National Income & Business Cycles

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4: Money and Inflation

Objectives

- The classical theory of inflation
  - causes
  - effects
  - social costs

- “Classical” -- assumes prices are flexible & markets clear.
- Applies in the long run.

Key Concepts

- Money
- Functions of money
- Types of money
- Central bank
- Open-market operations
- Reserves
- Fractional-reserve banking
- Velocity
- Money multiplier

- Hyperinflation
- Quantity theory of money
- Money demand function
- Seigniorage
- Fisher equation
- Costs of inflation
- Money neutrality
- Classical dichotomy

Inflation ($\pi$) and its trend, 1960-2015

% change in CPI from 12 months earlier
long-run trend

Shaded areas indicate U.S. recessions
Source: U.S. Bureau of Labor Statistics
myf.red/giN2d
Money: functions & types

- Functions:
  - medium of __________
  - store of __________
  - unit of __________

- Types
  1. ________ money
  2. ________ money

The money supply

Money Supply: controlled (imperfectly) by the government via (monetary policy):

1. ________________: swap between bonds and money
2. ________________: legal restrictions on the percent of bank assets that cannot be lent out.
3. ________________: the interest rate charged by the central bank on its loans to banks.

There are many measures of money (M1, M2, etc.). They are not important for this course.

The Quantity Theory of Money

- links the inflation rate to the growth rate of the money supply.

- People hold money to conduct their ________ _____________.

- Velocity
  - the number of times the average dollar bill changes hands in a given time period
  - Ex: In 2001, $500 billion in transactions and money supply was $100 billion. The average dollar is used in five transactions in 2001, so velocity = 5

Velocity, cont.

- This suggests the following definition:

\[ V = \frac{T}{M} \]

- Use nominal GDP as a proxy for total transactions.

\[ V = \frac{P \times Y}{M} \]

The Quantity Equation:
Inflation and Money Growth

Representing the quantity equation in percent-change form we have that

\[ \frac{\Delta M}{M} + \frac{\Delta V}{V} = \frac{\Delta P}{P} + \frac{\Delta Y}{Y} \]

The quantity theory of money assumes

\( V \) is constant, so \( \frac{\Delta V}{V} = 0 \).

Inflation and Money Growth

\% \Delta M + \% \Delta V = \% \Delta P + \% \Delta Y

a) productive capability (\( K, L \)) determines \% \Delta Y

b) \( V \) is constant
c) \( \pi = \frac{\Delta P}{P} \)

then

prices rise (inflation \( \pi \)) only if:

\% \Delta M \quad \% \Delta Y

Implications of Quantity Theory

\( \pi = \% \Delta M - \% \Delta Y \)

- Normal economic growth requires a certain amount of money supply growth to facilitate the growth in transactions.
- Money growth in excess of this amount leads to inflation.
  - Countries with _______ money growth rates should have _______ inflation rates.
  - The long-run trend behavior of a country’s inflation should be similar to the long-run trend in the country’s _______ growth rate.

International data on inflation and money growth
Inflation as a fiscal phenomenon: Seigniorage

- To spend more without raising taxes or selling bonds, the gov’t can print money.
- The “revenue” raised from printing money is called ____________.
- The ____________: Printing money to raise revenue causes inflation. Inflation is like a tax on people who hold money.

Inflation, interest rates, and the Fisher effect

- Nominal interest rate, $i \rightarrow$ ____________ for inflation
- Real interest rate, $r \rightarrow$ ____________ for inflation:
- Recall from Chap 3: $S = I$ determines __
  $\rightarrow$ an increase in $\pi$ causes an equal increase in __.
- This one-for-one relationship is called the ____________ ____________.
Exercise:

Suppose $V$ is constant, $M$ is growing 5% per year, $Y$ is growing 2% per year, and $r = 4$.

\[
\frac{\% \Delta V}{\% \Delta M} = \frac{\% \Delta Y}{r} = 1.
\]

1. Solve for $i$ (the nominal interest rate).

2. If the Fed increases the money growth rate by 2 percentage points per year, find $\Delta i$.

Exercise:

3. Suppose the growth rate of $Y$ falls to 1% per year.
   - What will happen to $\pi$?

   - What must the Fed do if it wishes to keep $\pi$ constant?

Two real interest rates

- $\pi =$ _______ inflation rate
  (not known until after it has occurred)

- $\pi^e =$ _______ inflation rate

- $i - \pi^e =$ _______ real interest rate:
  what people expect at the time they buy a bond or take out a loan

- $i - \pi =$ _______ real interest rate:
  what people actually end up earning on their bond or paying on their loan

They differ because of the differences in expected and actual inflation.
The money demand function

$$(M/P)^d = L(i, Y)$$

$(M/P)^d$ = real money demand, depends
- negatively on __
- ___ is the opportunity cost of holding money
- positively on __
  - higher __ $\Rightarrow$ more spending
  - $\Rightarrow$ so, need more money

(“$L$” is used for the money demand function because money is the most liquid asset.)

• When people are deciding whether to hold money or bonds, they don’t know what ______ will turn out to be.

• Hence, the nominal interest rate relevant for money demand is _______. Therefore, the price level depends on today’s money supply and expected future money supplies.

What determines what

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

variable how determined (in the long run)

$M$
$r$
$Y$
$P$

How $P$ responds to $\Delta M$

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

- For given values of $r$, $Y$, and $\pi^e$,
  - a change in $M$ causes $P$ to change by
  - _________________ – just like in the quantity theory of money.
What about expected inflation?

- Over the long run, people don’t consistently over- or under-forecast inflation, so \( \pi^e = \) on average.
- In the short run, \( \pi^e \) may change when people get new information.
- EX: Fed announces it will increase \( M \) next year. People will expect next year’s  to be higher, so  rises.
- This affects now, even though  hasn’t changed yet….

How \( P \) responds to \( \Delta \pi^e \)

\[
\frac{M}{P} = L(r + \pi^e, Y)
\]

- For given values of \( r, Y, \) and \( M \),
  \( \uparrow \pi^e \Rightarrow \)
  \( \Rightarrow \)
  \( \Rightarrow \)

A common misperception

- Common misperception: \textit{inflation reduces real wages}
- This is true only in the ______ run, when nominal wages are fixed by contracts.
- (Chap 3) In the ______ run, the real wage is determined by ____________ and ________________, \textit{not the price level or inflation rate}.
- Consider the data…

The CPI and Average Hourly Earnings, 1965-2009

- Real average hourly earnings in 2009 dollars, right scale
- Nominal average hourly earnings, (1965 = 100)
- CPI (1965 = 100)
The classical view of inflation

- The classical view:
  A change in the price level is merely a change in the units of measurement.

So why, then, is inflation a social problem?

The Social Costs of Inflation

1. ______ costs: waste productive effort trying to protect oneself against \( \pi \)
2. _____ costs: changing prices is costly (physical or reputation cost)
3. Variability in ______ prices: leads to ______ inefficiency
4. _____ laws: measures capital gains by comparing nominal values instead of real values.
5. Inconvenience: currency is a less ______ measure when its value changes a lot.
   - Unexpected inflation redistributes wealth ________.

Benefit(s) of inflation?

- ______ wages are rarely reduced, even when the equilibrium real wage falls.
- Inflation allows the real wages to reach equilibrium levels without nominal wage ______.
- Therefore, moderate inflation improves the functioning of ______ markets.

Hyperinflation

- def: \( \pi \geq 50\% \) per month
- inflation costs **HUGE** under hyperinflation
- Money ceases to function as a store of value, and may not serve its other functions
- transactions with _____ or a stable ______ currency
- Why it happens?
  - excessive money supply growth:
    - central bank prints money → the price level _____
    - if it prints money rapidly enough, the result is ________________
Why gov’ts create hyperinflation

- When a government cannot raise _____ or sell ________,
- it must finance spending increases by ________ _________.
- In theory, the solution to hyperinflation is simple: stop _________________.
- In the real world, this requires drastic and painful ________ restraint.

A few examples of hyperinflation

<table>
<thead>
<tr>
<th>country</th>
<th>period</th>
<th>CPI Inflation % per year</th>
<th>M2 Growth % per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Israel</td>
<td>1983-85</td>
<td>338%</td>
<td>305%</td>
</tr>
<tr>
<td>Brazil</td>
<td>1987-94</td>
<td>1256%</td>
<td>1451%</td>
</tr>
<tr>
<td>Bolivia</td>
<td>1983-86</td>
<td>1818%</td>
<td>1727%</td>
</tr>
<tr>
<td>Ukraine</td>
<td>1992-94</td>
<td>2089%</td>
<td>1029%</td>
</tr>
<tr>
<td>Argentina</td>
<td>1988-90</td>
<td>2671%</td>
<td>1583%</td>
</tr>
<tr>
<td>Dem. Republic of Congo / Zaire</td>
<td>1990-96</td>
<td>3039%</td>
<td>2373%</td>
</tr>
<tr>
<td>Angola</td>
<td>1995-96</td>
<td>4145%</td>
<td>4106%</td>
</tr>
<tr>
<td>Peru</td>
<td>1988-90</td>
<td>5050%</td>
<td>3517%</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>2005-07</td>
<td>5316%</td>
<td>9914%</td>
</tr>
</tbody>
</table>

The Classical Dichotomy

- Nominal variables ______ influence real variables

- Since money is a nominal measure, it cannot affect the real GDP of the economy

We call this ____________________

Summary

1. Money
   - serves as a medium of exchange, store of value, and unit of account.
   - Central bank controls money supply.

2. Quantity theory of money
   - conclusion: the money growth rate determines the inflation rate.

3. Nominal interest rate
   - equals real interest rate + inflation rate.
   - Fisher effect: nominal interest rate moves one-for-one w/ expected inflation.
   - is the opp. cost of holding money
Summary

4. Money demand
   • depends on income in the Quantity Theory
   • it also depends on the nominal interest rate

5. Costs of inflation
   • Expected inflation
   • Unexpected inflation

6. Hyperinflation
   • caused by rapid money supply growth when money printed to finance gov’t budget deficits

7. Classical dichotomy
   • In classical theory, money is neutral—does not affect real variables