Chapter 11 - *Money Growth and Inflation*

- *The Classical Theory of Inflation*
  - Inflation is an increase in the overall level of prices
  - Hyperinflation is an extraordinary high rate of inflation
  - Inflation: Historical Aspects
    - Over the past 60 years, the prices have risen on average about 4 percent a year
    - **Deflation** occurred in Canada in the twentieth century
      - meaning decreasing average prices
    - **Hyperinflation**
      - High rates of inflation
    - In the 1970s prices rose by 7 percent per year
    - During the 1990s, prices rose at an average rate of 2 percent per year
  - The **quantity theory of money** is used to explain the long-run determinants of the price level and the inflation rate
  - Inflation is an economy-wide phenomenon that concerns the value of the economy's medium of exchange
  - When the overall price level rises, the value of money falls

- **The Value of Money**

$$\text{P} = \text{Price Level}$$

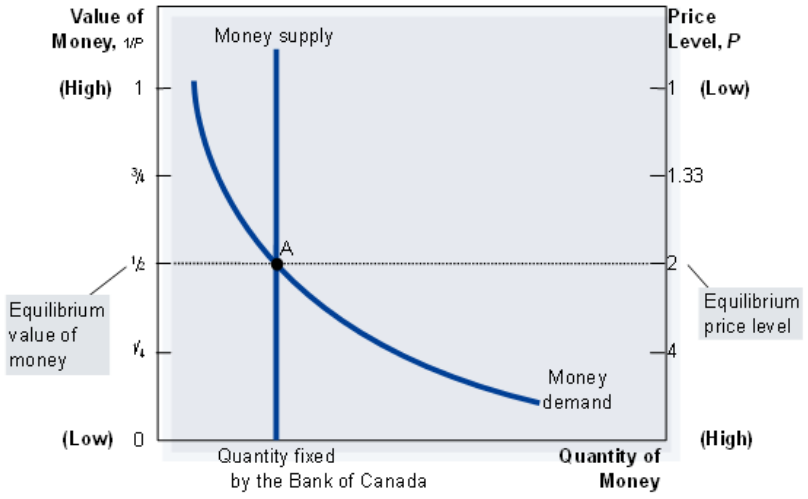
  - (*e.g. CPI of GDP*)
  - P is the price of the basket of goods, measured in money

$$\text{value of } \$1 = \frac{1}{\text{P}}$$

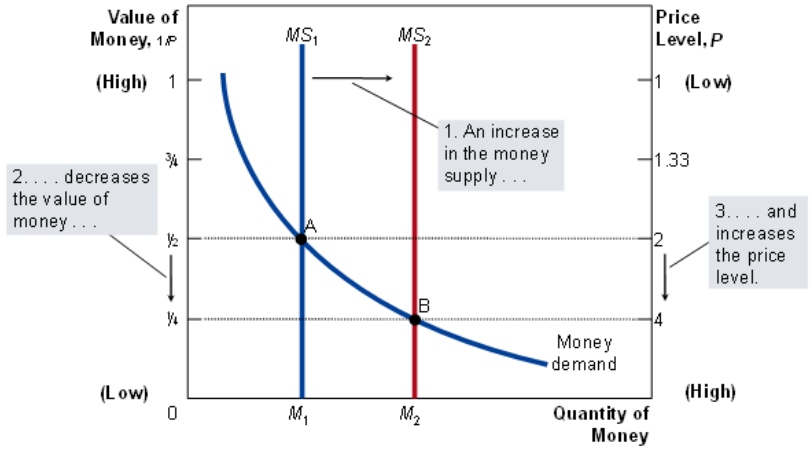
  - **Example**
    - Basket contains one candy bar
      - If P = $2, value of $1 = 1/2 of a candy bar
      - If P = $3, value of $1 = 1/3 of a candy bar
  - Inflation drives up prices, and down the value of money.

- *Money Supply & Demand, and Monetary Equilibrium*
  - Money supply is a policy variable that is controlled by the Bank of Canada
  - Through instruments such as open-market operations, the Bank of Canada controls the quality of money supplied
  - Money demand reflects how much wealth people want to hold in **liquid form**
    - Has several determinants, including interest rates and average level of prices in the economy
  - People hold money because it is the **medium of exchange**
    - Amount of money people chose to hold depends on the price of goods and services
  - In the long-run, the overall level of prices adjusts to the level at which the demand for money equals the supply

- *Monetary Equilibrium*



- *The Effects of a Monetary Injection*



- *The Quantity Theory of Money*
  - Developed by 18th century philosopher David Hume, and classical economists
  - Advocated in more recent years by Milton Friedman
  - Asserts that the quantity of money determines the value of money

- *Adjustment Process*
  - Increasing MS causes P to rise
  - People get rid of their excess money by spending it or by loaning it to others
    - Result: increased demand for goods
  - But supply of goods not increase, so the price must rise

- *Classical Dichotomy*
  - **Classical Dichotomy**
    - The theoretical separation of nominal and real variables
  - Hume and the classical economists suggested that monetary developments affect nominal variables, but not real variables
  - If central bank doubles the money supply, Hume & classical thinkers contend
    - All nominal variables - including prices - will double
    - All real variables - including relative prices - will remain unchanged

- *Real Versus Nominal Variables*

  - **Nominal Variables**
    - Are measured in monetary units
    - Examples
      - Nominal GDP
      - Nominal Interest Rates (*Rate of return measured in $*)
      - Nominal Wage (*$ per hour worked*)

  - **Real Variables**
    - Are measured in physical units
    - Examples
      - Real GDP
      - Real Interest Rate (*Measured in output*)
      - Real Wage (*Measured in output*)

  - Prices are normally measured in terms of money
    - Price of a compact disc - $15/CD
    - Price of pepperoni pizza - $10/Pizza
  - A **relative price** is the price of one good relative to another
    - Relative price of CDs in terms of pizza

$$\frac{\text{Price of CD}}{\text{Price of Pizza}} = \frac{\$15/\text{CD}}{\$10/\text{Pizza}} = 1.5 \text{ Pizzas per CD}$$

  - Relative prices are measured in physical units, so they are real variables

- *Real Versus Nominal Wages*
  - An important relative price is the real wage:

$$W = \text{Nominal Wage} = \text{Price of Labour}$$

$$P = \text{Price Level} = \text{Price of Goods and Services}$$

  - Real Wage is the price of labour relative to the price of output

$$\frac{W}{P} = \frac{\$15/\text{hour}}{\$5/\text{unit of output}} = 3 \text{ units output per hour}$$

- *The Neutrality of Money*
  - **Monetary Neutrality**
    - The proposition that changes in the money supply do not affect real variables in the long-run
  - Doubling money supply causes all nominal prices to double; what happens to relative prices

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

The relative price is unchanged.

$$\frac{\text{price of cd}}{\text{price of pizza}} = \frac{\$30/\text{cd}}{\$20/\text{pizza}} = 1.5 \text{ pizzas per cd}$$

  - Similarly, the real wage W/P remains unchanged, so
    - Quantity of labour supplied does not change
    - Quantity of labour demanded does not change
    - Total employment of labour does not change
  - The same applies to employment of capital and other resources
  - Since employment of all resources is unchanged, total output is also unchanged by the money supply
  - Most economists believe the classical dichotomy and neutrality of money describe the economy in the long-run

- *The Velocity of Money and the Quantity Equation*
  - **Velocity of Money**
    - The rate at which money changes hands
    - Notation:

$$\begin{aligned} P \times Y &= \text{nominal GDP} \\ &= (\text{price level}) \times (\text{real GDP}) \\ M &= \text{money supply} \\ V &= \text{Velocity} \end{aligned}$$

    - Velocity formula:

$$V = \frac{P \times Y}{M}$$

  - **Quantity of Money**
    - Quantity formula:

$$M \times V = P \times Y$$

- Quantity Theory in 5 Steps
  - Start with M x V = P x Y
  - **V** is stable
  - A change in **M** causes nominal GDP (**P x Y**) to change by the same percentage
  - A change in **M** does not affect **Y**: money is neutral, **Y** is determined by technology and resources
  - So, **P** changes by the same percentage as **P x Y** and **M**
  - Rapid money supply growth causes rapid inflation

- *Hyperinflation*
  - Hyperinflation is generally defined as inflation exceeding 50% a month
  - Prices rise when the government prints too much money
  - Excessive growth in money supply always causes hyperinflation

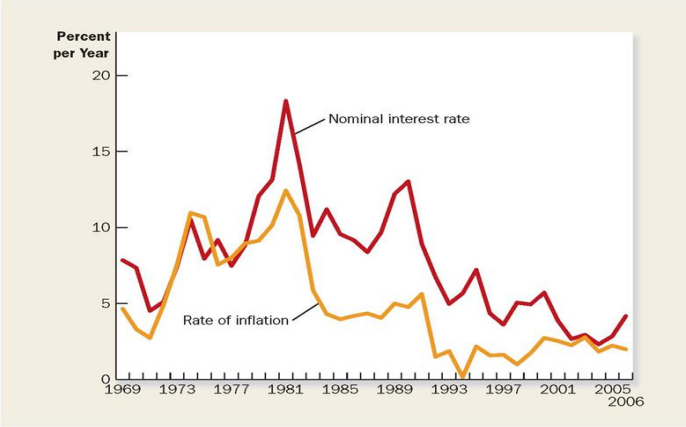
- *Inflation Tax*
  - When tax revenue is inadequate and ability to borrow is limited, government may print money to pay for its spending - most hyperinflations start this way
  - The revenue from printing money is the **inflation tax**
    - Printing money causes inflation, which is like tax on everyone who holds money
  - In Canada, the inflation tax accounts for less than 1% of total government revenue

- *The Fisher Effect*

$$\text{nominal interest rate} = \text{inflation rate} + \text{real interest rate}$$

  - Real interest rate is determined by saving and investment in the loanable funds market
  - Money supply growth determines inflation rate
  - This equation shows how the nominal interest rate is determined
  - In the long-run, money is neutral, so a charge in the money growth rate affects the inflation rate but not the real interest rate
  - **The Fisher Effect**
    - the nominal interest rate adjusts one-for-one with changes in the inflation rate

- *Nominal Interest*



- *Fisher Effect and Inflation Rate*
  - The inflation tax applies to people's holding of money, not their holdings of wealth
  - **Fisher Effect**
    - An increase in inflation causes an equal increase in the nominal interest rate, so the real interest rate, so the real interest rate (*on wealth*) is unchanged

- *Costs of Inflation*
  - **Inflation Fallacy**
    - Most people think inflation erodes real incomes
  - But inflation is a general increase in prices, of the things people buy and the things they sell (*e.g. their labour*)
  - In the long-run, real incomes are determined by real variables, not the inflation rate

  - **Shoeleather Costs**
    - The resources wasted when inflation encourages people to reduce their money holdings - the time and transactions costs of more frequent bank withdrawals
  - **Menu Costs**
    - The cost of changing prices - printing new menus, mailing new catalogs, etc.
  - **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 and Inconvenience**
    - Inflation changes the yardstick we use to measure transactions. Complicates long-range planning and the comparison of dollar amounts overtime
  - **Tax distortions**
    - Inflation makes nominal income grow faster than real income. Taxes are based on nominal income, and some are not adjusted for inflation. So, inflation causes people to pay more taxes even when their real incomes don't increase

- *How Inflation Raises Tax Burdens on Saving*

	Economy A (price stability)	Economy B (inflation)
Real interest rate	4%	4%
Inflation rate	0	8
Nominal interest rate (real interest rate + inflation rate)	4	12
Reduced interest due to 25 percent tax (.25 × nominal interest rate)	1	3
After-tax nominal interest rate (.75 × nominal interest rate)	3	9
After-tax real interest rate (after-tax nominal interest rate − inflation rate)	3	1

- *A Special Cost of Unexpected Inflation*
  - **Arbitrary Redistributions of Wealth**
    - Higher than expected inflation transfers purchasing power from creditors to debtors
      - Debtors get to repay their debt with dollars that rent worth as much
    - Lower than expected inflation transfers purchasing power from debtors to creditors
    - High inflation is more variable and less predictable than low inflation
  - These arbitrary redistributions are frequent when inflation is high

- *Cost of Inflation*
  - All of these costs are high for economies experiencing hyperinflation
  - For economies with low inflation (*< 10% per year*), these costs are probably much smaller, though the exact size is debatable