Chapter 11: Inflation, Money and interest rate

Two choices of investment:
(1) Saving money in a bank give the nominal interest rate, \( i \).
(2) Investing on the assets gives the real return, \( r \), and the price of the assets increase by \( \pi \). The total return of assets equals \( r + \pi \)

Thus, an arbitrage condition implies the Fisher equation:

\[ i = r + \pi \]

or, can be written as:

real interest rate = nominal interest rate - inflation rate

\[ r = i - \pi \]

- Note: an opportunity cost of holding money is a nominal interest rate
  - The opportunity cost of not invest = \( r \)
  - The value of cash depreciates = \( \pi \)
  - The total cost is \( r + \pi = i \)

- The real rate of interest on money
  - Notice: money does NOT give the nominal return \( (i = 0) \)
  - The real return: \( r = i - \pi = (0) - \pi = -\pi \)

Review:
- Budget constraint (2-period):
  \[ C_1 + \frac{C_2}{1 + i_1} = Y_1 + \frac{Y_2}{1 + i_1} + A_0 \]

- Budget constraint (3-period):
  \[ C_1 + \frac{C_2}{1 + i_1} + \frac{C_3}{(1 + i_1)(1 + i_2)} = Y_1 + \frac{Y_2}{1 + i_1} + \frac{Y_3}{(1 + i_1)(1 + i_2)} + A_0 \]

- Two effects of an increase in an interest rate:
  - Substitution effect: \( C_1 \downarrow \) and \( C_2 \uparrow \).
  - Income effect: \( C_1 \uparrow \) and \( C_2 \uparrow \).
  - Total effect: \( C_1(?) \) and \( C_2 \uparrow \).
• Permanent Income : The constant income, $V$, such that the life-time income equals the life-time permanent income.

$$V + \frac{V}{1 + i_1} + \frac{V}{(1 + i_1)(1 + i_2)} = Y_1 + \frac{Y_2}{1 + i_1} + \frac{Y_3}{(1 + i_1)(1 + i_2)}$$

• Permanent Income Hypothesis ($PIH$) : Consumptions depend only on the permanent income.

• Capital Utilization: $Y = AF(\kappa K, L)$

• Net capital income = $\frac{L}{P} \kappa - \delta(\kappa)$

  – Does NOT depend on the amount of capital, $K$.

• A change in an employment : $\triangle L = \phi U - \sigma L$

  – At steady state, $\triangle L = 0$ and $u^n = \frac{U}{U + L} = \frac{\sigma}{\sigma + \phi}$

• The reservation wage : the lowest real wage offer that an unemployed worker would accept.

• Money Demand : $M^d = P \cdot L(Y, i)$

• Real money demand : $\frac{M^d}{P} = L(Y, i)$

• The money demand for $T$ days = $\frac{1}{2} \cdot PCT \cdot T$

• The average money demand = $\frac{1}{2} \cdot \frac{PCT \cdot T}{T} = \frac{1}{2} \cdot PCT$

• The nominal cost of using money

  – An opportunity cost (an interest cost) = $\frac{1}{2} PCT i$

  – A transaction cost = $\frac{\gamma}{T}$

• The optimal $T^* = \sqrt{\frac{2\gamma}{PCi}}$

• The optimal average money demand = $M^d = \frac{1}{2} PCT = \frac{\sqrt{\gamma PC}}{2i}$

• The optimal average real money demand = $\frac{M^d}{P} = \frac{1}{2} CT = \frac{\sqrt{\gamma C}}{2Pi}$

• money is neutral : One time changes in the supply of money affect nominal variables like the price level, but do not affect real variables like real GDP, the real wage, $w/P$, and the real rental price of capital, $R/P$.

• Index bond : a bond whose cash flow is inflation-adjusted, by being linked to the purchasing power of a particular currency.

  – gives the real interest rate and adjust for the inflation

  – example: If $r = 3\%$ then an index bond pays $(3\% + \pi)$. 
Exercise

1. An increase in the transaction costs ______ the real money demand while an increase in the cost of making shopping trips (e.g. an increase in the cost of gasoline) ______ the real money demand.

2. Suppose that the interest rate is zero. Alexis makes $125 today, $75 tomorrow, $250 the day after, and then dies. What is her permanent income?

3. According to our model, if the government increases the money supply
   (a) Price will increase only
   (b) Price will increase, making consumption goods less attractive, and thus lowering consumption
   (c) Price will increase, raising the price of output, and thus stimulating labor supply to increase
   (d) No real or nominal variables will change, as money is neutral

4. Which of the following decreases the nominal demand for money?
   (a) An increase in the price level
   (b) An increase in the interest rate
   (c) An increase in the amount of consumption expenditures
   (d) An increase in the transactions costs of exchanging bonds for money.

5. Consider a worker with an annual income of $60000. Suppose he receives wage payments (of equal value) twice a month. Consumption spending is constant at $60000. Assume that he holds no bonds. That is, he holds all financial assets in the form of money.
   (a) If the worker shops 6 times each month, what is the average money balance? Make sure that you draw a clear graph
   (b) If he shops two times a month, what will his average money balance be? Make sure that you draw a clear graph.
   (c) What is the relationship between the frequency of shopping trips and average money balance.

6. A consumer lives for three years. (You need to assume that his goal in life is to smooth his consumption over time) He receives $20000 in the first year, $40,000 in the second year and $10,000 in the third year. The interest rate between the first and the second year is 10 while that between the second and the third is 15. What is his permanent income? What is his annual consumption? What is the amount that he saves (if any) in the first year?

7. Suppose that farmers experience a bumper crop say due to above-average weather conditions that unexpectedly increases current agricultural production (You may view this as a temporary parallel shift). The aggregate quantity of money does not change. Using two graphs, indicate what happens to aggregate output, $Y$; the interest rate $R$ and the price level $P$. 