Notes for Thursday, January 22, 2004

Announcements

Sandor’s Office Hours: Tuesday and Thursday 2:30-3:45 pm
By today you should have read Chapter 3, Sec 1-6.
- Read the rest of Chapter 3 for Tuesday.
- Study Questions: Ch 3 – Q6, Q9 and Q16
- Chapter 4 is on the web.

Problem set #1 is due today.
Problem set #2 goes out today. It is due: Tuesday, February 3, 2004

Inflation
  What is inflation?
  How is it measured?

Components of the Interest Rate
  Nominal interest rate = inflation and real interest rate
  Factors affecting real interest rate

Combining Interest Rates
  \[ i = (1 + r)(1 + k) - 1 \]

Nominal and Real Values
  Definitions

Deflating and Inflating
  Definitions
  Formulas

Key Facts and Rules for Financial Analyses with Inflation
**Inflation**

- *Inflation* is an increase in the average price level, reducing the purchasing power of the dollar.

- The *inflation rate* is the average annual rate of increase in the price of goods.

- Inflation is measured by a variety of indexes. The broadest and most commonly-used are the *consumer price index* (CPI) and the *producer price index* (PPI).
  

- The formula to calculate the inflation rate between two points in time, using the CPI, is:

  \[
  k = \left[ \frac{(t_2 - t_1)}{\sqrt[12]{\frac{CPI_{t_2}}{CPI_{t_1}}}} \right] - 1
  \]

**Example**

- The CPI was 38.8 in 1970 and 176.6 in 2002. What was the average inflation rate, as measured by the CPI, between 1970 and 2002?
Nominal vs. Real Interest Rates

L The nominal interest rate (sometimes simply called the nominal rate) is the interest rate that is quoted by banks, credit cards, stock brokers, etc.

• The nominal rate includes both the cost of capital and inflation.
• It is the rate you should use to discount actual, inflated future values (i.e., nominal future values).

L The real interest rate (also called the real rate) is the rate earned on a capital investment or a loan after accounting for inflation.

• Inflation has been removed from the real interest rate.
• The real interest rate should be used to discount future values that are expressed in current dollar values (i.e., real future values).
Components of the Interest Rate
(Or, Why Interest Rates Are Not All the Same.)

L nominal interest rate = inflation + real interest rate

L factors affecting the real interest rate:
- risk
- illiquidity
- time period
- transactions costs

• Each of these factors adds a premium to the pure interest rate.

L The pure interest rate is the real rate of return earned by an imaginary, risk-free, perfectly liquid, tax-free investment with no transactions costs and a very short time period.

• Why do interest rates vary over time?
Combining Interest Rates

L The basic formula expressing the mathematical relationship between the nominal interest rate, the real interest rate, and the inflation rate is:

\[(1 + i) = (1 + r)(1 + k)\]

L The basic formula can be solved for each of the three rates as a function of the other two:

\[i = (1 + r)(1 + k) - 1\]

\[r = \frac{(1 + i)}{(1 + k)} - 1\]

\[k = \frac{(1 + i)}{(1 + r)} - 1\]
Example

L If you wish to earn a real rate of at least 3% on an investment and you expect the inflation rate will be 4% during the investment period, what is the minimum the nominal rate you must earn?

Example

L If the nominal interest rate earned on an investment was 8% and the inflation rate was 3% during the investment period, what real rate was earned on the investment?
**Nominal and Real Values**

L A *nominal value* is a value expressed in the currency of the year in which the value occurs, i.e., a value that is expressed in dollars that have the purchasing power of dollars in the year when the value occurs.

L A *real value* is a value that is expressed in terms of dollars with the same purchasing power as dollars today, or at any other meaningful reference point in time.
Deflating and Inflating

Deflating is the process of converting a value expressed in the currency of a given point in time into a value with an equivalent amount of purchasing power expressed in the currency of an earlier time; for example, converting a value expressed in 2010 dollars to an equivalent value expressed in 2002 dollars.

Inflating is the process of converting a value expressed in the currency of a given point in time into a value with an equivalent amount of purchasing power expressed in the currency of a later time; for example, converting a value expressed in 2002 dollars to an equivalent value expressed in 2010 dollars.

Example of inflating using the CPI

A reasonable starting salary for a person graduating from college in 1948 was $4,000 per year. What would be an equivalent salary today? (Note: the CPI for 1948 is 24.1, and the CPI for 2002 (so far) is 176.6.)
Formulas for Deflating and Inflating

Deflating values using the inflation rate:

\[ V_n = (1 + k)^{-n} V_n^* = \frac{V_n^*}{(1 + k)^n} \]

Example

If inflation averages 3% per year between 2004 and 2010, what will be the real value, in $2004, of a nominal value of $1,000 in 2010?

Inflating values using the inflation rate:

\[ V_n^* = (1 + k)^n V_n \]

Example

You figure that you will need at least $450,000 in today’s dollars in savings to retire in comfort. If inflation averages 2.5% over the next 40 years, how much will you need in 2042 dollars to retire in comfort?
Key Facts and Rules for Financial Analyses with Inflation

L Real future values are uninflated; nominal future values are inflated.

L Converting a nominal future value into a real future value is an example of deflating.

L Converting a real future value to a nominal future values is an example of inflating.

L To convert real future values to nominal future values or vice versa, you must use the inflation rate.

L To discount real future values, use a real interest rate.

L To discount nominal future values, use a nominal interest rate.

L Compounding a present value with a real interest rate results in a real future value.

L Compounding a present value with a nominal interest rate results in a nominal future value.