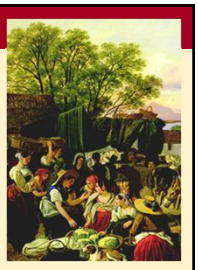
N. Gregory Mankiw

Principles of
Economics
Sixth Edition



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Money Growth and Inflation

Premium PowerPoint Slides by Ron Cronovich

In this chapter, look for the answers to these questions:

- How does the money supply affect inflation and nominal interest rates?
- Does the money supply affect real variables like real GDP or the real interest rate?
- How is inflation like a tax?
- What are the costs of inflation? How serious are they?

Introduction

§ This chapter introduces the **quantity theory of money** to explain one of the Ten Principles of Economics from Chapter 1:

> ***Prices rise when the govt prints too much money.***

§ Most economists believe the quantity theory

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The Value of Money

- ***P*** = the price level
  (e.g., the CPI or GDP deflator)
-
- Example: basket contains one candy bar.
  - If ***P*** = $2, value of $1 is 1/2 candy bar
  - If ***P*** = $3, value of $1 is 1/3 candy bar
- Inflation drives up prices

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The Quantity Theory of Money

- Developed by 18th century philosopher
  David Hume and the classical economists
- Advocated more recently by Nobel Prize Laureate
  Milton Friedman
-
- We study this theory using two approaches:
  1. A supply-demand diagram
  2. An equation

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Money Supply (MS)

- In real world, determined by Federal Reserve,
  the banking system, consumers.
- In this model, we assume

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Money Demand (MD)

- Refers to
- Depends on
- Thus, quantity of money demanded is _____ related to the value of money and _____ related to ***P***, other things equal. (These "other things" include real income, interest rates, availability of ATMs.)

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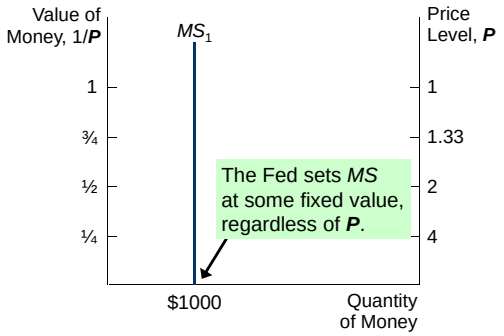
The Money Supply-Demand Diagram



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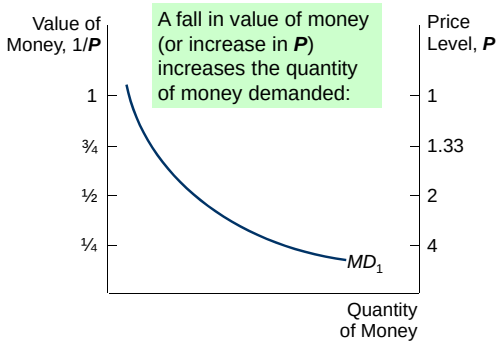
The Money Supply-Demand Diagram



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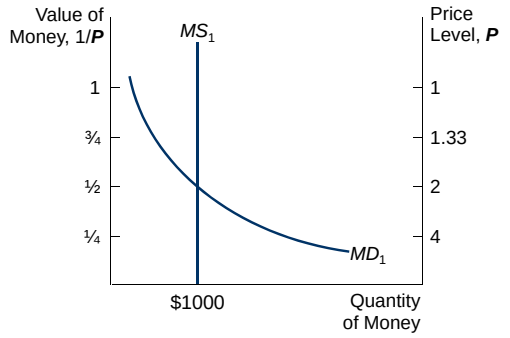
The Money Supply-Demand Diagram



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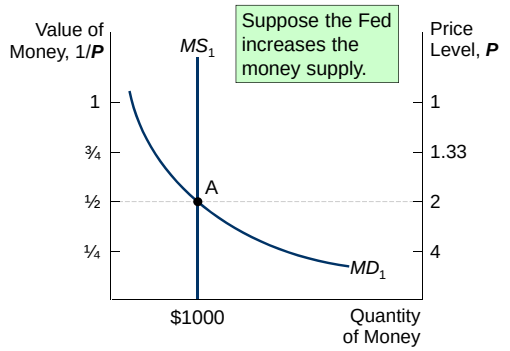
The Effects of a Monetary Injection



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A Brief Look at the Adjustment Process

Result from graph: Increasing MS causes ***P*** to rise.

How does this work? Short version:

- At the initial ***P***, an increase in MS causes
- People get rid of their excess money by spending it on g&s or by loaning it to others, who spend it. Result:
- But supply of goods

(Other things happen in the short run, which we will study in later chapters.)

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Real vs. Nominal Variables

§ **Nominal variables**

Examples: nominal GDP,
nominal interest rate (rate of return measured in $)
nominal wage ($ per hour worked)

§ **Real variables**

Examples: real GDP,
real interest rate (measured in output)
real wage (measured in output)

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Real vs. Nominal Variables

Prices are normally measured in terms of money.

§ Price of a compact disc: $15/cd
§ Price of a pepperoni pizza: $10/pizza

A **relative price**

§ Relative price of CDs in terms of pizza:

Relative prices are measured in _____,
so they are real variables.

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Real vs. Nominal Wage

An important relative price is the real wage:

W = nominal wage = price of labor, e.g., $15/hour

P = price level = price of g&s, e.g., $5/unit of output

Real wage is the price of labor relative to the price of output:

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The Classical Dichotomy

- **Classical dichotomy**:
- Hume and the classical economists suggested
- If central bank doubles the money supply, Hume & classical thinkers contend
  - all nominal variables
  - all real variables

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The Neutrality of Money

- **Monetary neutrality**:
- Doubling money supply causes all nominal prices to double; what happens to relative prices?
- Initially, relative price of cd in terms of pizza is

$$\frac{\text{price of cd}}{\text{price of pizza}} = \frac{\$15/\text{cd}}{\$10/\text{pizza}} = 1.5 \text{ pizzas per cd}$$

- After nominal prices double,

$$\frac{\text{price of cd}}{\text{price of pizza}} = \frac{\text{/cd}}{\text{/pizza}} = \text{\_\_\_\_ pizzas per cd}$$

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The Neutrality of Money

- Similarly, the real wage ***W*/*P***
  - quantity of labor supplied
  - quantity of labor demanded
  - total employment of labor
- The same applies to employment of capital and other resources.
- Since employment of all resources is _____, total output is also unchanged by the money supply.

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The Neutrality of Money

- Most economists believe the classical dichotomy and neutrality of money describe the economy in the long run.
- In later chapters, we will see that monetary changes can have important *short-run* effects on real variables.

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The Velocity of Money

- **Velocity of money**:

- Notation:
  - $P \times Y$ = nominal GDP
  - = (price level) x (real GDP)
  - M = money supply
  - V = velocity
- Velocity formula:

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The Velocity of Money

Example with one good: pizza.
In 2012,

- Y = real GDP = 3000 pizzas
- P = price level = price of pizza = \$10
- $P \times Y$ = nominal GDP = value of pizzas = \$30,000
- M = money supply = \$10,000
- V = velocity =

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ACTIVE LEARNING 1

Exercise

One good: corn.

The economy has enough labor, capital, and land to produce ***Y*** = 800 bushels of corn.

V is constant.

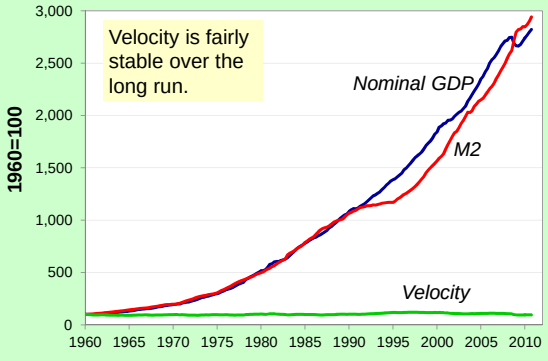
In 2008, MS = \$2000, ***P*** = \$5/bushel.

Compute nominal GDP and velocity in 2008.

ACTIVE LEARNING 1

Answers

U.S. Nominal GDP, M2, and Velocity
1960–2011



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The Quantity Equation

Velocity formula: $V = \frac{P \times Y}{M}$

- Multiply both sides of formula by ***M***:

- Called the **quantity equation**

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The Quantity Theory in 5 Steps

Start with quantity equation: $M \times V = P \times Y$

1. ***V*** is stable.
2. So, a change in ***M*** causes
3. A change in ***M***
   money is neutral,
   Y is determined by
4. So, ***P*** changes by
5. Rapid money supply growth causes rapid inflation.

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ACTIVE LEARNING 2

Exercise

One good: corn. The economy has enough labor, capital, and land to produce ***Y*** = 800 bushels of corn. ***V*** is constant. In 2008, MS = \$2000, ***P*** = \$5/bushel.

For 2009, the Fed increases MS by 5%, to \$2100.

a. Compute the 2009 values of nominal GDP and ***P***. Compute the inflation rate for 2008–2009.

b. Suppose tech. progress causes ***Y*** to increase to 824 in 2009. Compute 2008–2009 inflation rate.

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ACTIVE LEARNING 2

Answers

ACTIVE LEARNING 2

Summary and Lessons about the Quantity Theory of Money

- If real GDP is constant, then
- If real GDP is growing, then
- The bottom line:
  - Economic growth increases # of transactions.
  -

Hyperinflation

- Hyperinflation is generally defined as
- Recall one of the Ten Principles from Chapter 1:
  Prices rise when the government prints too much money.
-

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Hyperinflation in Zimbabwe

Large govt budget deficits led to the creation of large quantities of money and high inflation rates.

Sign posted in public restroom

date	*Zim$ per US$*
Aug 2007	245
Apr 2008	29,401
May 2008	207,209,688
June 2008	4,470,828,401
July 2008	26,421,447,043
Feb 2009	37,410,030
Sept 2009	355

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The Inflation Tax

- When tax revenue is inadequate and ability to borrow is limited, govt may print money to pay for its spending.
- Almost all hyperinflations start this way.
- **inflation tax**:
- In the U.S., the inflation tax today accounts for less than 3% of total revenue.

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The Fisher Effect

- Rearrange the definition of the real interest rate:
- The real interest rate is determined by saving & investment in the loanable funds market.
-
- So, this equation shows how the nominal interest rate is determined.

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The Fisher Effect

- In the long run, money is neutral, so a change in the money growth rate affects the inflation rate but not the real interest rate.
- So, the nominal interest rate

- This relationship is called the **Fisher effect** after Irving Fisher, who studied it.

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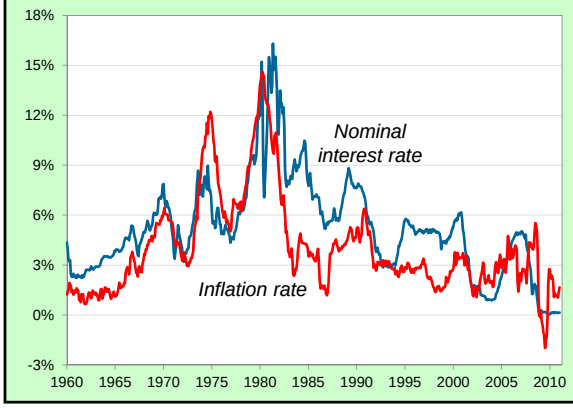
U.S. Nominal Interest & Inflation Rates, 1960–2011



The Fisher Effect & the Inflation Tax

Nominal interest rate	=	Inflation rate	+	Real interest rate

- The inflation tax applies to people's holdings of money, not their holdings of wealth.
- The Fisher effect: an increase in inflation causes an equal increase in the nominal interest rate, so the real interest rate (on wealth) is unchanged.

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The Costs of Inflation

- The inflation fallacy:
- But inflation is a general increase in prices of the things people buy and
- In the long run,

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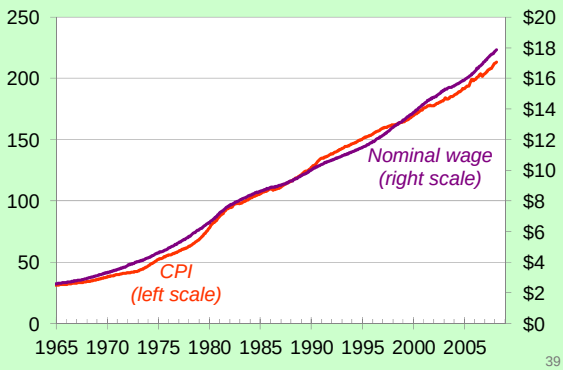
U.S. Average Hourly Earnings & the CPI



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The Costs of Inflation

- **Shoeleather costs**: the resources wasted when inflation encourages people to reduce their money holdings
- **Menu costs**:

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The Costs of Inflation

- **Misallocation of resources from relative-price variability**: Firms don't all raise prices at the same time, so relative prices can vary… which distorts the allocation of resources.
- **Confusion & inconvenience**: Inflation changes the yardstick we use to measure transactions. Complicates long-range planning and the comparison of dollar amounts over time.

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The Costs of Inflation

- **Tax distortions**:

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ACTIVE LEARNING 3

Tax distortions

You deposit $1000 in the bank for one year.

CASE 1: inflation = 0%, nom. interest rate = 10%

CASE 2: inflation = 10%, nom. interest rate = 20%

a. In which case does the real value of your deposit grow the most?

Assume the tax rate is 25%.

b. In which case do you pay the most taxes?

c. Compute the after-tax nominal interest rate, then subtract inflation to get the after-tax real interest rate for both cases.

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ACTIVE LEARNING 3

Answers

A Special Cost of Unexpected Inflation

- **Arbitrary redistributions of wealth**

Higher-than-expected inflation

Debtors get to repay their debt with dollars that aren't worth as much.

Lower-than-expected inflation

High inflation

So, these arbitrary redistributions are frequent when inflation is high.

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The Costs of Inflation

- All these costs are quite high for economies experiencing hyperinflation.
- For economies with low inflation (< 10% per year), these costs are probably much smaller, though their exact size is open to debate.

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CONCLUSION

- This chapter explains one of the Ten Principles of economics:

  Prices rise when the govt prints too much money.

- We saw that

- In later chapters, we will see that money has important effects in the short run on real variables like output and employment.

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