14-2

Actual dollars are the cash dollars that we use to make transactions in our economy. These are the dollars that we carry around in our wallets and purses, and have in our savings accounts. Real dollars represent dollars that do not carry with them the effects of inflation, and these are sometimes called “inflation-free” dollars. Real dollars are expressed as purchasing power for a particular year, such as Year-2000-based-dollars.

The inflation rate expresses the loss in purchasing power of an actual dollar as an annual percentage. The real interest rate captures the growth of purchasing power of an initial investment. It does not include the effects of inflation and is sometimes called the “inflation-free” interest rate. The market interest rate, also called the combined rate, combines the inflation and real rates into a single rate.

14-10

*f* = 0.06

*i’* = 0.10

*i* = 0.10 + 0.06 + (0.10) (0.06) = **16.6%**

14-13

*i* = *i’* + *f* + (*i’*)(*f*)

0.15 = *i’* + 0.12 + 0.12(*i’*)

1.12 *i’* = 0.03

*i’* = 0.03/1.12 = 0.027 = **2.7%**

14-17

See the table below for (a) through (e)

|  |  |  |
| --- | --- | --- |
| **Year** | **Average Price ($K)** | **Inflation for Year** |
| 5 years ago | 265 | (a) 0.3% |
| 4 years ago | 267 | (b) 1.8% |
| 3 years ago | 272 | (c) 2.9% |
| 2 years ago | 280 | (d) 1.1% |
| Last year | 283 | (e) 2.5% |
| This year | 290 | (f) see below |

One could predict the inflation (appreciation) in the home prices this year using a number of approaches. One simple rule might involve using the average of the last 5 years’ inflation rates, which is given by (1+*f*)5 = 290/265, implying *f* = 1.82%

14-32

The CPI value in 1922 was 9.2, and in 2007 it was 111.5.

Suppose the average inflation rate over this 85-year period was *f*.

Then 9.2(1 + *f*)85 = 111.5

So *f* = (111.5/9.2)(1/85) – 1 = **2.98%**

14-41

Cost of Filterco = $7,000

Life = 5 years

Inflation = 8%

Value of Filterco 5 years hence = 7,000 (*F/P*, 8%, 5) = 7,000 (1.469) = $10,283

Therefore, total cost for Filterco in 10 years with two 5-year life spans

= $7,000 (1st Filterco bought) + $10,283 (2nd Filterco bought after 5 years)

= $17,283

Cost of Duro = $10,000

Life = 10 years

If the company buys the Filterco unit, it would spend $17,283 over 10 years; if the company buys the Duro unit, it would spend $10,000 over 10 years. Since the rate of return on both units is 20%, it is wise to **buy the Duro unit**.

14-45

Let us do a constant-dollar analysis, for which we need to use the real interest rate, *iʹ* = (*i* – *f*)/(1 + f)

*iʹ* = (0.2 – 0.0275)/(1 + 0.0275) = 0.1679 = 16.79%

**Alternative A**

NPW = –$236,000 – ($64,000 + $4,000) (*P/A*, 16.79%, 15) + $23,000 (*P/F*,16.79%,15)

NPW = –$236,000 – $68,000 (5.375) + $23,000 (0.09748) = –$599,258

**Alternative B**

NPW = –$345,000 – ($38,000+$5,000) (*P/A*, 16.79%, 15) + $51,000 (*P/F*,16.79%,15)

NPW = –$345,000 – $43,000 (5.375) + $51,000 (0.09748) = –$571,154

Alternative B is the cheaper alternative.

14-51

The **Consumer Price Index (CPI)** is a measure of the average price of bundles of common consumer goods and services, such as housing, clothing, food, transportation, and entertainment. In Canada, it is one of several price indices calculated by Statistics Canada

**Commodity-specific indexes** measure the historical change in price for specific items, such as construction labour or iron ore.

**Composite cost indexes** do not track historical prices for individual items. Instead, they measure the historical prices of bundlesor market baskets of assets. Examples of composite indexes are the Consumer Price Index (CPI) and the Producer Price Index(PPI).

In engineering economic analysis, the *average historical percentage increases (or decreases)* from commodity-specific and composite indexes, along with data from market analyses and other sources, can be used to estimate costs and benefits.

14-60

To minimize purchase price **Mary Clare should select the vehicle from company X**.

|  |  |  |  |
| --- | --- | --- | --- |
| **Car** | **Current Price** | **Inflation** | **Future Price** |
| X | 27,500 | 4.0% | 30,933 |
| Y | 30,000 | 1.5% | 31,370 |
| Z | 25,000 | 8.0% | 31,492 |
|  |  | **Min=** | 30,933 |

14-65

Let *x* = selling price

Then long-term capital gain = *x* − $18,000

Tax = 0.15 (*x* − $18,000)

After-Tax cash flow in year 10 (actual $) = *x* − 0.15 (*x* − $18,000) = 0.85*x* + $2,700

|  |  |  |  |
| --- | --- | --- | --- |
| **Year** | **ATCF (Actual $)** | **Multiply by** | **ATCF (Real $)** |
| 0 | −$18,000 | 1 | −$18,000 |
| 10 | +0.85*x* + $2,700 | 1.06−10 | 0.4743*x* + $1,508 |

For a 10% real rate of return:

$18,000 = (0.4746*x* + $1,508) (*P/F*, 10%, 10)

= 0.1830*x* + $581

*x* = **$95,186**

**Alternative Solution** using an equivalent interest rate

iequiv = *i’* + *f* + (*i’*) (*f*) = 0.10 + 0.06 + (0.10) (0.06) = 0.166

So $18,000 (1 + 0.166)10 = 0.85*x* + $2,700

$83,610 = 0.85*x* + $2,700

Selling price of the lot = *x* = ($83,610 − $2,700)/0.85 = **$95,188**

14-71

Inflation rate = 5%

Nominal interest rate (real dollars) = 15.5%

Actual interest rate = 1.05(1.155) – 1 = 21.27%

We take a 10-year time horizon; that is, we just consider the PW of the couple’s costs for the next 10 years for each alternative.

**Alternative 1: Renting a One-Bedroom Duplex**

The costs given in the table are in actual dollars. In real dollars, the monthly cost is a constant

$450 + 139 = $589. The present worth of these costs over the next 10 years will be

(589 × 12)(*P/A*, 15.5, 10) = 589 × 12 × 4.9246 = **$34,806**

**Alternative 2: Buying a House**

$3,750 down payment plus $3,750 sales commission plus approximately $750 in closing costs for a cash requirement of $8,250.

Mortgage interest rate per month = 8%/12 = 0.667%

*n* = 30 years × 12 = 360 payments.

Monthly mortgage payment (*A*):

*A* = (75,000 – 3,750)(*A/P*, 0.667%, 360) = $523 (Actual $)

But we must also take into account the annual appreciation in value of the house, of $75,000 (0.06) = $4,500/year (Actual $).

On top of this they have to pay $210/month for utilities, insurance and maintenance (Real $)

So the present worth of these expenses is

PW = $8,250 + (210 × 12)(*P/A*, 15.5, 10) + ((523 × 12) – 4,500)(*P/A*, 21.27, 10)

= $8,250 + 2,520(4.9246) + 1,776(4.0180)

= **$27,796**

**So buying the house is better than renting.**

14-75

We calculate the equivalent after-tax annual cost in real dollars:

We assume the maintenance cost rises at 5% per annum.

We assume that the corporation is located in BC and hence pays taxes at a marginal rate of 25%.

The MARR in actual dollars is (1.08)(1.05)–1 = 13.4%

The UCC of the copier at the end of Year 10 is $882, so when it is sold for $2,000,

CCA recapture of (2000–882) = $1,118 occurs, and this is taxed at 25%, giving a tax of $279

With these assumptions, the present worth of the cashflows associated with buying the copier is

–$22,911. This is equivalent to a uniform annual cost of

EUAC = 22,911(*A/P*, 0.08, 10) = 22,911(0.1490) = $3,413 in real dollars

Inflation increases the annual cost of the purchase, since it reduces the value of the tax relief provided by the CCA allowance.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Year** | **BTCF** | **CCA(30%)** | **TI** | **25% Tax** | **ATCF(Real)** | **PW at 13.4%** |
| 0 | –$18,000 |  |  |  |  | –$18,000 |
| 1 | –$1,300 | –$2,700 | –$4,000 | –$1,000 | –$300 | –$265 |
| 2 | –$1,365 | –$195 | –$1,560 | –$390 | –$975 | –$758 |
| 3 | –$1,433 | –$205 | –$1,638 | –$410 | –$1,024 | –$702 |
| 4 | –$1,505 | –$215 | –$1,720 | –$430 | –$1,075 | –$650 |
| 5 | –$1,580 | –$226 | –$1,806 | –$451 | –$1,129 | –$602 |
| 6 | –$1,659 | –$237 | –$1,896 | –$474 | –$1,185 | –$557 |
| 7 | –$1,742 | –$249 | –$1,991 | –$498 | –$1,244 | –$516 |
| 8 | –$1,829 | –$261 | –$2,091 | –$523 | –$1,307 | –$478 |
| 9 | –$1,921 | –$274 | –$2,195 | –$549 | –$1,372 | –$442 |
| 10 | –$17 | –$288 | –$305 | –$225 | $208 | $59 |
|  |  |  |  |  |  | –$22,911 |

14-80

**Cash Flow**

|  |  |  |
| --- | --- | --- |
| **Year** | **$500 Kit** | **$900 Kit** |
| 0 | −$500 | −$900 |
| 5 | −$500 | $0 |

(a) PW$500 kit = $500 + $500 (*P/F*, 10%, 5) = $810

PW$900 kit = $900

To minimize PW of Cost, choose $500 kit.

(b) Replacement cost of $500 kit, five years hence = $500 (*F/P*, 7%, 5) = $701.5

PW$500 kit = $500 + $701.5 (*P/F*, 10%, 5) = $935.60

PW$900 kit = $900

To minimize PW of Cost, choose $900 kit.