

## Assignment 06

### 1. Problem 1

In the 1920 Eaton's catalogue, an oak chest of drawers costs \$32, including shipping. In 2020, this same chest of drawers, in good condition, costs \$1,800.

- (a) If the average rate of inflation over that period was 3%, what was the average real annual increase in the value of the furniture, adjusted for inflation? (Round to two decimal places: x.xx%.)
- (b) How much would the chest have cost in 2020, if its value had risen only by the average rate of inflation? Round to the nearest dollar.

(a)

$$\$32(F/P, i\%, 100) = \$1,800$$

$$i = 4.11\%$$

$$\text{Average real annual increase} = \text{Market interest rate} - \text{Inflation rate}$$

$$\rightarrow 4.11\% - 3\% = 1.11\%$$

(b)

$$32(F/P, 3\%, 100) = \$615$$

## 2. Problem 2

Pollution control equipment must be purchased to remove the suspended organic material from liquid being discharged from a vegetable packing plant. Two different pieces of equipment are available that would accomplish the task. A Filterco unit costs \$7,200, will cost \$1,300 per year to operate in the first year of operation, and has a five-year useful life. A Duro unit, on the other hand, costs \$16,000, will cost \$1,000 per year to operate in the first year of operation, but will have a 10-year useful life. The Duro unit will also have a salvage value of \$500.

Equipment purchase costs are expected to rise at 6% per year due to inflation for the next 10 years. Therefore, when the Filterco unit needs to be replaced, the cost will be higher than the original purchase cost.

Operating costs for both pieces of equipment are also expected to rise by 4% per year, due to increases in electricity costs.

Assume you will borrow money to pay for the equipment, at a borrowing interest rate of 5% (which you should use as the discount rate). Calculate the NPW of each option. Which piece of pollution control equipment should be purchased? Show your calculations, and round each NPW to the nearest dollar.

Analysis Period: 10 years → Buy 2 Filterco or 1 Duro unit

**Filterco:**

*Future Replacement Cost of Unit* :  $\$7,200(F/P, 6\%, 5) = \$9,635$

*Present Replacement Cost* :  $\$9,635(P/F, 5\%, 5) = \$7,549$

*Operation Cost* :  $\$1,300(P/A, g = 4\%, 5\%, 10) = \$11,864$

TOTAL:  $\$7,200 + \$7,549 + \$11,864 = \$26,613$

**Duro:**

*Salvage Value* :  $\$500(P/F, 5\%, 10) = \$307$

*Operation Cost* :  $\$1,000(P/A, g = 4\%, 5\%, 10) = \$9,126$

TOTAL:  $\$16,000 + \$307 + \$9,126 = \$25,433$

Choose the Duro unit.

## 3. Problem 3

Sam bought a house for \$150,000 with some creative financing. The bank, which agreed to lend Sam \$120,000 for six years at 15% interest, took a first mortgage on the house. The Joneses, who sold Sam the house, agreed to lend him the remaining \$30,000 for six years at 12% interest. They received a second mortgage on the house. Thus Sam became the owner without paying any cash at the beginning. He pays \$2,100 a month on the first mortgage and \$400 a month on the second mortgage. In both cases these are “interest-only” loans, and the principal is due at the end of the loan.

Right away, Sam rented the house to a different couple. After receiving their monthly rent and paying the taxes, insurance, and so on, he needed to pay \$1,200 a month of his own money to cover the remainder of the monthly mortgage payments. At the end of three years, Sam sold the house for \$205,000. After paying off all costs (such as the two loans and the real estate broker), he had \$55,000 left. (Ignore taxes for this problem.)

- (a) What rate of return did Sam receive on this investment (rounded to 1 decimal point)?
- (b) After an 6% annual inflation rate is taken into account, what was his rate of return (same rounding)?

(a)

$$\text{Present Cash Outflow} : \$1,200(P/A, i\%, 12 \times 3)$$

$$\text{Present Terminal Cash Flow} : \$55,000(P/F, i\%, 12 \times 3)$$

$$\text{Present Cash Outflow} = \text{Present Terminal Cash Flow}$$

$$\$1,200(P/A, i\%, 12 \times 3) = \$55,000(P/F, i\%, 12 \times 3)$$

$$i\% = 1.3\%$$

$$\text{Rate of Return} : (1 + 1.3\%)^{12} - 1 = 17.2\%$$

(b)

$$i' = \frac{i - f}{1 - f} = \frac{17.2\% - 6\%}{1 + 6\%} = 10.6\%$$

## 4. Problem 4

Future inflation forecasts have been issued for the next 15 years. General price inflation is estimated to be 5% for the next five years, 3.8% in the five years after that, and 3% in the following five years. Suppose you invest \$10,000 today and will earn 4.2% interest per year, compounding the interest annually for those 15 years.

- (a) How much money will be in your investment account in 15 years, rounded to the nearest dollar?
- (b) What will the real value of that investment be in 15 years, adjusting for the nasty bite of inflation?
- (c) What will the real average annual growth rate of your investment be, over the 15 years (rounded to one decimal place)?

(a)

$$\$10,000(F/P, 4.2\%, 15) = \$18,536$$

(b) First Five Years:

$$\text{Real Interest Rate : } 4.2\% - 5\% = -0.8\%$$

$$\text{Real Value of Investment After Five Years : } \$10,000(F/P, -0.8\%, 5) = \$9,606$$

Middle Five Years:

$$\text{Real Interest Rate : } 4.2\% - 3.8\% = 0.4\%$$

$$\text{Real Value of Investment After Ten Years : } \$9,606(F/P, 0.4\%, 5) = \$9,800$$

Last Five Years:

$$\text{Real Interest Rate : } 4.2\% - 3\% = 1.2\%$$

$$\text{Real Value of Investment After 15 Years : } \$9,800(F/P, 1.2\%, 5) = \underline{\$10,402}$$

(c)

$$\$10,000(F/P, r\%, 15) = \$10,402$$

$$r = 0.3\%$$