Macroeconomics

MECN 450
Winter 2004

Topic 3: Monetary Policy and Inflation
Main topics:

- What is “money”?
- The Federal Reserve and Monetary Policy
- Money and prices
- Money, prices, and exchange rates

What is “money”? Functionally, money facilitates transactions

- Medium of exchange
- Unit of account
- Store of value (though not the best...)
Quantitatively, “money” is

- **M1**, the most liquid
  - Currency + Checking Accounts
- **M2**, intermediate liquidity
  - Everything in M1, plus
  - Savings Deposits (and MMDAs)
  - Small-denomination time deposits
  - Money Market Mutual Funds

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Monetary Aggregates, December 2003 (billions, SA)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total M1</td>
<td>1293</td>
</tr>
<tr>
<td>Currency</td>
<td>664</td>
</tr>
<tr>
<td>Demand Deposits</td>
<td>311</td>
</tr>
<tr>
<td>Other Checkable</td>
<td>309</td>
</tr>
<tr>
<td>Travelers Checks</td>
<td>8</td>
</tr>
<tr>
<td>Total M2</td>
<td>6062</td>
</tr>
<tr>
<td>Savings Deposits</td>
<td>3157</td>
</tr>
<tr>
<td>Small Time Deposits</td>
<td>806</td>
</tr>
<tr>
<td>Retail Money Funds</td>
<td>807</td>
</tr>
</tbody>
</table>
$664 billion in currency = almost $2000 per person in the US

*Where is all this cash?*

- About $100 per person held as cash
- About $100 per person held by businesses for transactions
- About $100 per person in the underground economy

... the rest (apparently) is held abroad.

Why would this be?

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Which money measure (if any) should we care about?

Or... how does money affect the economy?

- Monetary effects occur not because of money per se, but via liquidity
  - ability to make transactions
  - by both firms and households
- What determines how “liquid” the economy is?
  - Is it just currency?
The Fed can affect the economy by “nudging” the availability of liquidity at a critical juncture.

*The Fed intervenes in the bond market in order to affect the availability of reserves to banks – and hence the liquidity of the banking system.*

*There is then a multiplier effect from the banking system to the funds available in the rest of the economy.*

*Let’s follow this logic through the structure of the fed and the mechanics of monetary policy...*

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*The Federal Reserve and Monetary Policy*

- How is the money supply determined?
- The Central Bank is the monetary authority, but doesn’t have unilateral power to set “M”
- *The Fed acts on the monetary system, but doesn’t control it.*
The Fed is governed by

- A seven-member Board of Governors
  - appointed by the President and confirmed by the Senate to serve 14-year terms of office
  - Only one member of the Board may be selected from any one of the twelve Federal Reserve Districts.

- The Federal Open Market Committee (FOMC) sets monetary policy
  - It is composed of the seven governors, plus
  - five regional Fed Presidents, always including the President of the NY Fed
The Fed is instructed by legislation (December 23, 1913)

**FEDERAL RESERVE ACT**

**SECTION 2A—Monetary Policy Objectives**

The Board of Governors of the Federal Reserve System and the Federal Open Market Committee shall maintain long run growth of the monetary and credit aggregates commensurate with the economy's long run potential to increase production, so as to promote effectively the goals of maximum employment, stable prices, and moderate long-term interest rates.

The Fed has a few levers under its control

- The Fed can change the monetary base
- Or banking regulations
  - Reserve requirements
  - The discount rate
  - And also margin requirements

If the Fed changes policy, how does this operationally feed through the banking system?
The money supply with only currency, backed by a commodity:

<table>
<thead>
<tr>
<th>Central Bank Balance Sheet</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assets</strong></td>
<td><strong>Liabilities</strong></td>
</tr>
<tr>
<td>Gold 1,000,000</td>
<td>Currency 1,000,000</td>
</tr>
</tbody>
</table>

The monetary liabilities of the central bank are the monetary base.

In an all-currency economy, the money supply equals the monetary base.

The money supply with fractional reserves:

<table>
<thead>
<tr>
<th>Initial Banking System Balance Sheet</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assets</strong></td>
<td><strong>Liabilities</strong></td>
</tr>
<tr>
<td>Currency 1,000,000</td>
<td>Deposits 1,000,000</td>
</tr>
</tbody>
</table>

- The deposits are 100% backed by currency reserves.
- Suppose the reserve requirement is only 20%.
- The bank can lend out some of the currency it is holding as reserves.
- It lends out $800,000, which borrowers deposit back.
### New Banking System Balance Sheet

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Currency</td>
<td>Deposits</td>
</tr>
<tr>
<td>1,000,000</td>
<td>1,800,000</td>
</tr>
<tr>
<td>Loans</td>
<td></td>
</tr>
<tr>
<td>800,000</td>
<td></td>
</tr>
</tbody>
</table>

- Now, the deposits are \(1/1.8 = 55.5\%\) backed by currency reserves.
- But the reserve requirement is only 20%.
- The bank can lend out more of the currency it is holding as reserves.
- It lends until the *reserve ratio* = 20%

### Final Banking System Balance Sheet

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Currency</td>
<td>Deposits</td>
</tr>
<tr>
<td>1,000,000</td>
<td>5,000,000</td>
</tr>
<tr>
<td>Loans</td>
<td></td>
</tr>
<tr>
<td>4,000,000</td>
<td></td>
</tr>
</tbody>
</table>

- The deposits are 20% backed by currency reserves.
- Bank runs are now possible!
- Money supply = Deposits = monetary base/0.2
- Money supply = 5,000,000 = 1,000,000/0.2
- The “money multiplier” is \(\frac{1}{0.2} = \frac{1}{\text{reserve ratio}}\)
The money supply with fractional reserves and currency held by the public:

- When some currency is held by the public, part of each loan is not re-deposited in the bank.
- It can’t be used to loan out to someone else.
- This is “leakage” from the money multiplier process, and reduces the money multiplier.
- This leakage is summarized by the currency/deposit ratio, $cu$

The money multiplier becomes $\frac{1 + cu}{cu + \text{reserve ratio}}$

In our example where the reserve ratio = 0.2

- with no currency held by the public, the money multiplier is $1/0.2 = 5$
- with a currency-deposit ratio of 0.75, the money multiplier is $\frac{1+0.75}{0.75+0.2} = \frac{1.75}{0.95} = 1.84$

The M1 money multiplier in the US is now about $\frac{1+0.75}{0.75+0.07} = \frac{1.75}{0.82} = 2.13$
The Fed tries to move the money supply

Money Supply = Monetary Base \times \left[ \frac{1 + cu}{cu + \text{reserve ratio}} \right]

- Banks choose the reserve ratio
- Borrowers choose the currency-deposit ratio, cu
- The Fed can affect the reserve ratio
- *The Fed can move the monetary base*

The currency-deposit ratio and the reserve-deposit ratio in the Great Depression
(a) The monetary base and the money multiplier in the Great Depression

(b) The money supply in the Great Depression
The Fed moves the monetary base via an open market operation

Initial Central Bank Balance Sheet

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold</td>
<td>1,000,000</td>
</tr>
<tr>
<td>Bonds</td>
<td>2,000,000</td>
</tr>
<tr>
<td>Currency</td>
<td>3,000,000</td>
</tr>
</tbody>
</table>

after a $500,000 open market purchase of bonds

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold</td>
<td>1,000,000</td>
</tr>
<tr>
<td>Bonds</td>
<td>2,500,000</td>
</tr>
<tr>
<td>Currency</td>
<td>3,500,000</td>
</tr>
</tbody>
</table>

The monetary base rises ⇒ the money supply rises

The Federal Reserve Balance Sheet, $billions, SA, October, 2003

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold</td>
<td>11</td>
</tr>
<tr>
<td>US Treasuries</td>
<td>667</td>
</tr>
<tr>
<td>Repurchase Agreements</td>
<td>23</td>
</tr>
<tr>
<td>Other</td>
<td>55</td>
</tr>
<tr>
<td>TOTAL</td>
<td>756</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Currency</td>
</tr>
<tr>
<td>Vault Cash In circulation</td>
</tr>
<tr>
<td>Deposits of banks</td>
</tr>
<tr>
<td>Other</td>
</tr>
<tr>
<td>TOTAL</td>
</tr>
</tbody>
</table>

Reserves = deposits of banks + vault cash = $62 billion
Monetary Base = currency in circulation + reserves = $738 billion
How does monetary policy work in practice?

- The Fed conducts open market operations in order to maintain a target federal funds rate
  - The Federal Funds rate is the rate at which banks lend to one another in the overnight market (mostly reserves)
  - This is a measure of short-term liquidity
- A higher target requires removing funds from the market (tighter monetary policy = less liquidity)
  - Which the Fed accomplishes via an open market sale of bonds
  - An open market purchase would add liquidity and lower the federal funds rate.

The Fed’s official description of how its policy affects money markets:

- **Effects of Policy**
  Depository institutions are required to maintain reserves in certain proportions against various types of their checkable deposits. Open market operations directly affect the level of reserves in the banking system. Federal Reserve purchases of securities add to reserves; sales withdraw reserves from the System. If reserves increase, depository institutions will generally acquire new loans and investments, which will tend to exert downward pressure on interest rates.

- **Open market operations as directed by the FOMC** are the major tool used to influence the total amount of money and credit available in the economy. The Federal Reserve attempts to provide enough reserves to encourage expansion of money and credit in keeping with the goals of price stability and sustainable growth in economic activity.
How might this affect the economy?

- Consider a monetary tightening:
  - The target Fed Funds rate is increased
  - The Fed conducts an open market bond sale, reducing liquidity
  - The interest rate (the cost of funds) rises

- Classic effect: what happens to Investment?
  - An increase in interest rates reduces investment
  - Especially in sensitive sectors, like construction and to some extent equipment and durables
  - Output falls
  - This effect can be exacerbated if bank lending tightens also (banks cut back)

Observed responses of output, prices, and the Fed funds rate to a contractionary monetary policy shock

- Interest rates rise
- Output falls

Fed tightens monetary policy
What happens in the long run?

- Now consider expansionary monetary policy
  - The interest rate initially falls
  - From the previous graph, output responds in the first 1 to 2 quarters and continues for a few years
  - ... but after the first year, prices start to respond, too: inflation builds up
  - Nominal interest rate = real interest rate + E(inflation)
  - In the long run, E(inflation) drives the interest rate back up, undoing the monetary stimulus
  - Loose monetary policy stimulates output in the short run (via liquidity), but inflation in the long run.
Average Money Growth and Inflation in the 1980s

Money growth and inflation: Transition Economies, 1995-'98
The German Hyperinflation

Why is it harder for the Fed to affect long-run interest rates than to affect short-run interest rates?

- Remember, at any horizon,
  $i_{\text{nominal}} = i_{\text{real}} + E(\text{inflation})$
  
  $i_{\text{nominal}}(1\text{yr}) = r_{\text{real}}(1\text{yr}) + E(\text{inflation, } 1\text{yr})$
  
  $i_{\text{nominal}}(10\text{yr}) = r_{\text{real}}(10\text{yr}) + E(\text{inflation, } 10\text{yr})$

- If the Fed loosens,

  - $r_{\text{real}}(1\text{yr})$ falls because of a liquidity effect
  - $E(\text{inflation, } 1\text{yr})$ probably doesn't move much (may even fall since you wonder why the Fed is loosening!)
  - So $i_{\text{nominal}}(1\text{yr})$ falls
What happens to long rates?
- \( r_{\text{real}}(10\text{yr}) \) probably doesn't move (the liquidity effect is short term)
- \( E(\text{inflation}, 10\text{yr}) \) could rise if money growth persists
- UPWARD pressure on \( i_{\text{nominal}}(10\text{yr}) \) unless there is an expectation of lower future inflation
- This gives a steepening yield curve!
- The potential long-run effect of inflation gives perverse effects of monetary policy on nominal interest rates.

Alternatively, think about tight monetary policy:
- Remember, at any horizon, \( i_{\text{nominal}} = r_{\text{real}} + E(\text{inflation}) \)
- If the Fed tightens,
  - \( r_{\text{real}}(1\text{yr}) \) rises because of the liquidity effect
  - \( E(\text{inflation, 1yr}) \) probably doesn't move much (may even rise since you wonder why the Fed is tightening!)
  - So \( i_{\text{nominal}}(1\text{yr}) \) rises
- What happens to long rates?
  - \( r_{\text{real}}(10\text{yr}) \) probably doesn't move (the liquidity effect is short term)
  - \( E(\text{inflation, 10yr}) \) could even fall
  - Downward pressure on \( i_{\text{nominal}}(10\text{yr}) \) if tightness persists
- This gives a flattening of the yield curve!
- Remember, the early part of a recession is often characterized by an inverted yield curve.

Consider the dynamics of the yield curve in light of this….
In the long-run, prices absorb the monetary change...

in the short run?

- Prices don’t move much
- Interest rates and lending adjust
- This affects output
... But with “long and variable” lags

This gives the monetary authority some scope to stimulate the economy ...

... by reducing the interest rate
stimulating output, especially in interest sensitive sectors.
But there are limits to this – witness the recent weakness in business investment
Money Growth and Federal Funds Rate

<table>
<thead>
<tr>
<th>Month</th>
<th>M2, billions</th>
<th>Growth since last month (percent, annualized)</th>
<th>Growth since last year (percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003-07-01</td>
<td>5996.102</td>
<td>10.22181</td>
<td>7.918697</td>
</tr>
<tr>
<td>2003-08-01</td>
<td>6033.145</td>
<td>7.670571</td>
<td>8.156077</td>
</tr>
<tr>
<td>2003-09-01</td>
<td>6078.239</td>
<td>9.347313</td>
<td>8.139518</td>
</tr>
<tr>
<td>2003-10-01</td>
<td>6117.667</td>
<td>8.067904</td>
<td>8.162926</td>
</tr>
<tr>
<td>2003-11-01</td>
<td>6097.493</td>
<td>-3.88621</td>
<td>7.299564</td>
</tr>
<tr>
<td>2003-12-01</td>
<td>6079.121</td>
<td>-3.55633</td>
<td>6.118827</td>
</tr>
<tr>
<td>2004-01-01</td>
<td>6071.278</td>
<td>-1.53725</td>
<td>5.12919</td>
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<tr>
<td>2004-02-01</td>
<td>6062.330</td>
<td>-1.75432</td>
<td>4.454801</td>
</tr>
</tbody>
</table>
Implementing monetary policy is complicated by

• Lags: today’s monetary policy should anticipate future events.
• Uncertainty: reactions to the Fed partially determine how effective monetary policy will be.

If markets anticipate that the Central Bank will inflate, its attempts to affect output are doomed.

• Long-term nominal interest rates rise ⇒ undoes the stimulus
• Prices rise now ⇒ promotes inflation

Put differently, if loose monetary policy increases output, why don’t hyperinflationary economies have booming output?

Credibility is key...
How is credibility achieved?

- Insulate the Central Bank from politics
- Appoint “tough” Central Bankers