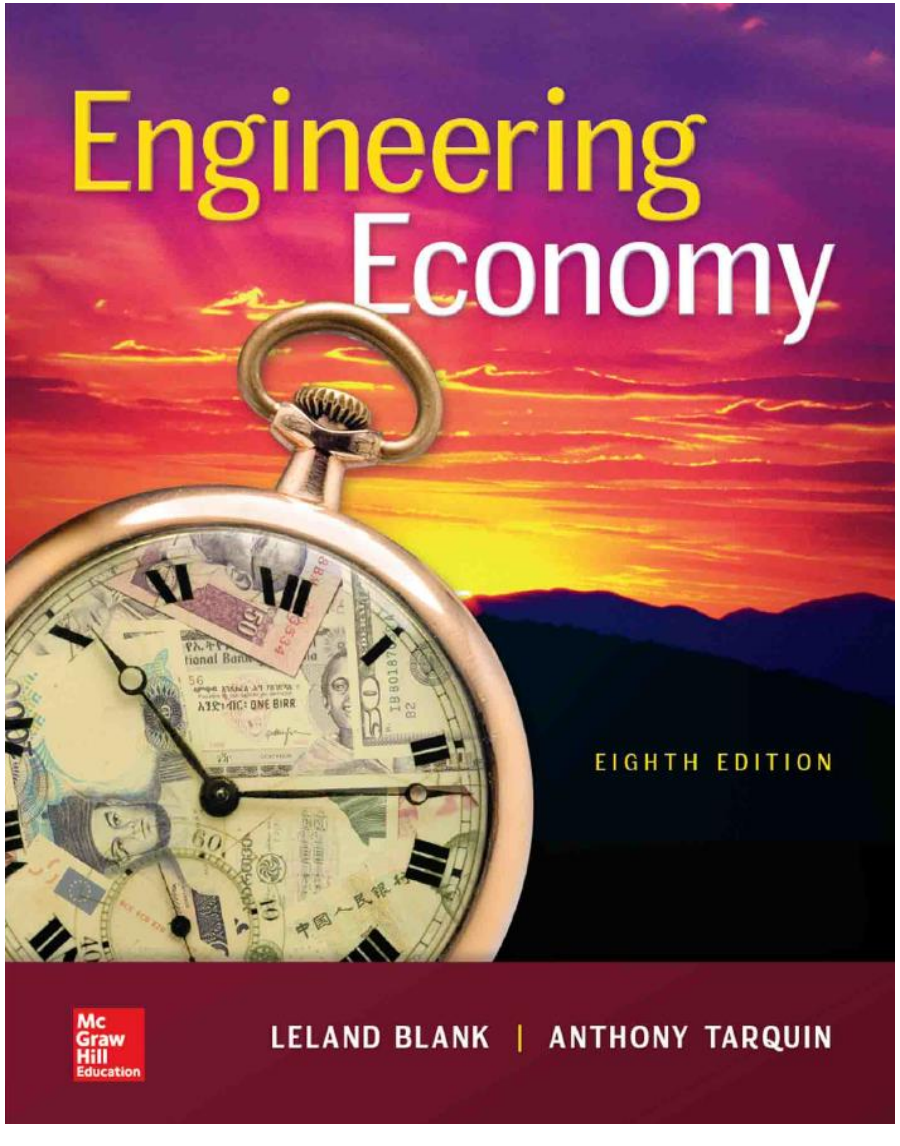

Chapter 14

Effects of Inflation

Lecture slides to accompany

Engineering Economy

8th edition

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LEARNING OUTCOMES

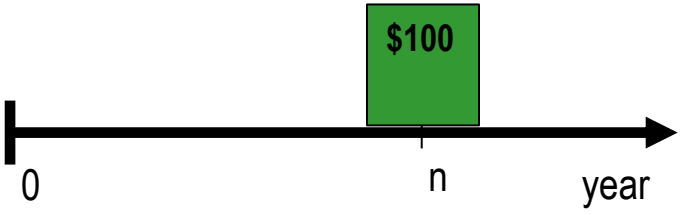
1. Understand inflation/deflation
2. Calculate PW of cash flows with inflation
3. Calculate FW with inflation considered
4. Calculate AW with inflation considered

Understanding Inflation

Actual $ vs. Constant $

- **Actual $** : expressed in the amount of _____ that you are expected to have at year n
- **Constant $** : expressed in the amount of _____ _____ as of year __ that you are expected to have at year n

$100(Actual)



$100(Constant)

+

Constant $

Could be purchased with  at year 0

Convert

+

Conversion from Constant $ to Actual $

(Inflation, f = 5%)

Period	NCF **Constant $**	Conversion Factor	NCF in **Actual $**
0	-$250.00	(1+0.05)^0	-$250.00
1	$100.00	(1+0.05)^1	$105.00
2	$100.00	(1+0.05)^2	$110.25
3	$100.00	(1+0.05)^3	$115.76
4	$100.00	(1+0.05)^4	$121.55
5	$100.00	(1+0.05)^5	$127.63

Understanding Inflation

Inflation: _____ in amount of money needed to purchase ____ *amount* of goods or services. **Inflation results in a**_____ ***in purchasing power, i.e., one unit of money buys*** _____ *goods or services*

Two ways to work problems *when considering inflation: (Fig. 14-1)*

(1) Convert to **constant value** (CV) dollars, then use real rate *i*.

If *f* = inflation rate (% per year), the equation is:

$$\text{Constant \$} = \frac{Actual\ \$}{(1+f)^n}, \quad \therefore \text{PV} = \frac{Constant\ \$}{(1+i)^n} = \frac{Actual\ \$}{(1+f)^n \times (1+i)^n}$$

(2) Leave money amounts ***as is*** and use ***interest rate adjusted for inflation,*** $i_f = i + f + (i)(f)$, $\therefore$ PV = $= \frac{Actual\ \$}{(1+i+f+i \cdot f)^n}$

Example: Constant Value Dollars

How much would be *required today* to purchase an item that increased in cost by exactly the inflation rate? The cost 30 years ago was $1,000 and inflation has consistently averaged 4% per year.

Solution: Solve for future dollars

$$\text{Future dollars} = \text{constant value dollars}(1 + f)^n$$
$$= 1{,}000(1 + 0.04)^{30}$$
$$= \mathbf{\$3{,}243}$$

Note: This calculation only accounts for the _____ *purchasing power of the currency*. It does ***not*** take into account the ***time value of money*** (to be discussed)

Deflation: Opposite of inflation; purchasing power of money is _____ in future than at present; however, money, credit, jobs are 'tighter'

Three Different Rates

- Real or inflation-free rate *i* – Rate at which interest is earned when *effects of inflation are* _____ ; *i* represents the real increase in purchasing power

- Market or inflation-adjusted rate i_f – Rate that *takes* _____ *into account.* Commonly stated rate everyday

- Inflation rate *f* – Rate of *change in value of currency*

Relation between three rates is derived using the relation

$$P = F\frac{1}{(1+i_f)^n} = F(P/F,i_f,n)$$

_____ rate is: $i_f = i + f + (i)(f)$

Example: Market vs. Real Rate

Money in a medium-risk investment makes a guaranteed **8%** per year. Inflation rate has averaged **5.5%** per year. What is the real rate of return on the investment?

Solution: Solve for the real rate i in relation for i_f

$$i_f = i + f + (i)(f)$$

$$i = \frac{i_f - f}{1 + f}$$

$$= \frac{0.08 - 0.055}{1 + 0.055}$$

$$= 0.024$$

Investment pays only _____% per year in real terms vs. the stated 8%

PW Calculations with Inflation

Two ways to account for inflation in PW calculations

(1) Convert cash flow into *constant-value* (___) *dollars* and use regular i

where: CV = future dollars/$(1 + f)^n$ = then-current dollars/$(1 + f)^n$

f = inflation rate

(**Note:** *Calculations up to now have assumed constant-value dollars*)

(2) Express cash flow in *future (_____) dollars* and use inflated interest rate where $i_f = i + f + (i)(f)$

(**Note:** *Inflated interest rate is the market interest rate*)

Example: PW with Inflation

A honing machine will have a cost of $25,000 (future cost) six years from now. Find the PW of the machine, if the real interest rate is 10% per year and the inflation rate is 5% per year using (a) constant-value dollars, and (b) future dollars.

Solution: (a Determine _____ dollars and *use i* in PW equation

$$\mathbf{CV} = 25{,}000 / (1 + 0.05)^6 = \$18{,}655$$

$$\mathbf{PW} = 18{,}655(P/F,10\%,6)$$
$$= \$10{,}530$$

(b) Leave as _____ dollars and *use* i_f in PW equation

$$\mathbf{i_f} = 0.10 + 0.05 + (0.10)(0.05) = 15.5\%$$

$$\mathbf{PW} = 25{,}000(P/F,15.5\%,6)$$
$$= \$10{,}530$$

FW Calculations with Inflation

FW values can have *four different* interpretations

(1) The *actual amount accumulated*

✓ Use i_f in FW equation → **FW = PW(F/P, i_f, n)**

(2) The *purchasing power* in terms of CV dollars *of the future amount*

✓ Use i_f in FW equation and divide by $(1+f)^n$ or **use real *i***

where real i = $(i_f - f)/(1 + f)$ → **FW = PW(F/P,i,n)**

(3) The *number of future dollars required to have the same purchasing power* as a dollar today with no time value of money considered

✓ Use *f* instead of *i* in F/P factor → **FW = PW(F/P,f,n)**

(4) The amount required to *maintain the purchasing power of the present sum **and** earn a stated real rate of return*

✓ Use i_f in FW equation → **FW = PW(F/P, i_f, n)**

Example: FW with Inflation

An engineer invests $15,000 in a savings account that pays interest at a real 8% per year. If the inflation rate is 5% per year, determine (a) the amount of money that will be accumulated in 10 years, (b) the purchasing power of the accumulated amount (in terms of today's dollars), (c) the number of future dollars that will have the same purchasing power as the $15,000 today, and (d) the amount to maintain purchasing power and earn a real 8% per year return.

Solution:

(a) The *amount accumulated* is a function of the *market interest rate*, i_f

$$i_f = 0.08 + 0.05 + (0.08)(0.05) = 13.4\%$$

Amount Accumulated = 15,000(F/P,13.4%,10)

= **$52,750**

Example: FW with Inflation (cont'd)

(b) To find the *purchasing power* of the accumulated amount *deflate* the inflated dollars

Purchasing power = 15,000(F/P,13.4%,10) / $(1 + 0.05)^{10}$
= **$32,384**

(c) The number of future dollars required to purchase goods that cost $15,000 now is the inflated cost of the goods

Number of future dollars = 15,000(F/P,5%,10)
= **$24,434**

(d) In order to maintain purchasing power *and* earn a real return, money must grow by the inflation rate ***and*** the interest rate, or i_f = 13.4%, as in part (a)

FW = 15,000(F/P,13.4%,10)
= **$52,750**

Capital Recovery with Inflation

The A/P and A/F factors require the use of i_f when inflation is considered

If a small company invests $150,000 in a new production line machine, how much must it receive each year to recover the investment in 5 years? The real interest rate is 10% and the inflation rate is 4% per year.

Solution: Capital recovery (CR) is the AW value

$$i_f = 0.10 + 0.04 + (0.10)(0.04) = 14.4\%$$

$$CR = AW = 150{,}000(A/P,14.4\%,5)$$

$$= \$44{,}115 \text{ per year}$$

Summary of Important Points

- **Inflation occurs because _____ *of currency has changed***
- **Inflation _____ purchasing power; one unit buys less goods or services**
- **Two ways to account for inflation in economic analyses:**
  (1)Convert all cash flows into _____-value dollars and use i
  (2)Leave cash flows as inflated dollars and use _____
- During _____, purchasing power of money is ***greater*** in future than at present
- **Future worth values can have *four different interpretations,*** requiring different interest rates to find FW
- ***Use*** **___ in calculations involving A/P or A/F when inflation is considered**

HOMEWORK

1. Please solve every Examples in your textbook. You do not have to submit your works.

2. Please upload following “PROBLEMS” solution file on “Assignment” menu in e-Class.
   - ① 14.29
   - ② 14.41
   - ③ 14.56
   - ④ 14.67