Income Tax Considerations in Engineering Projects

- tax dollars are real cash flows
- maximize the value of the firm on an after-tax basis
- taxes and depreciation affect the magnitude and timing of cash flows
- therefore, they must be considered in the evaluation of alternatives
- use the most favourable depreciation and tax methods to minimize and defer until later any tax liability
- the federal government influences the level of economic activity in Canada through its *monetary* and *fiscal* policies

MONETARY POLICY – influences the availability and cost of credit

FISCAL POLICY – deals with government receipts and expenditures

- taxation is the key instrument in fiscal policy
- level of economic activity in Canada is influenced by changes in
  - the tax rate
  - the depreciation regulations
  - tax credit programs

Income Tax Considerations in Engineering Projects

- no income tax existed in Canada prior to 1917
- a “temporary” measure to fund Canada’s involvement in World War I!

Desirable Properties of an Income Tax System

- fair and equal
  - people in equal situations should pay equal amounts
  - people in unequal situations should pay according to their ability to pay
  - the Income Tax Act uses “progressive” tax rates in order to attempt to make the tax more equitable
- efficient
  - low ratio of administrative cost to revenue produced
- neutral
  - the tax should have a minimal effect on the total economic system
- certain and predictable
  - a person should know what is owed and when
- simple
  - tax laws should be easy to understand and straightforward to comply with

Canadian Income Tax Rates
Individual & Corporate Rates

Individual Combined Provincial and Federal Income Tax Rates - 2014 versus 1998 - Top Marginal Rate by Province

1998	BC	Alberta	Sask	Manitoba	Ontario	Quebec	NB	NS	PEI	Nfld	Yukon	NWT	
Interest & Ordinary	54.2	45.6	51.6	50.1	50.3	52.6	50.4	49.7	50.3	53.3	46.6	44.4	
Capital gains	40.6	34.2	38.7	37.6	37.7	39.5	37.8	37.3	37.7	40.0	34.9	33.3	
Canadian Dividends	36.6	31.1	36.3	36.1	34.0	39.4	34.1	33.5	34.0	36.0	31.4	30.0	
Rank	1	11	4	8	7	3	5	9	6	2	10	12	
	Ontario's highest rate was 53.2% during 1994-1995.												
	Canada's highest rate was 54.2% during 1994-1998 in British Columbia.												
2014	**BC**	**Alberta**	**Sask**	**Manitoba**	**Ontario**	**Quebec**	**NB**	**NS**	**PEI**	**Nfld**	**Yukon**	**NWT**	**Nunavut**
Interest & Ordinary	45.8	39.0	44.0	46.4	49.5	50.0	46.8	50.0	47.4	42.3	42.4	43.1	40.5
Capital gains	22.9	19.5	22.0	23.2	24.8	25.0	23.4	25.0	23.7	21.2	21.2	21.5	20.3
Canadian Dividends	28.7	19.3	24.8	32.3	33.8	35.2	27.4	36.1	28.7	30.2	15.9	22.8	27.6
Rank	6	12	7	5	2	1	4	1	3	10	9	8	11
	Top tax rate is effective on taxable income above $220 000 (in Ontario).												

Corporate Provincial and Federal Income Tax Rates - 2014 in Ontario

	Federal	Ontario	Combined
Canadian-Controlled Private Corporations up to $500 000	11.0	4.5	15.5
General Corporate Tax Rate	15.0	11.5	26.5

Individual Income Tax Schedule
Ontario – 2014

Ontario 2014 Individual Income Tax Schedule						
Gross Income	Taxable Income	Tax Paid			Average Tax Rate	Marginal Tax Rate
		Ontario	Federal	Total		
$ 31,138	$ 20,000	$ 522	$ 1,329	$ 1,851	5.9%	20.0%
$ 41,138	$ 30,000	$ 1,027	$ 2,829	$ 3,856	9.4%	20.0%
$ 51,138	$ 40,000	$ 1,532	$ 4,329	$ 5,861	11.5%	20.0%
$ 61,138	$ 50,000	$ 2,441	$ 6,253	$ 8,694	14.2%	31.2%
$ 71,138	$ 60,000	$ 3,356	$ 8,453	$ 11,809	16.6%	31.2%
$ 81,138	$ 70,000	$ 4,271	$ 10,653	$ 14,924	18.4%	31.2%
$ 91,138	$ 80,000	$ 5,357	$ 12,853	$ 18,210	20.0%	33.0%
$ 101,138	$ 90,000	$ 6,963	$ 15,136	$ 22,099	21.9%	43.4%
$ 111,138	$ 100,000	$ 8,704	$ 17,736	$ 26,440	23.8%	43.4%
$ 161,138	$ 150,000	$ 17,409	$ 31,148	$ 48,557	30.1%	48.0%
$ 211,138	$ 200,000	$ 26,894	$ 45,648	$ 72,542	34.4%	48.0%
$ 311,138	$ 300,000	$ 47,111	$ 74,648	$ 121,759	39.1%	49.5%
The tax paid and the average tax rate columns assume that only the basic tax credit is available ($11,138 in 2014) and that all income is ordinary.						
The top marginal rate starts at a taxable income of $220,000.						

Income Tax Rates in the United States

2014 Combined Income Tax Rates in Selected States

US 2014 Income Tax Rates versus Ontario Income Tax Rates ($US)								
Taxable Income		Federal	Illinios	California	Michigan	New York	"Low Tax"	**Ontario**
From	**To**	Tax Rate	Tax Rate	Tax Rate	Tax Rate	Tax Rate	Tax Rate	
$ 36,900	$ 89,349	25.0%	30.0%	37.3%	29.3%	33.8%	25.0%	**24.2% - 43.4%**
$ 89,350	$ 186,349	28.0%	33.0%	40.3%	32.3%	36.8%	28.0%	**43.4% - 48.0%**
$ 186,350	$ 405,099	33.0%	38.0%	45.3%	37.3%	41.8%	33.0%	**48.0% - 49.5%**
Above	$ 405,100	39.6%	44.6%	51.9%	43.9%	48.4%	39.6%	**49.5%**
State tax rates are the combined federal and state tax rates. Some cities and counties also levy income tax which is not included.								
"Low Tax" states include Alaska, Florida, Nevada, New Hampshire, South Dakota, Tennessee, Texas, Washington & Wyoming.								

Average versus Marginal Tax Rates
Individual Income Tax - Ontario

Average versus Marginal Tax Rates - Federal/Ontario - 2014						
Annual Salary	100,000					
Personal Exemption	11,138					
Taxable Income	88,862					
	Tax Bracket	Income in Bracket	Tax $			
first $40,120	20.05%	40,120	8,044			
over $40,120 up to $43,953	24.15%	3,833	926			
over $43,593 up to $70,651	31.15%	26,698	8,316			
over $70,651 up to $80,242	32.98%	9,591	3,163			
over $80,242 up to $83,237	35.39%	2,995	1,060			
over $83,237 up to $87,907	39.41%	4,670	1,840			
over $87,907 up to $136,270	43.41%	955	415			
Total Income Taxed		88,862	23,764	Total Income Tax		
Taxpayer's Average Tax Rate	23,764	23.76%				
	100,000					
Taxpayer's Marginal Tax Rate		43.41%				
If the taxpayer has $5,000 of interest income in addition to the the salary,						
how much of that interest does the taxpayer keep?						
Taxable Income increases to $93,862 and the additional income falls into the 43.41% bracket.						
Interest Income		5,000				
Marginal Tax Rate	43.41%					
Income Tax		2,171				
After-tax interest income		2,830				
Taxpayer's Average Tax Rate	25,935	24.70%				
	105,000					
Taxpayer's Marginal Tax Rate		43.41%				

The Income Tax Act & Depreciation

- the gradual conversion of the cost of an asset (other than land) into an expense over its economic life
- charge the cost of the loss of usefulness of an asset to the accounting period that benefits from that asset's use
- depreciation is a non-cash expense; therefore, it follows that depreciation is not a cash flow
- since depreciation reduces the amount of taxes paid (which is a cash flow), depreciation must be considered in a cash flow financial analysis
- Capital Cost Allowance (CCA) is the Canadian term for depreciation used in the Income Tax Act
- CCA specifies the maximum percentage of a capital asset's cost that is allowed to be deducted each year
- CCA recognizes that most capital assets depreciate in value as they are used due to:
  - physical deterioration
  - technological obsolescence
  - functional deterioration
- deductions permitted by CCA often reflect government policy rather than the actual decline in the market value of an asset
- market values are unimportant – the initial cost of the asset is used for CCA during the entire life of the asset

Depreciation Methods

- Straight-Line
- Declining Balance
  - required by the Canada Revenue Agency (CRA)
- Modified Accelerated Cost Recovery System
  - required by the U.S. Internal Revenue Service (IRS)
- companies usually keep two sets of books
  - one for tax purposes
  - one to offer a realistic view of profit from the company's viewpoint (GAAP)
- depreciation may be recorded on the financial books of a company using the straight-line method even though the CCA method is required for tax purposes

Depreciation Factors

P – cost basis (first cost)
- purchase price plus other acquisition expenses

D_t – depreciation expense in Year t

n – useful life
- economic life of the asset – not the physical life

S – salvage value at the end of the asset's useful life

B_t – book value
- undepreciated cost in Year t

p – Capital Cost Allowance rate

Straight-Line Method of Depreciation

- provides for the uniform annual write-off of an asset
- the yearly depreciation expense

$$D_t = \frac{P - S}{n}$$

- the book value for each Year t

$$B_t = P - \left(\frac{P - S}{n} \right) t$$

- the Canadian Income Tax Act permits intangible property such as patents, copyrights and franchises to be depreciated on a straight-line basis
- all other property requires the Capital Cost Allowance depreciation method

Straight-Line Method of Depreciation
Network Router Acquisition

original cost	$9 500
installation	$1 000
estimated economic life	5 years
estimated salvage value	$1 500

first cost = $9 500 + $1 000 = $10 500

Year t	Depreciation D_t	Book Value B_t
0	-	10 500
1	1 800	8 700
2	1 800	6 900
3	1 800	5 100
4	1 800	3 300
5	1 800	1 500

Declining Balance Method of Depreciation

- the fixed percentage on the declining balance method is required by the Canadian Income Tax Act
- the annual depreciation allowed is the specified percentage of the undepreciated capital cost balance remaining in the class

  i.e., a constant fraction (p) of the book value of the previous year

$$D_t = p\, B_{t-1}$$
$$B_t = P\,(1-p)^t$$
$$D_t = p\, P\,(1-p)^{t-1}$$

- note that no estimate for salvage value is required

Network Router Acquisition

CCA rate for Class 10: $p = 30\%$

t	D_t	B_t
0		10 500
1	3 150	7 350
2	2 205	5 145
3	1 544	3 602
4	1 080	2 522
5	756	1 766
6	530	1 236

Capital Cost Allowance (CCA)

- for both individuals and corporations, the only allowable tax-deductible depreciation expense for tangible property is CCA
- CCA applies to classes of assets grouped together
- each CCA Class has a CCA rate specified by law

Each asset class must be accounted for separately.

1 Start with the undepreciated capital cost (UCC) at the beginning of the year.

2 Subtract the proceeds from assets disposed of during the year. If the proceeds exceed the original cost, the excess is a capital gain, and only the original cost can be included in this step.

3 Add the total allowable cost of asset additions.

"Half-Year Rule" – only 50% allowed during the first year
– the remaining 50% allowed the following year

4 Subtract any government assistance payments or Investment Tax Credits.

5 The previous four steps have determined the UCC for this taxation year. Use the appropriate CCA rate for the Class to calculate the CCA for the year. This is the maximum depreciation deduction allowed.

6 Depreciation cannot be used to reduce the taxable income below zero.

7 Reduce the UCC by the amount of CCA claimed on this year's tax return to form next year's UCC.

Capital Cost Allowance (CCA)

- depreciation is calculated by applying the CCA rate for the particular Class of the asset against the undepreciated capital cost (UCC)
- in Canada, the “Half Year Rule” must be used in Year 1 of the project

Network Router Acquisition

original cost	$9 500
installation	$1 000
estimated economic life	5 years
estimated salvage value	$1 500

- Capital Cost Allowance Class 10
  - general purpose EDP (electronic data processing) equipment
  - CCA rate = 30%
- both the original expenditure and any installation charges form the basis for original capital cost to be used in the calculation of CCA
- note that the estimated economic life and salvage value are not required

Capital Cost Allowance (CCA)

Network Router Acquisition

EOY	UCC (Beginning of Year)	Additions	UCC (for Taxation Year)	D_t	B_t
0					10 500
1	0	5 250	5 250	1 575	8 925
2	3 675	5 250	8 925	2 678	6 248
3	6 248		6 248	1 874	4 374
4	4 374		4 374	1 312	3 062
5	3 062		3 062	919	2 143
6	2 143		2 143	643	1 499

- the “Half-Year Rule” permits only half of the first costs of the acquired asset to be added to the pool in the first year
- the “Half-Year Rule” was introduced in 1981 since the federal government believed that capital assets were being written off too quickly by Canadian corporations

Capital Cost Allowance Rate by Class
Information Technology Assets

Class	Eligible Assets	*p*(%)
3	Telephone or data communication equipment that is a) a wire or cable b) supporting equipment (pole, mast, etc.)	5
8	Property not included in any other class such as fixtures, furniture, machinery and tools Basic software and firmware in central office telephone equipment	20
10	General purpose EDP equipment (including systems software)	30
12	Computer software acquired after May 26, 1976 (excluding systems software) Application software in central office telephone equipment	100
17	Telephone or data communication switching equipment (excluding equipment installed on customers' premises)	8
30	Unmanned telecommunications spacecraft designed to orbit above the earth	40
42	Fibre optic cable	12

- depreciable assets are grouped into asset pools according to their nature with a CCA write-off rate prescribed for each CCA class

Straight-Line vs. Capital Cost Allowance Comparison

- Assume the net contribution (revenues less expenses) of the network router project was $2 500 per year before the depreciation expense

Tax Viewpoint

Year	1	2	3	4	5
Net Contribution	2 500	2 500	2 500	2 500	2 500
Depreciation (CCA)	1 575	2 678	1 874	1 312	919
Contribution	925	(178)	626	1 188	1 581

Financial Statement Viewpoint

Year	1	2	3	4	5
Net Contribution	2 500	2 500	2 500	2 500	2 500
Depreciation (S/L)	1 800	1 800	1 800	1 800	1 800
Contribution	700	700	700	700	700

- Which viewpoint more accurately reflects the annual contribution of this project to the company's bottom line?

Comparison of Depreciation Methods
Straight-Line vs. CCA

- CCA may allow for accelerated (i.e., higher) depreciation deductions early in the project life
- accelerated depreciation reduces taxes thereby increasing cash flows earlier in the project life at the expense of a corresponding decrease in cash flows later in the project life
- these increased cash flows earlier in the project life add to the present value of a project whose assets are allowed accelerated depreciation
- CCA deductions reflect government policy more than the actual decline in the market value of the asset
- book value seldom matches market value of asset
- accounting statements will often use straight-line depreciation to more accurately portray a project's financial contribution even though the maximum deduction permitted by CCA is taken by the company to reduce taxes
- DEFERRED TAXES – occurs when assets are depreciated "on the books" at a slower rate than the Income Tax Act allows

Income Tax Concepts

- taxes paid represent a real cost of doing business
- usually a significant factor in the cash flows of any investment proposal
- usually before-tax and after-tax analyses indicate the same order of preference among competing alternatives
- order of preference can change if some proposals are subject to special treatment by the Income Tax Act
- an after-tax analysis reveals the actual cash flows that result from an investment proposal

Types of Taxes

Property taxes – charged by local governments on land and buildings
– amount of tax based on appraised market value of the assets

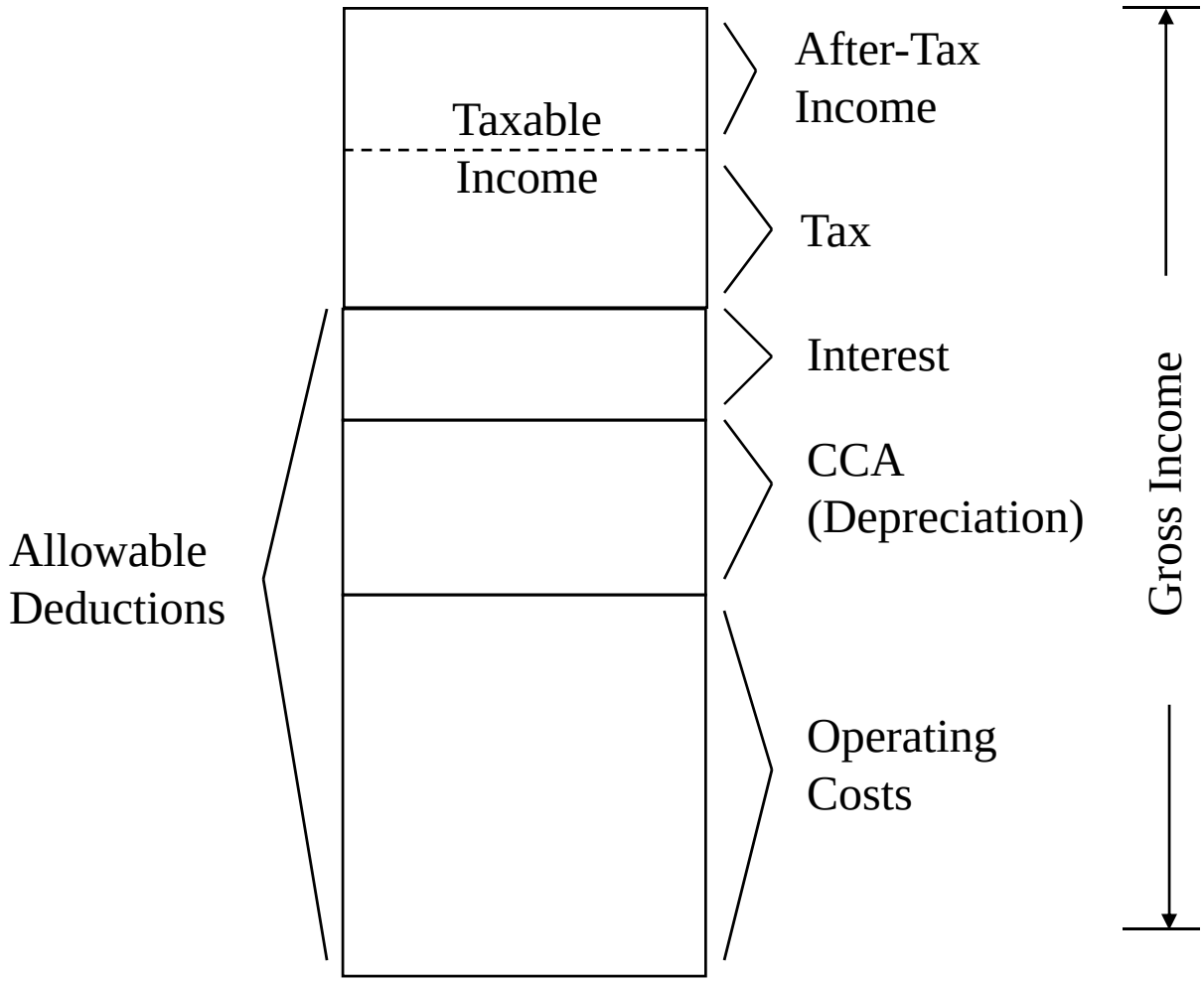
Excise taxes – levied on the production of certain products such as tobacco and alcohol

Sales taxes – both federal and provincial taxes are levied on the final consumer
– exemptions and credits for manufacturers

Income taxes – levied on personal and corporate income
– based on taxable income after deductions

- income taxes are usually the only significant tax to consider in an engineering economic study

Corporate Income Tax



- dividends paid out from after-tax corporate income is again taxed as dividend income in the hands of the shareholder

Corporate Income Tax

- assume the effective rate of combined federal and provincial tax on income of most Canadian corporations is 40% for examples in the lecture notes

- corporations pay tax on their income whether or not it is distributed to shareholders

Tax Treatment of Allowable Deductions

Determine whether an expenditure is an expense item or a capital asset.

- expense item
  - fully deductible from income in the year that the expense is incurred

- capital asset
  - must be depreciated
  - maximum deduction allowed in each year is specified by the CCA rate

How does the tax treatment of the expenditure affect its after-tax cost?

Expense Items

- all estimates of future cash flows should be examined on an after-tax basis
- tax dollars are real cash flows
- only after-tax cash flows add value to the firm
- consider the after-tax impact of an additional $1 000 expense

	Before		**After**
Gross income	50 000		50 000
Allowable deductions	30 000	+ 1 000 →	31 000
Taxable income	20 000		19 000
Taxes (40%)	8 000		7 600
After tax income	12 000		11 400

$600

- the incremental after-tax cost of the additional $1 000 expense is $600

$$\text{After-Tax Cost} = 1\,000\,(1 - t)$$

where t is the tax rate

Capital Assets

- consider a $1 000 investment in a capital asset

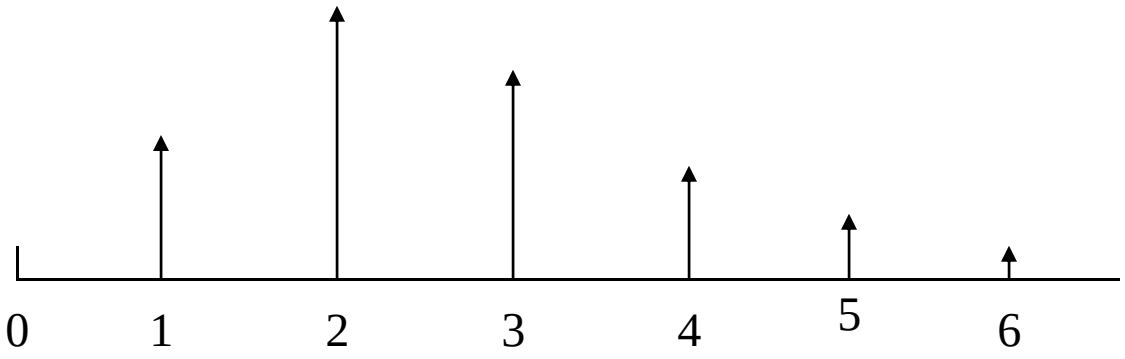
Year *t*	Book Value	CCA (30%)	Tax Savings (40%)	P|F(15,*t*)	PV (Tax Savings)
0	1 000				
1	850	150	60	0.8696	52
2	595	255	102	0.7561	77
3	417	179	71	0.6575	47
4	292	125	50	0.5718	29
5	204	87	35	0.4972	17
6	143	61	24	0.4323	11
7	100	43	17	0.3759	6
8	70	30	12	0.3269	4
9	49	21	8	0.2843	2
10	34	15	6	0.2472	1
1 to 10		966	386		247
Future Years		34	14		2
TOTAL		1 000	400		249

- the $1 000 expenditure can no longer be expensed immediately but must be depreciated over a long period of time

Capital Assets

- therefore, the $1 000 investment in a capital asset has an after-tax present-value cost of $751
- compare this to the after-tax cost of a $1 000 expense item which equals $600
- capital cost allowances associated with the asset give rise to a stream of future tax savings
- if the firm is profitable, and therefore paying taxes, these savings are real cash flows since they reduce the tax that would have otherwise been paid

CCA Tax Savings



- if a company is not profitable, then it cannot save taxes and the depreciation is of no value until the company returns to profitability

After-Tax Cost of a Capital Asset

- What is the after-tax present value cost of a capital asset?

Capital Cost Tax Factor

– Declining Balance

– No "Half-Year Rule"

$$\text{CCTF} = 1-\frac{tp}{i+p}$$

$$= 1-\frac{(0.4)(0.3)}{0.15+0.3}=0.733$$

t	=	tax rate
	=	40%
p	=	CCA rate
	=	30%
i	=	MARR
	=	15%

- what is the effect of the "Half-Year Rule"?

$$\text{CCTF} = 1-\left[0.5\left(\frac{tp}{i+p}\right)+0.5\left(\frac{1}{1+i}\right)\left(\frac{tp}{i+p}\right)\right]$$

$$= 1-\left(\frac{tp}{i+p}\right)\left(\frac{1+0.5i}{1+i}\right)$$

$$= 1-\left(\frac{(0.4)(0.3)}{0.15+0.3}\right)\left(\frac{1+(0.5)(0.15)}{1+0.15}\right)=0.751$$

- reducing the allowable depreciation expense in Year 1 by one half has increased the after-tax cost of the investment

$10 Million Telephone Switch

After-Tax Capital Cost

MARR=10%
t=40%

1 $10 000 000 switch sold as a switch

$\therefore$ Class 17 – 8% depreciation

$$\begin{aligned} \text{ATC} &= (10)(\text{CCTF}) \\ &= 10\left(1-\left[0.5\left(\frac{tp}{i+p}\right)+0.5\left(\frac{1}{1+i}\right)\left(\frac{tp}{i+p}\right)\right]\right) \\ &= 10(0.83) = \$8.30 \text{ million} \end{aligned}$$

2 $10 000 000 switch sold as

		Class	CCA
5 000 000	switch	17	8%
10 000	operating system software	8	20%
4 990 000	application software	12	100%

$$\begin{aligned} \text{ATC} &= (5)(\text{CCTF})\Big|_{8\%} + (0.01)(\text{CCTF})\Big|_{20\%} + (4.99)(\text{CCTF})\Big|_{100\%} \\ &= 5(0.8300) + 0.01(0.7450) + 4.99(0.6530) \\ &= \$7.42 \text{ million} \end{aligned}$$

- the after-tax cost to the customer has decreased by $0.88 million!