting in the bank on deposit, since this will lose you money? So the money gets spent and ends up in deposit accounts with other banks.
  
  - And if, for whatever reason, the loaned money remained in the bank as deposits, then a bank choosing to meet the minimum reserve requirement (as is assumed here) can use these reserves to make new loans, just as we assumed other banks did in the example.
Banks Are Financial Intermediaries

- Some claim the fact that banks can issue loans by crediting an account the borrower has with the same bank is a radical one which overturns the idea that banks are financial intermediaries.

- People who adopt this position say “Banks don’t need to get funds from depositors or elsewhere to make loans, they can simply create the money from nowhere. So they are not really financial intermediaries.”

- This thinking misses the next thing that happens after the customer gets the funds deposited in their account. They spend it on a car or house or whatever, so the money comes out of the bank reducing its stock of reserves. Only the original customer deposits remain with the bank.

- An important question for those who believe banks can just create as much credit as they want: Why do banks sometimes go to great effort to issue interest-bearing bonds to obtain funding for their activities? This line of thinking suggests there is no need for that.

- Credits to customers for the purposes of providing them with a loan will only ever be a small percentage of bank’s funding. And this funding is not stable – people take out the loans to spend them on stuff.
Incorporating Currency and Excess Reserves

- The previous example did not allow for the possibility that some of the loan proceeds would be withdrawn as currency rather than just re-deposited in the banking system. (Note, though, the increase in the monetary base would still always have been $100 if we had introduced currency withdrawals). Now assume currency is a constant fraction $c$ of deposits, $C = cD$.

- It also assumed that banks would maintain a reserve ratio of $r$. Banks may want to hold higher reserves as a fraction of deposits for precautionary reasons. Assume now that reserves are $R = (r + e)D$.

- The monetary base is
  \[ MB = R + C = (r + e + c)D \]

- The M1 money supply is
  \[ M1 = D + C = (1 + c)D \]

- The money multiplier is thus
  \[ m = \frac{M1}{MB} = \frac{1 + c}{r + e + c} \]

- The money multiplier gets smaller as $c$ and $e$ get bigger.
Friedman and Schwartz on the Great Depression

- Through careful collection of data that had not been previously available, Friedman and Schwartz’s famous 1963 study “A Monetary History of the United States, 1867-1960” showed that \( e \) and \( c \) had increased during the Great Depression and that there had been a sharp decline in the money multiplier.

- We will discuss why this happened in the coming weeks but, looking ahead, the underlying cause was a banking crisis which lead to a lack of confidence in banks.

- Depositors withdrew money from banks they viewed as perhaps not being safe, preferring to keep it as cash, and banks needed to keep large stocks of reserves, in case they were hit by a bank run.

- The Federal Reserve during the 1930s did not collect detailed monetary statistics and had not been aware that the money supply was sharply contracting.

- Friedman and Schwartz attributed the decline in activity to the sharp contraction of the money supply.
Why the Money Multiplier Contracted During the Great Depression

**Figure 5** Excess Reserves Ratio and Currency Ratio, 1929–1933

Consider an economy where the ratio of required reserves to bank deposits is \( r = 0.15 \), the ratio of currency holdings to deposits is \( c = 0.2 \) and the ratio of bank excess reserves to deposits is \( e = 0.25 \). Show how to calculate the value of the M1 money multiplier predicted by the money multiplier model.

- The money multiplier is given by

\[
m = \frac{M1}{MB} = \frac{1 + c}{r + e + c}
\]

- Plugging in \( r = 0.15 \), \( c = 0.2 \) and \( e = 0.25 \), we get

\[
m = \frac{M1}{MB} = \frac{1.2}{0.15 + 0.25 + 0.2} = \frac{1.2}{0.6} = 2
\]
Consider an economy where the ratio of required reserves to bank deposits is $r = 0.15$, the ratio of currency holdings to deposits is $c = 0.2$, the ratio of bank excess reserves to deposits is $e = 0.25$ and the monetary base is 100. Show how to calculate the value of the M1 measure of the money supply.

- Plugging in $r = 0.15$, $c = 0.2$ and $e = 0.25$ into the money multiplier formula, we get
  \[ m = \frac{M1}{MB} = \frac{1 + c}{r + e + c} = \frac{1.2}{0.15 + 0.25 + 0.2} = \frac{1.2}{0.6} = 2 \]

- The M1 money supply is
  \[ M1 = m \times MB = 2 \times 100 = 200 \]
Part III

The Quantity Theory of Money
Why Care About the Money Supply?

- A useful term when thinking about the role of money in the economy is velocity. The velocity of money is defined as $V = \frac{PY}{M}$ where $P$ is the GDP price index, $Y$ is real GDP and $M$ is the money supply.

- So velocity is the amount of spending over a given period (national accounts usually measure GDP over a year) that is supported by one unit of money.

- If velocity is constant, then nominal GDP is proportional to the money supply:

$$PY = MV \Rightarrow PY \propto M.$$  

- Most economists believe in long-run monetary neutrality meaning the level of real GDP is independent of the amount of money that has been supplied.

- This would mean that, in the long-run, the price level is proportional to the money supply:

$$PY \propto M \Rightarrow P \propto M$$

- This idea is known as the **Quantity Theory of Money** was an important part of monetarist thinking.
11. It follows from these propositions that inflation is always and everywhere a monetary phenomenon in the sense that it is and can be produced only by a more rapid increase in the quantity of money than in output. Many phenomena can produce temporary fluctuations in the rate of inflation, but they can have lasting effects only insofar as they affect the rate of monetary growth. However, there are many possible reasons for monetary growth, including gold discoveries, the financing of government spending, and the financing of private spending. Hence, these propositions are only the beginning of an answer to the causes and cures for inflation. The deeper question is why excessive monetary growth occurs (see chapter 8).
Section C Examples: The Velocity Equation

If monetary velocity is 5, the GDP price deflator equals 2 and real GDP is 250, what is the money supply?

The question tells us that \( V = 5, \ P = 2, \ Y = 250 \) and we know that

\[
MV = PY \Rightarrow M = \frac{PY}{V} = \frac{2 \times 250}{5} = 100
\]

Nominal GDP is \( PY \). The velocity identity tells us

\[
PY = MV = 100 \times 5 = 500
\]

If the money supply equals 100 and monetary velocity is 5, what is nominal GDP?

Nominal GDP is \( PY \). The velocity identity tells us

\[
PY = MV = 100 \times 5 = 500
\]
De Grauwe and Polan’s Study

- There have been many studies done on the relationship between the money supply and inflation.
- Some of them look at the relationship over time within a particular country; others examine the relationship across a range of different countries.
- I have linked on the website to a cross-country study by Paul De Grauwe and Magdalena Polan called “Is Inflation Always and Everywhere a Monetary Phenomenon?” The paper assesses the quantity theory by examining the relationship in a sample of 116 countries over a thirty year period between money growth and price inflation.
- The chart on the next page is taken from the paper and it shows a strong relationship between money growth and inflation over the thirty year period. Each dot represents the data on money growth and inflation for an individual country.
- The chart shows a clear positive relationship between money growth and inflation. One interesting pattern not predicted by the theory is that the study estimates the effect of money growth on inflation to be greater than predicted by the Quantity Theory: The coefficient on money growth is estimated to be greater than one.
Money Growth and Inflation: 116 Countries

![Graph showing the relationship between average M1 growth and average inflation rate for 116 countries.](image-url)
Velocity During Periods of High Inflation

- What explains the coefficient on money growth being greater one? The answer turns out to be that velocity tends to increase as inflation goes up.
- During periods of high inflation, people look to spend money as quickly as possible before it loses value.
- Let’s go back to the identity $MV = PY$. This means the sum of the growth rates of money and velocity equals the sum of the growth rates of prices plus real GDP.
- Let the growth rate of a series $X$ be denoted as $G_X$. Written in terms of growth rates, the quantity equation is expressed as

$$G_M + G_V = G_P + G_Y$$

- The increase in velocity during a hyperinflation explains why inflation increases more than one for one as money growth increases by

$$G_P = G_M + G_V - G_Y$$

As money growth increases, velocity also increases, further raising inflation.
Suppose monetary velocity is growing at 2 percent, the rate of change of the money supply is 3 percent and real GDP grows at 4 percent. What is the rate of inflation, as measured by the rate of change of the GDP deflator?

- The question tells us that $G_V = 2$, $G_M = 3$, $G_Y = 4$ and we know that

\[ G_P = G_M + G_V - G_Y = 3 + 2 - 4 = 1 \]

- Inflation is 1 percent.

Suppose monetary velocity is growing at 3 percent, the rate of change of the money supply is 5 percent and the GDP price deflator is growing at 2 percent. What is the growth rate of real GDP?

- The velocity growth formula tells us

\[ G_P + G_Y = G_M + G_V \Rightarrow G_Y = G_M + G_V - G_P = 5 + 3 - 2 = 6 \]

- Real GDP is growing at 6 percent.
Fiscal Sources of Hyperinflations

- Hyperinflation is defined as inflation above 50 percent per month.
- In countries with poorly developed tax systems or countries undergoing crises such as wars, central bank money printing often becomes the key source of government funding.
- I have put a document on the website that puts together information on five different hyperinflations from a nice CNBC web presentation “Top 5 Hyperinflations of All Time.”
- I have also put up a link to a short paper by Steve Hanke and Nicholas Krus documenting various hyperinflations from world history.
- Most examples of hyperinflation have stemmed from central banks providing large amounts of financing to fund government budget deficits.
- The next few pages describe some examples.
Greece 1944

- Highest monthly inflation: 13,800%. Prices doubled every 4.3 days.

- At the outset of World War II, Greece saw a budget surplus for fiscal 1939 of 271 million drachma, but this slipped to a deficit of 790 million drachma in 1940, due mostly to trade, reduced industrial production as a result of scarce raw materials and unexpected military expenditures. The country’s deficits would continue to be funded by monetary advances from the Bank of Greece, which had doubled the money supply in two years.

- When the government in exile returned to Athens, they had a limited ability to collect taxes outside of the capital and ran into substantial unemployment and refugee costs. By the time the new government’s stabilization effort went into effect, revenues comprised 0.4 percent of expenditures, with the Bank of Greece covering the rest.

- After the civil war of Jan-Dec. 1945/46, the British offered a plan to stabilize the country, which included increasing revenues through the sale of aid goods, an adjustment of specific tax rates, improved tax collection methods and the creation of the Currency Committee for fiscal responsibility. By the beginning of 1947, prices had stabilized.
Germany 1923

- Highest monthly inflation: 29,500%. Prices doubled every 3.7 days.

- The German papiermark, which was introduced in 1914 when the country’s gold standard was eliminated, went from an exchange rate of 4.2 per US dollar at the outbreak of WWI up to 1 million per US dollar in August 1923. By November, that number had skyrocketed to about 238 million papiermark to 1 US dollar, and a psychological disorder called “Zero Stroke” was coined, after people were forced to transact in the hundreds of billions for every day items and were dizzied by the amount of zeros involved.

- The war reparations required expenses to be paid for with a gold or foreign currency equivalent, instead of German papiermarks, so the government could not simply inflate their way out of their debts. However, to purchase foreign currencies, the government used government debt-backed papiermarks and accelerated the devaluation of their currency.

- The rapid inflation caused the government to issue a redenomination, thus replacing the papiermark with the rentenmark in November 1923, exchanging at a rate of 4.2 per US dollar and cutting 12 zeros off of the papiermark’s face value. Although the retenmark brought price stability, some people think the hyperinflation contributed to the rise of the Nazis.
Zimbabwe 2008

- Highest monthly inflation: 79,600,000,000%. Prices doubled every day.

- The path towards hyperinflation began when President Mugabe initiated a series of land redistribution programs that severely damaged the country's capacity for food production, dropping supply far below demand and raising prices as a result. Early in the 21st century, Zimbabwe entered hyperinflation and by 2006 the country printed 21 trillion ZWD to pay off loans from the IMF. Later that year, the country again had to print money, in excess of 60 trillion, in order to pay salaries of soldiers, policemen and other civil servants.

- With prices almost doubling every 24 hours, just days after issuing a $100 million bill, the Reserve Bank issued a $200 million bill and capped bank withdrawals at $500,000, which at the time was equal to about $0.25 US. At one point, the government even declared inflation to be “illegal” and arrested the executives of companies for raising prices of their products.

- The LA Times reported in July 2008 that the government ran out of paper on which to print money as European suppliers of the paper stopped supplying the country due to humanitarian concerns. In 2009, Zimbabwe abandoned its currency.
Hungary 1946

- Highest monthly inflation: 13,600,000,000,000,000%. Prices doubled every 15.6 hours.

- When World War II hit, Hungary was in a weak economic position and the central bank was almost entirely under the government’s control; printing money based on the government’s budgetary needs without any sort of financial restraint.

- By mid-1946, Hungary’s highest denomination bill was the 100,000,000,000,000,000,000 (One Hundred Quintillion) pengo, compared to 1944’s highest denomination, 1,000 pengo.

- Eventually, the inflationary environment became so dire that coins began disappearing from circulation, beginning with the silver coins and even bronze and nickel currency, as the component metals became far more valuable than the coins themselves.

- The only remedy was to introduce a new currency, the forint, which had a direct conversion into gold and thus into other world currencies.
Brazil, 1960s-1990s

Most hyperinflations occurred around wars or other crises but they can also occur in peaceful times.

For example, Brazil suffered from high or hyperinflation between the 1960s and the 1990s. Many attempts were made to issue new “hard” currencies to end the high inflation.

1. 1 Cruzeiro Novo = 1,000 Cruzeiros (1967)
2. 1 Cruzado = 1,000 Cruzeiro Novo (1986)
3. 1 Cruzado Novo = 1,000 Cruzados (1989)
4. Name change: 1 Cruzeiro = 1 Cruzado Novo (1990)
5. 1 Cruzeiro Real = 1,000 Cruzeiros (1993)
6. 1 Real = 2,750 Cruzeiros Reals (1994)

The Real has proven to be a successful relatively low inflation currency.
Venezuela Since 2017


Venezuela is releasing new banknotes for the second time in less than a year, the central bank said on Wednesday, after hyperinflation eroded the effects of an August 2018 monetary overhaul meant to improve availability of cash.

Venezuela’s president, Nicolas Maduro, last year cut five zeroes off the currency and prices. The move was supposed to ease shortages of cash that pushed most of the economy toward debit and credit card operations and put heavy strain on digital commerce platforms.

Banknotes of 10,000, 20,000 and 50,000 bolivar denominations will begin circulating on Thursday to “make the payment system more efficient and facilitate commercial transactions”, the central bank said in a statement.

The largest of those bank notes, equivalent to about US$8, is more than the minimum wage of 40,000 bolivars a month.

Following the 2018 overhaul, the lowest denomination notes were 500 bolivars, which now would not be enough to buy a piece of candy.
Venezuela Since 2017


Inflation in May reached 815,000 percent after peaking earlier this year above 1.7 million percent, according to the opposition-run congress. Maduro blames the OPEC nation’s economic predicament on sanctions by the US meant to force him from office. His critics say the collapse was caused by two decades of incompetent management that squandered hundreds of billions of dollars in oil revenue.
The 2018 New Venezuelan Notes
The 2019 New Venezuelan Notes
Exchanging Old Notes For New Ones

Karl Whelan (UCD)
Part IV

Friedman’s Policy Recommendations
Short-Run Implications of the Quantity Theory

- Recall that if velocity is constant, nominal GDP is proportional to the money supply:

\[ PY = MV \Rightarrow PY \propto M. \]

- So an increase in the money supply raises nominal GDP. This could take the form of only the price level increasing, only real GDP increasing or some combination of the two variables increasing.

- The idea of long-run monetary neutrality means that, in the end, only the price level increases after an increase in the money supply.

- However, Friedman accepted that, in the short-run, the supply of money increased real GDP with this increase being gradually reversed over time.

- We will discuss Friedman’s views on monetary neutrality more later in the course. For now, though, just understand that Friedman accepted that increasing the money supply was one way to boost the economy in the short to medium-term.
Friedman’s Skepticism of Activist Policy

- You might imagine that Friedman’s views meant he favoured regular adjustment of the money supply in response to the state of the economy.

- However, Friedman was deeply conservative and skeptical of the role of government in the economy. He was the intellectual leader of the “Chicago school” of economists that emphasised the gains from free markets.

- So while he accepted that monetary policy could, in theory, be used to “fine tune” the economy in an activist manner, he stressed the difficulties of doing so in practice.

- Friedman emphasised how difficult it was to diagnose, in real time, what was going on in the macroeconomy and how tricky it was to design policies to respond to these.

- Ultimately, Friedman proposed that with the exception of responding to major shocks (such as wars and depressions) central banks should focus on increasing the money supply at a constant predictable percentage rate.

- See the next two pages for quotes from Friedman’s famous 1967 presidential address to the American Economic Association.
I have put this point last, and stated it in qualified terms—as referring to major disturbances—because I believe that the potentiality of monetary policy in offsetting other forces making for instability is far more limited than is commonly believed. We simply do not know enough to be able to recognize minor disturbances when they occur or to be able to predict either what their effects will be with any precision or what monetary policy is required to offset their effects. We do not know enough to be able to achieve stated objectives by delicate, or even fairly coarse, changes in the mix of monetary and fiscal policy. In this area particularly the best is likely to be the enemy of the good. Experience suggests that the path of wisdom is to use monetary policy explicitly to offset other disturbances only when they offer a “clear and present danger.”
My own prescription is still that the monetary authority go all the way in avoiding such swings by adopting publicly the policy of achieving a steady rate of growth in a specified monetary total. The precise rate of growth, like the precise monetary total, is less important than the adoption of some stated and known rate. I myself have argued for a rate that would on the average achieve rough stability in the level of prices of final products, which I have estimated would call for something like a 3 to 5 per cent per year rate of growth in currency plus all commercial bank deposits or a slightly lower rate of growth in currency plus demand deposits only. But it would be better to have a fixed rate that would on the average produce moderate inflation or moderate deflation, provided it was steady, than to suffer the wide and erratic perturbations we have experienced.
Recap: Key Points from Part 5

Things you need to understand from these notes:

1. Definitions of M0 (monetary base) and M1.
2. Events in which demand for currency changed.
3. How central banks control the monetary base.
4. Basic and expanded models of the money multiplier.
5. Definition of monetary velocity.
7. Cross-country evidence on money growth and inflation.
8. Why hyperinflations occur.
9. Why inflation rises more than one for one with money growth during hyperinflations.
10. Milton Friedman’s policy recommendations.