
Money & Inflation

A quick review and continuation from last week's class

EC121 – Intermediate Macroeconomics

Brown University

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The Quantity Theory of Money

- The quantity equation is expressed as:

$$M \times V \equiv P \times T$$

- M is quantity of money in the economy
 - V denotes the transactions velocity of money
 - The number of times a unit of currency changes hands in a given period of time
 - P is the price of a typical transaction
 - T is the total number of transactions in given period of time
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The Quantity Theory (Cont.)

- Example: A bread economy
 - Transactions: $T = 60$ loaves of bread / yr
 - Price: $P = \$0.50$ / loaf
 - Therefore dollar value of transactions is: $PT = \$30$ / yr
 - Suppose $M = \$10$
 - Then, V must be given by $PT/M = 3$ times / yr
 - Observe that the quantity equation is really an identity – it always holds true (tautology)
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The Quantity Theory (Cont.)

- The number of transactions (T) is difficult to measure but is directly related to aggregate output (Y) in an economy.
- In theory, the dollar value of transactions is equal to that of Y (or nominal GDP) so that:

$$P \times T = P \times Y$$

- The revised quantity equation is therefore:

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

which is an equation NOT an identity.

The Quantity Theory (Cont.)

- V is called the “income” velocity of money in the revised quantity equation
 - Real money balances is defined as M/P (i.e. the units of real stuff, like bread loaves, that can be purchased with money quantity M)
 - Implications of the revised quantity equation:
 - A one-for-one relationship between ‘demand’ for real money balances and output
 - A one-for-one relationship between inflation and the growth rate of money ‘supply’
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Demand for Real Money Balances

- Rearranging the quantity equation, the supply of real money balances is expressed as:

$$M / P = (1 / V) \times Y = k \times Y$$

- Let $(M/P)^d$ denote the demand for real money
- Equilibrium in the money market then implies:

$$(M / P)^d = k \times Y$$

- Thus, the demand for real money is:
 - Directly related to real output in the economy
 - Inversely related to the income velocity of money

Inflation

- Taking natural logarithms on the Quantity equation and differentiating w.r.t time yields:

$$\hat{M} + \hat{V} = \hat{P} + \hat{Y}$$

- Assuming that velocity remains constant and there is no output growth in horizon being considered:

$$\hat{M} = \hat{P}$$

- Thus, inflation (growth rate of P) has a one-for-one relationship with the growth rate of M – i.e. raising the money supply simply causes inflation
 - This result is called “Money Neutrality”

Interest Rates

- Real vs. Nominal Interest Rates
 - Nominal interest is the “money” value of interest on loans, i.e. the rate that a bank pays out as money
 - Real interest is just the “goods” value of interest on loans, i.e. the purchasing power of the nominal rate
- The Fisher equation which relates real and nominal interest rates via rate of inflation is:

$$i = r + \pi$$

where: $i \equiv$ nominal interest rate

$r \equiv$ real interest rate

$\pi \equiv$ rate of inflation

Interest Rates (Cont.)

- Implications of the Fisher equation:
 - A one-for-one relationship between inflation and the nominal rate of interest (the Fisher Effect)
 - Together with the quantity theory, a one-for-one relationship between money supply growth rate and the nominal rate of interest
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Interest Rates (Cont.)

- The actual rate of inflation which will prevail during the life of a loan contract is unknown at the time the contract is made.
- It is anticipated / expected inflation that pins down *ex ante* real interest rate at the time a loan contract is made:

$$r = i - \pi^e$$

- Rearrangement then yields the expectation augmented Fisher Equation: $i = r + \pi^e$
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Generalized Money Demand

- The opportunity cost of holding money
 - Money earns no interest
 - Alternatively, bonds earn the nominal interest i
 - The cost of holding money instead of bonds is therefore the forgone nominal interest i , which would otherwise have been earned.
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Generalized Money Demand (Cont.)

- Alternative way of deriving the cost of holding money
 - Bonds earn the real return of r
 - Money earns a real expected return of $-\pi^e$
 - Its real value declines at the expected rate of inflation
 - Holding money instead of bonds means giving up the difference between the two real returns which is just: $r - (-\pi^e) = r + \pi^e = i$ (the nominal interest)

Generalized Money Demand (Cont.)

- The demand for real money balances is thus determined by Y (via quantity theory) and by the nominal rate of interest i (via opportunity cost).
- This yields the generalized demand function for real money balances:

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

where: $L(.,.) \equiv$ the “Liquidity Preference” function

$$\frac{\partial L}{\partial i} < 0 \quad \text{and} \quad \frac{\partial L}{\partial Y} > 0$$