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Principles of
Macroeconomics
 Sixth Edition

17

**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?

1

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

2

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

3

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

4

Money Supply (MS)

§ In real world, determined by Federal Reserve,
the banking system, consumers.

§ In this model, we assume

5

Money Demand (MD)

§ Refers to

§ Depends on

§ Thus, quantity of money demanded is

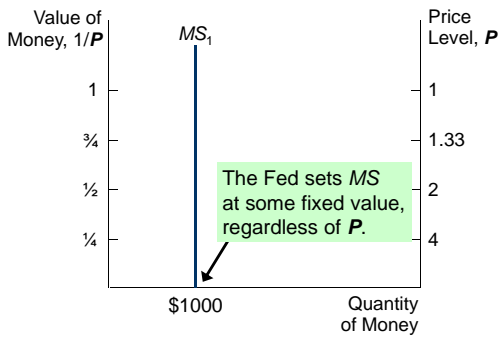
_____ related to the value of money

and _____ related to P , other things equal.

(These “other things” include real income, interest rates, availability of ATMs.)

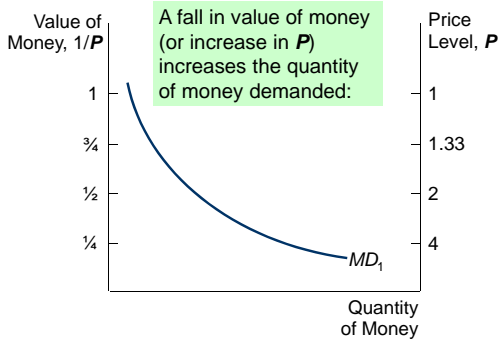
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The Money Supply-Demand Diagram



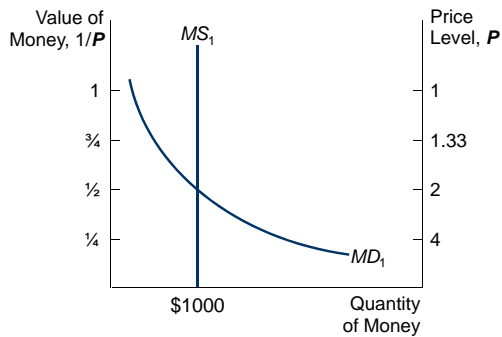
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The Money Supply-Demand Diagram



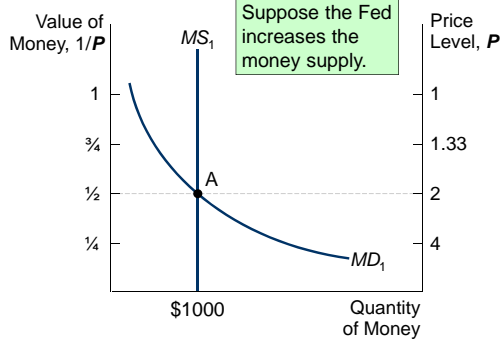
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The Money Supply-Demand Diagram



10

The Effects of a Monetary Injection



11

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.)

12

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)

13

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.

14

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:

15

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

16

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,

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

17

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.

18

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.

19

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:

20

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 =

21

ACTIVE LEARNING **1**

Exercise

One good: corn.

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

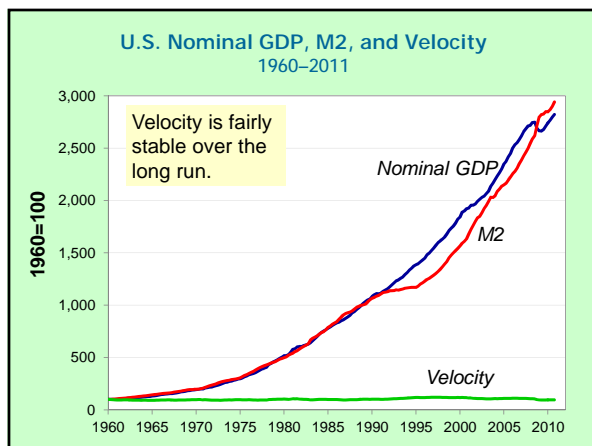
V is constant.

In 2008, $MS = \$2000$, $P = \$5/\text{bushel}$.

Compute nominal GDP and velocity in 2008.

ACTIVE LEARNING **1**

Answers



The Quantity Equation

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

§ Multiply both sides of formula by M :

§ Called the **quantity equation**

25

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.

26

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, $MS = \$2000$, $P = \$5/\text{bushel}$.

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.

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.***
- §

Hyperinflation in Zimbabwe

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



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

Sign posted in public restroom

32

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.

33

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.

34

The Fisher Effect

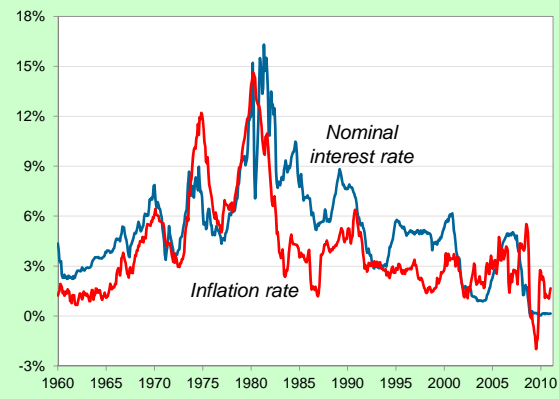
§ In the long run, money is neutral, so a change in the money growth rate affects the inflation rate but not the real interest rate.

§ So, the nominal interest rate

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

35

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



The Fisher Effect & the Inflation Tax

$$\text{Nominal interest rate} = \text{Inflation rate} + \text{Real interest rate}$$

§ 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.

37

The Costs of Inflation

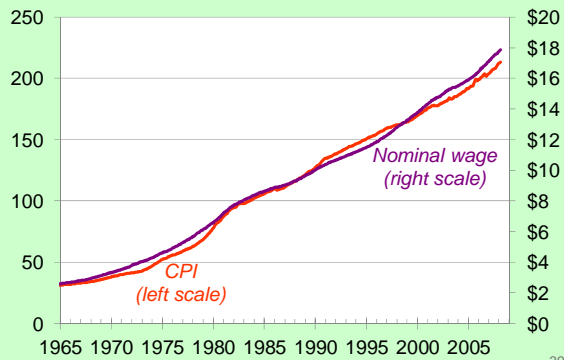
§ The inflation fallacy:

§ But inflation is a general increase in prices of the things people buy and

§ In the long run,

38

U.S. Average Hourly Earnings & the CPI



39

The Costs of Inflation

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

§ **Menu costs:**

40

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.

41

The Costs of Inflation

- § **Tax distortions:**

42

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.

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.

48

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.

49

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.

50
