ISE 220
Engineering Economics

Ch. 4
Equivalence Calculations Under Inflation

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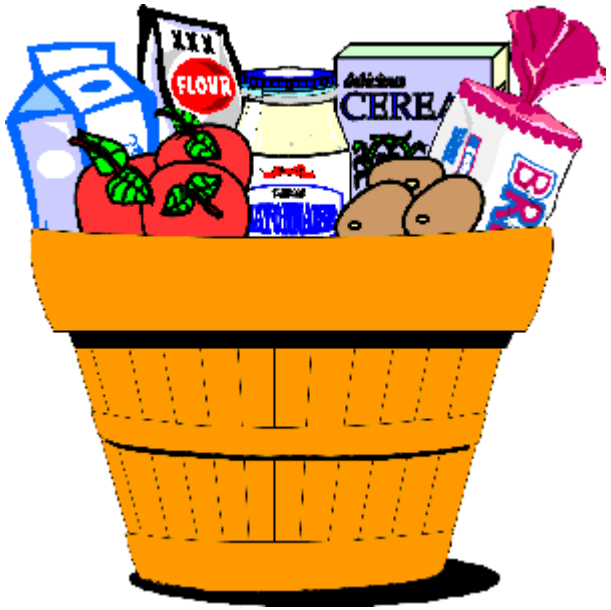
Agenda

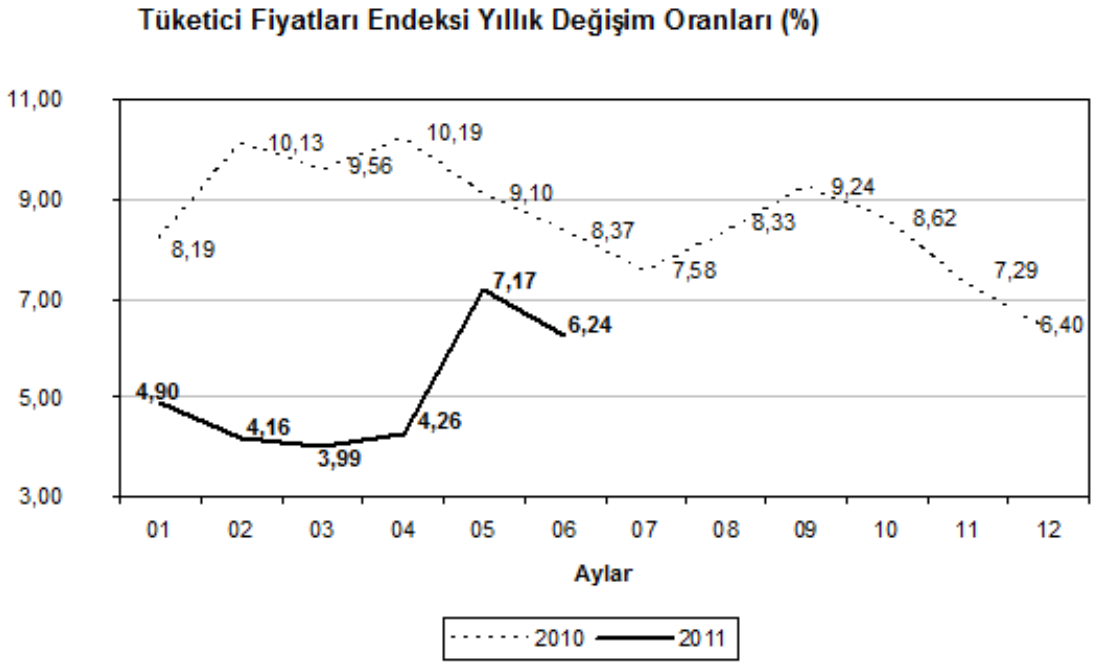
- Measure Of Inflation
  - Consumer – Producer Price Index
- Actual & Constant $ or TL
- Equivalence Calculations
  - Market interest rate – Inflation Free Interest Rate
  - Constant $-TL analysis
  - Actual $-TL analysis
  - Mixed $-TL analysis

Measure Of Inflation (Deflation)

- CPI (TUFE)
  Consumer Price Index
- PPI (UFE)
  Producer Price Index

Product Basket



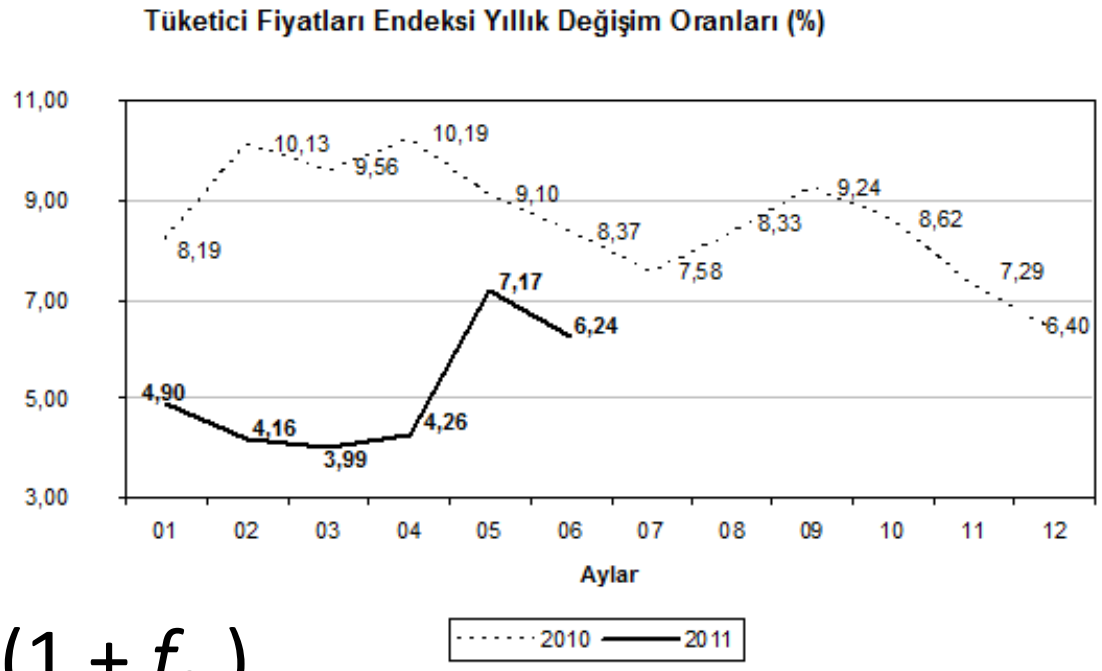


Average Inflation Rate

$f_{2009} = 8.19\%$

$f_{2010} = 4.90\%$

$f_{Av} = ??$



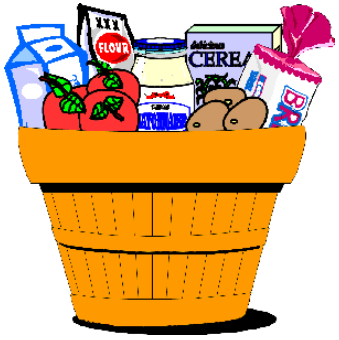
$$(1 + f_{Av})^2 = (1 + f_1)(1 + f_2)$$

$f_{total} = = CPI_2/CPI_1$

2011 - Jan / 2009 – Jan

For 2 Years

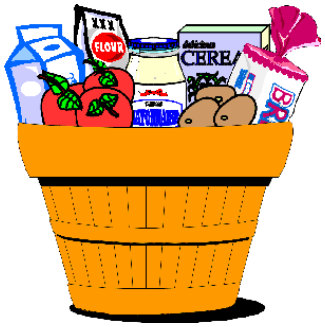
Average Inflation Rate



2001
Year 0

Value = 1000

P



2011
Year 10

Value = 2400

F

$$F = P(1+f)^{10}$$

$$f = (F/P)^{1/10} - 1 = 9.14935\%$$

Specific Inflation Rate

2001
Year 0

Value = 1000

P

2011
Year 10

Value = 3000

F

$$F = P(1+f)^{10}$$

$$f = (F/P)^{1/10} - 1 = 11.61232\%$$

Actual versus Constant $ or TL

If the average inflation rate is estimated as 8% what will be the value of 1000 constant dollars after 3 years in

- Constant dollars
- Actual dollars

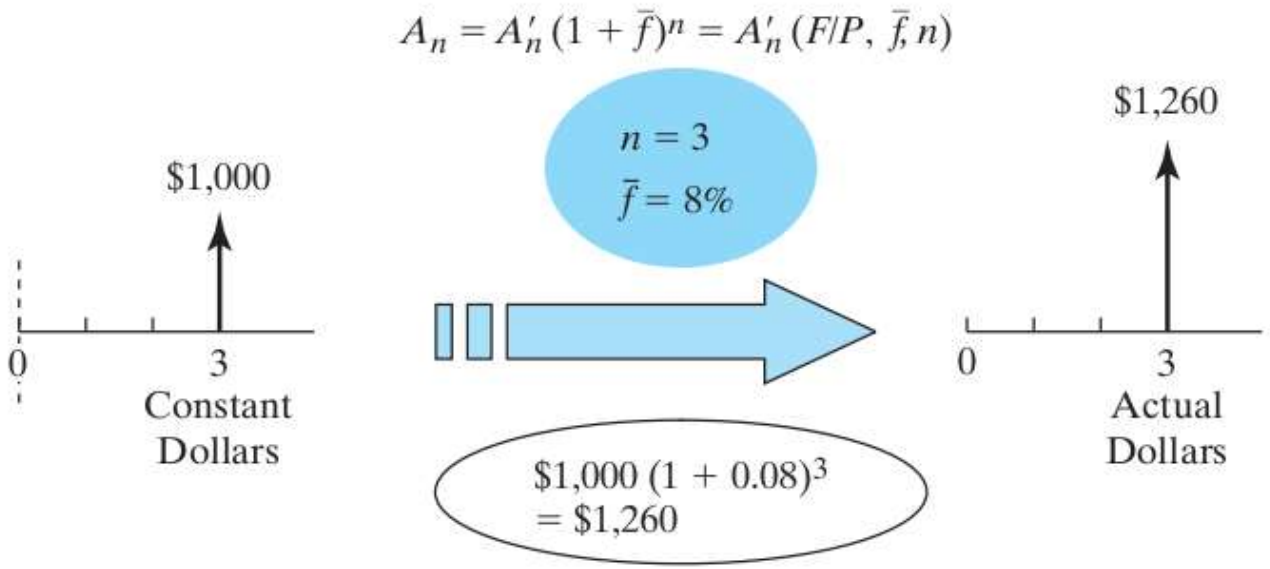
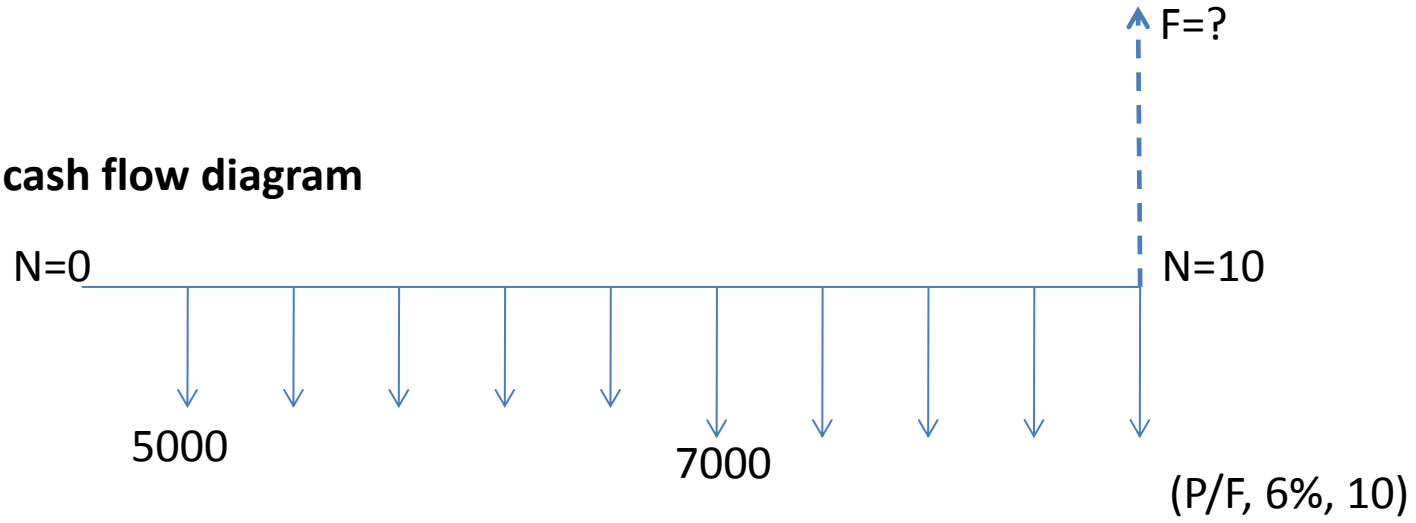


Figure 4.3 Conversion from constant to actual dollars

Convert the FV to Constant $

Suppose that you are working in US and deposit in a bank which says have interest rate of 12% / year. If you deposit $5000 each year for the first five years, and $7000 for the second five years, how much money will you have at the end of ten years **in Constant dollars if average inflation rate is estimated as 6%?**

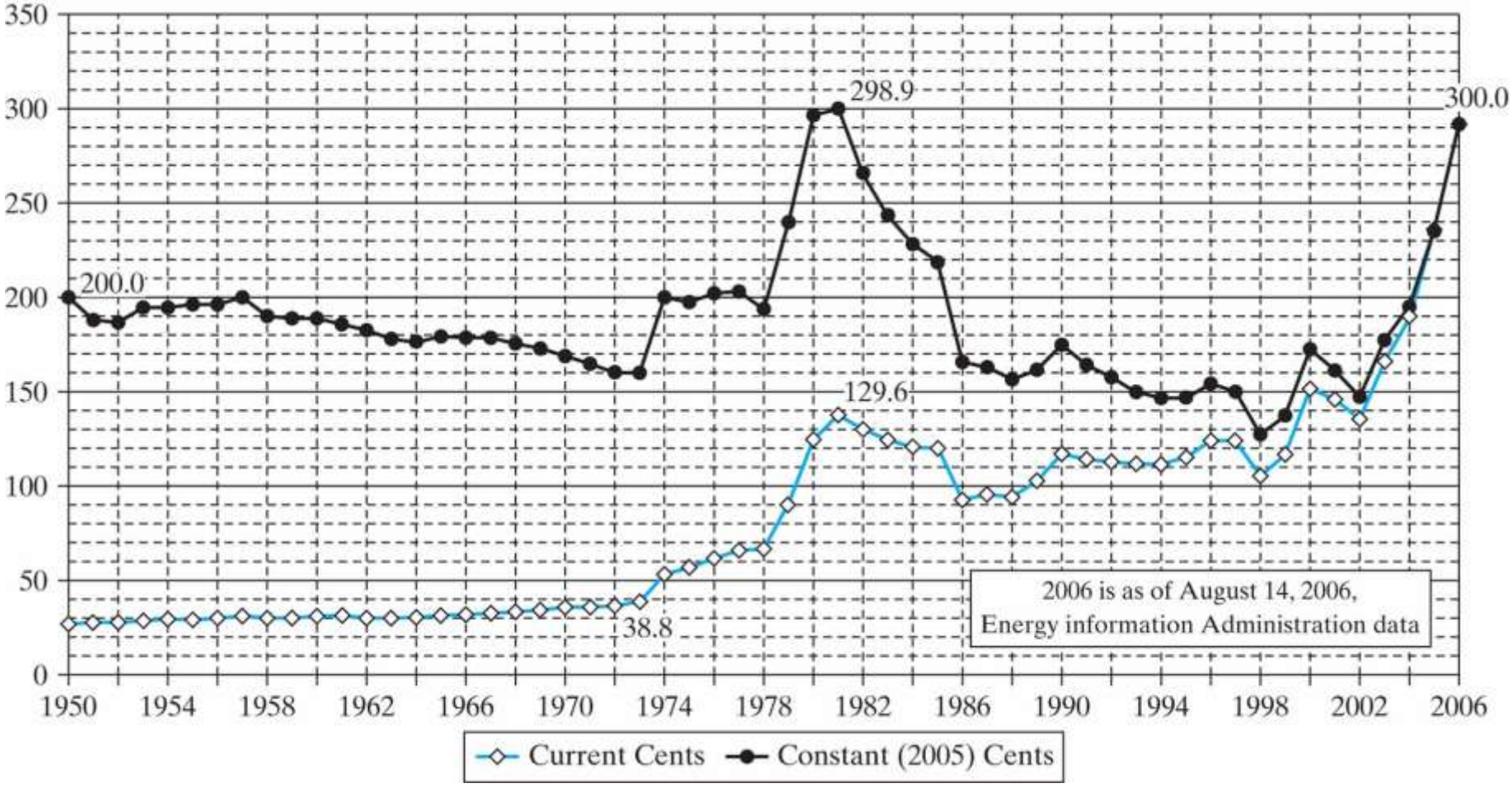
1. Draw cash flow diagram



2. Dissect into notation

$$F = [5000(F/A, 12\%, 10) + 2000(F/A, 12\%, 5)] / (1 + 0.06)^{10}$$

Diagramming with Constant $



Equvalence Calculations with Inflation Free Interest Rate

$$i' =\sim i - f$$

$$i' = (i - f) / (1 + f)$$

$$P_n = \frac{A_n}{(1+i)^n}$$

$$\frac{A_n}{(1+i)^n} = \frac{A_n}{[(1+\bar{f})\,(1+i')]^n}$$

$$(1+i) = (1+\bar{f})(1+i')$$

$$= 1 + i' + \bar{f} + i'\,\bar{f}$$

$$i = i' + \bar{f} + i'\,\bar{f}$$

$$P_n = \frac{\dfrac{A_n}{(1+\bar{f})^n}}{(1+i')^n}$$

Step 1

Step 2

$$= \frac{A_n}{(1+\bar{f})^n\,(1+i')^n}$$

$$= \frac{A_n}{[(1+\bar{f})\,(1+i')]^n}$$

Equivalence Calculations Under Inflation

Constant-Dollar and Actual-Dollar Analysis

Ex. 4.6.

Chena Hot Springs Resort built the very first ice museum in the United States. Chena is located 60 miles (100 km) northeast of Fairbanks, Alaska, which is the traditional world capital of ice art. To save the cooling cost for the ice museum in 2011, Chena installed an absorption chiller, which requires 148 HP (horsepower) to operate. This saves $244,560 in fuel costs per year at the 2011 diesel fuel price of $4.11 per gallon. The expected life of the plant is 15 years, and the diesel price is expected to increase at an annual rate of 5% during the life of operation of the absorption chiller. If Chena's market interest rate is 12%, which would account for the expected general inflation rate of 3% during this project period, what is the value of installing the absorption chiller in 2011 dollars? In solving this problem, we demonstrate that we will obtain the same result whether we use the constant-dollar analysis or the actual-dollar analysis.

Equivalence Calculations Under Inflation

Constant-Dollar and Actual-Dollar Analysis

$$g = \frac{1 + 0.05}{1 + 0.03} - 1 = 1.94\%$$

Inflation free Diesel price increase

Constant $

$i' = (i - f) / (1 + f)$ = 0.12 – 0.03 / 1 + 0.03 = 0.087378

Inflation free interest

P= 249.309 (P/A1, g, i', 15) = $2,275,096.-

1.94% increase of A in year 1

Real $

g = 0.05

i = 0.12

P= 256.788(P/A1, g, i, 15) = $2,275,096.-

5% increase of A in year 1

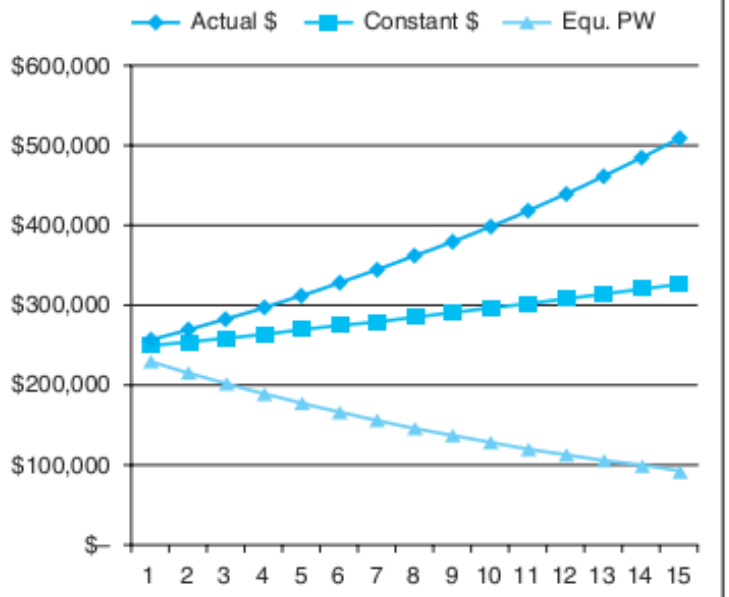
Equivalence Calculations Under Inflation

Constant-Dollar and Actual-Dollar Analysis

Constant $

TABLE 4.2 An Excel Worksheet to Perform a Constant-Dollar Analysis

	A	B	C	D	E	F	G	H	I	J	K	L
1												
2		Input				Output						
3												
4	(*i*) Market interest rate (%)			12%		(*i'*) Inflation-free interest rate (%)						8.738%
5	(*f*) General inflation rate (%)			3%		(*P*) Present worth ($)						$ 2,275,096
6	(*fj*) Inflation rate for diesel fuel (%)			5%								
7	(*A*1) Fuel savings in year 1 (constant $)			$ 244,560								
8												
9		Fuel savings	Fuel savings	Present								
10	Period	in Actual $	in Constant $	worth								
11												
12	0											
13	1	$ 256,788	$ 249,309	$ 229,275								
14	2	$ 269,627	$ 254,150	$ 214,945								
15	3	$ 283,109	$ 259,085	$ 201,511								
16	4	$ 297,264	$ 264,115	$ 188,917								
17	5	$ 312,127	$ 269,244	$ 177,109								
18	6	$ 327,734	$ 274,472	$ 166,040								
19	7	$ 344,120	$ 279,801	$ 155,663								
20	8	$ 361,327	$ 285,234	$ 145,934								
21	9	$ 379,393	$ 290,773	$ 136,813								
22	10	$ 398,362	$ 296,419	$ 128,262								
23	11	$ 418,281	$ 302,175	$ 120,246								
24	12	$ 439,195	$ 308,042	$ 112,730								
25	13	$ 461,154	$ 314,024	$ 105,685								
26	14	$ 484,212	$ 320,121	$ 99,079								
27	15	$ 508,423	$ 326,337	$ 92,887								
28												



=$D$7*(1+$D$6)^A27

=B27*(1+$D$5)^(-A27)

=C27*(1+$L$4)^(-A27)

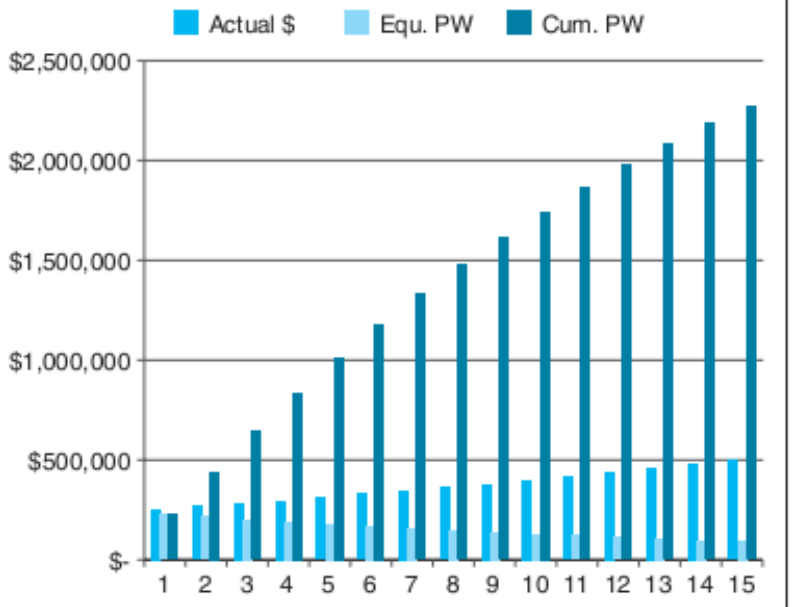
Equivalence Calculations Under Inflation

Constant-Dollar and Actual-Dollar Analysis

Real $

TABLE 4.3 An Excel Worksheet to Perform an Actual-Dollar Analysis

	A	B	C	D	E	F	G	H	I	J	K	L
1												
2		Input							Output	=(D4-D5)/(1+D5)		
3												
4	(*i*) Market interest rate (%)			12%		(*i'*) Inflation-free interest rate (%)						8.738%
5	(*f*) General inflation rate (%)			3%		(*P*) Present worth ($)						$ 2,275,096
6	(*fj*) Inflation rate for diesel fuel (%)			5%								
7	(*A*1) Fuel savings in year 1 (constant $)			$ 244,560								
8												
9		Fuel savings	Equivalent	Cum.								
10	Period	in Actual $	Present Worth	PW								
11												
12	0											
13	1	$ 256,788	$ 229,275	$ 229,275								
14	2	$ 269,627	$ 214,945	$ 444,220								
15	3	$ 283,109	$ 201,511	$ 645,732								
16	4	$ 297,264	$ 188,917	$ 834,648								
17	5	$ 312,127	$ 177,109	$ 1,011,758								
18	6	$ 327,734	$ 166,040	$ 1,177,798								
19	7	$ 344,120	$ 155,663	$ 1,333,461								
20	8	$ 361,327	$ 145,934	$ 1,479,394								
21	9	$ 379,393	$ 136,813	$ 1,616,207								
22	10	$ 398,362	$ 128,262	$ 1,744,469								
23	11	$ 418,281	$ 120,246	$ 1,846,715								
24	12	$ 439,195	$ 112,730	$ 1,977,445								
25	13	$ 461,154	$ 105,685	$ 2,083,130								
26	14	$ 484,212	$ 99,079	$ 2,182,209								
27	15	$ 508,423	$ 92,887	$ 2,275,096								
28												



=$D$7*(1+$D$6)^A27

=B27*(1+$D$4)^(-A27)

=D26+C27

Equvalence Calculations With Composite Cash Flow

A couple wishes to establish a college fund at a bank for their five-year-old child. The college fund will earn an 8% interest compounded quarterly. Assuming that the child enters college at age 18, the couple estimates that an amount of $30,000 per year, in terms of today's dollars (dollars at child's age of five), will be required to support the child's college expenses for four years. College expenses are estimated to increase at an annual rate of 6%. Determine the equal quarterly deposits the couple must make until they send their child to college. Assume that the first deposit will be made at the end of the first quarter and that deposits will continue until the child reaches age 17. The child will enter college at age 18, and the annual college expense will be paid at the beginning of each college year. In other words, the first withdrawal will be made when the child is 18.

Equvalence Calculations With Composite Cash Flow

$30000(1+f)^{13} = 63988$

$30000(1+f)^{14} = 67827$

$30000(1+f)^{15} = 71897$

$30000(1+f)^{16} = 76211$

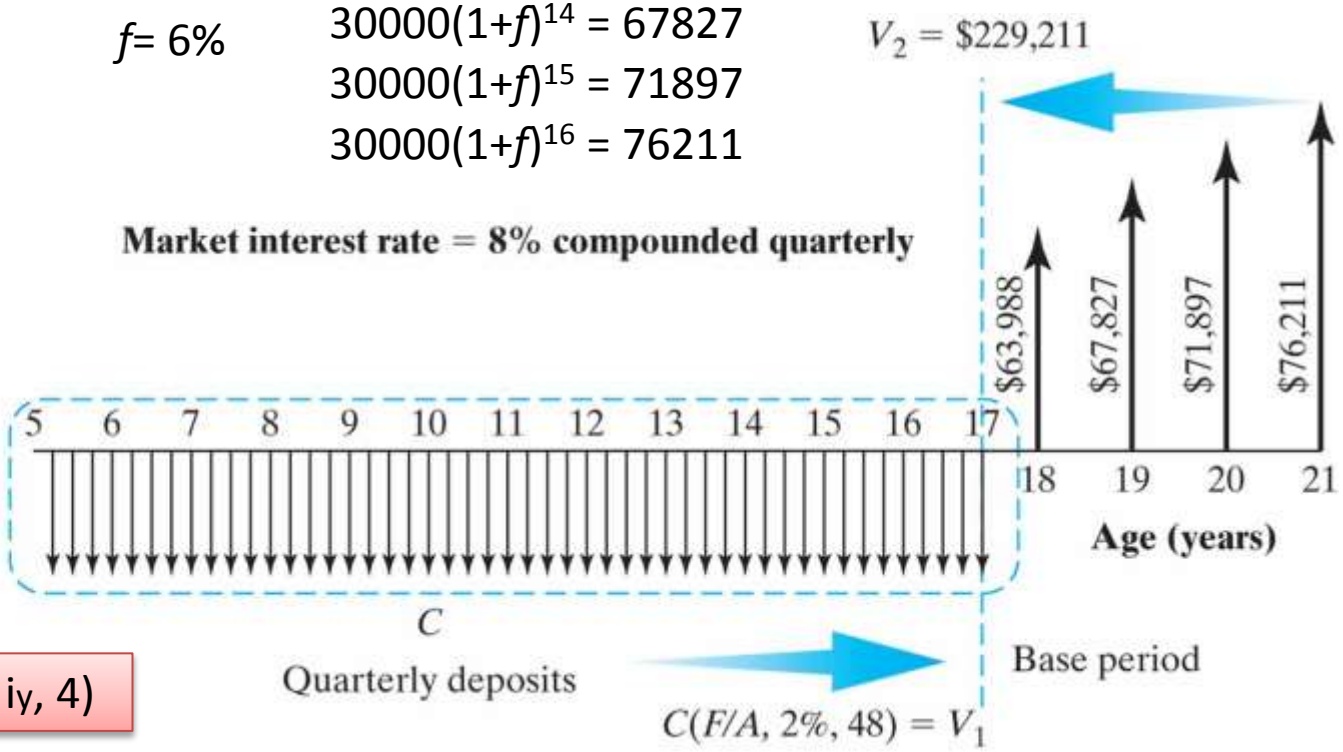
f= 6%

$V_1 = C(F/A, 2\%, 48)$

$V_2 = \$229{,}211$

Let $V_1 = V_2$ and solve for C.

$C = \$2{,}888.48$



V2 = 63,988 (P/A1, *6%* , iy, 4)

College expense is given as 30000 in constant $ of today.
Inflation on college expense is given as 6%.
C is required to be calculated as fixed by actual dollars.
Interest rate is 8% compounded quarterly for your deposits.

No Homework

For Midterm: Solve end Of Chapter questions (Ch.2-3-4) as much as you can.

Questions

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