



UNIVERSITY OF CALGARY
HASKAYNE SCHOOL OF BUSINESS

Corporate Finance

Capital Budgeting – Which cash flows?

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Which cash flows?

Taxation

Textbook example

Operating cash flows

Mutually exclusive projects of unequal lives

Practitioners' perspective

Chapter 8 of the textbook

How to get the inputs right for NPV?

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It has been seen previously that NPV has distinct advantages over the other investment decision criteria in a capital budgeting context.

This said, any decision process, even if well designed and with ample theoretical/practical justifications, is highly sensitive to the quality of its inputs and subject to the 'garbage in/garbage out' caveat.

The inputs to a NPV analysis for a given project are:

- The cash flows (magnitude in monetary unit and timing);
- The discount rate(s).

The analyst need to fully justify each individual input in a reasonable and well documented manner.

Of note, the cash flows used to calculate the NPV are usually the same used to calculate the IRR, the Payback, and the Profitability Index.

Which cash flows are relevant?

'Only but all' incremental (initial and future) cash flows are relevant

- Incremental: a net direct consequence of the project (including changes in **working capital**);
- Past cash flows (like '**sunk costs**') are irrelevant;
- Accounting figures like earnings are irrelevant (non cash items);
- After-tax cash flows are relevant (not before tax, so remember to deduct taxes);
- Incidental cash flows (e.g. **opportunity costs**, side effects) are relevant;
- Costs are to be allocated only if incremental and induced by project (e.g. **overhead** costs);
- Take inflation into consideration on a consistent basis (all nominal or all real, do not mix);
 - ▶ nominal interest rate \simeq real interest rate + inflation
- Interest expenses are already included in the discount rate (when using risk-adjusted WACC);
 - ▶ Separate investment and financing decisions.

If an existing resource is reallocated to the project, the cash flow from its previous use or the alternate best use is foregone. A project can increase or decrease cash flows elsewhere in the firm (**cannibalism** or **synergy**). Such incidental cash flows are nevertheless incremental to the project.

The timing of the cash flows

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Typically, the cash flow forecast is on an annual basis (since most projects span multiple years).

- “Year 0” comprises the cash flows occurring initially at time = 0, generally the initial investment outlay, if any;
 - ▶ “Year 0” is not a year! and you do not discount the year 0 cash flow since time = 0
- “Year 1”, by convention, is comprised of all the cash flows occurring throughout the first year (e.g. revenues and expenses) as if they did occur at the end of year 1 (for reason of simplicity);
- All subsequent years are compiled in the same manner as year 1;
- The terminal year is often comprised also of end-of-project cash flows like salvage value and recovery of working capital;
- Some cash flows do occur at the beginning of the year and therefore must be accounted as such;
 - ▶ e.g. lease payments
- Sometimes, cash flows are compiled on a monthly basis in a similar manner as above.

If a firm does not pay income tax, non-cash expenses decrease EBIAT (earning before interest after tax) but have no real effect on cash flows!

As soon as a firm pays corporate income tax (and as long as non-cash expenses are recognized by the tax authorities as legitimate business expenses), such non-cash expenses decrease taxes paid and therefore increase after-tax cash flows by the same amount of the said decrease (good).

In some tax jurisdictions, **corporate income taxes** are calculated using the reported income before taxes according to the accounting norms.

- In such cases, depreciation is the accounting concept giving rise a non-cash expense (induces lower taxes and thus higher cash flows).

In other jurisdictions, notably Canada, income has to be calculated according to the tax authorities' instructions (aka the 'tax books').

- In Canada, the tax concept equivalent to depreciation is the Capital Cost Allowance (CCA). So, in Canada depreciation does not provide any cash flow benefit via lower taxes, but CCA does.
- Must carefully read Appendix 8A of the textbook which briefly outlines how the CCA system works (pages 235 to 241).

Textbook Example - Majestic Mulch & Compost Co.

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Investment

- Machine costs 800,000 with a salvage value of 150,000 at year 8
- Machine is CCA class 8 20%

Calculation of annual capital cost allowance to enable calculation of annual income taxes

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
<u>CCA Schedule</u>								
Beginning capital cost	800,000	720,000	576,000	460,800	368,640	294,912	235,930	188,744
First year rule	0.5	1	1	1	1	1	1	1
Class 8 CCA	20%	20%	20%	20%	20%	20%	20%	20%
Capital cost allowance	80,000	144,000	115,200	92,160	73,728	58,982	47,186	37,749
Ending capital cost	720,000	576,000	460,800	368,640	294,912	235,930	188,744	150,995

Textbook Example - Majestic Mulch & Compost Co.

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Investment

- Machine costs 800,000 with a salvage value of 150,000 at year 8
- Machine is CCA class 8 20%

Key information

- Production in years 1 to 8 of 6, 9, 12, 13, 12, 10, 8 and 6 thousands units respectively
- Unit revenue of 100 in year 1 and +2%/year thereafter
- Unit production cost of 64 in year 1 and +5%/year thereafter
- Fixed costs of 50,000/year
- Corporate tax is 40% of earnings before interest and taxes (EBIT)
- Working capital: 40,000 initial, then 15% of sales and 0 at the end
- Test marketing of 250,000 is a sunk cost and therefore irrelevant

Textbook Example - Majestic Mulch & Compost Co.

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	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
<u>Operations</u>									
Units		6,000	9,000	12,000	13,000	12,000	10,000	8,000	6,000
Price/unit		100	102	104	106	108	110	113	115
Revenue		600,000	918,000	1,248,480	1,379,570	1,298,919	1,104,081	900,930	689,211
Cost/unit		64	67	71	74	78	82	86	90
Var. costs		384,000	604,800	846,720	963,144	933,509	816,820	686,129	540,327
Fixed costs		50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Total costs		434,000	654,800	896,720	1,013,144	983,509	866,820	736,129	590,327
CCA		80,000	144,000	115,200	92,160	73,728	58,982	47,186	37,749
EBIT		86,000	119,200	236,560	274,266	241,682	178,278	117,615	61,136
Taxes		34,400	47,680	94,624	109,707	96,673	71,311	47,046	24,454
EBIAT		51,600	71,520	141,936	164,560	145,009	106,967	70,569	36,682
Ops cash flow		131,600	215,520	257,136	256,720	218,737	165,949	117,755	74,430
<u>Investments</u>									
Working cap.	40,000	90,000	137,700	187,272	206,936	194,838	165,612	135,139	0
WC change	-40,000	-50,000	-47,700	-49,572	-19,664	12,098	29,226	30,473	135,139
Equipment	-800,000								150,000
Inv cash flow	-840,000	-50,000	-47,700	-49,572	-19,664	12,098	29,226	30,473	285,139
Cash flow	-840,000	81,600	167,820	207,564	237,056	230,835	195,175	148,228	359,570
NPV	4%	500,135	10%	188,042	15%	2,280	20%	-137,896	

Operating Cash Flows ('OCF')

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Be aware that there are three slightly different ways to calculate the OCF.

Bottom-up

$$OCF = Net\ Income + Depreciation/CCA$$

Top-down

$$OCF = Sales - Costs - Taxes$$

Tax Shield

$$OCF = (Sales - Costs)(1 - T) + Depreciation/CCA \times T$$

Operating Cash Flows ('OCF') - Comparative Example

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Sales	1,500
Costs	- 700
Depreciation	- 600
EBIT	200
Taxes	- 68 34%
Net Income	132

	Bottom-up
Net Income	132
Depreciation	<u>600</u>

OCF 732

Top-down

Sales	1,500
Costs	- 700
Taxes	<u>- 68</u>

OCF 732

Tax Shield

Sales	1,500
Costs	<u>- 700</u>
Operating BT	800
(1 - Tax rate)	66%
Operating AT	528
Depreciation	600
Tax rate	34%
Tax shield	<u>204</u>
OCF	732

Mutually exclusive projects of unequal lives

A traditional investment criterion cannot be directly used to analyze mutually exclusive projects of unequal lives. A classic example is the choice between long- and short-lived equipment.

Replacement chain

- Repeat the projects forever
- NPV the cash flows

Matching cycle

- Repeat projects until they end at the same time
- NPV the cash flows

Equivalent annual cost

- NPV projects and find the annuity equivalent
- Choose the lowest yearly cost-equivalent

Mutually exclusive projects of unequal lives

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The air-conditioning equipment of your machine shop has to be replaced. Without it you cannot operate your business. But you can use high-quality equipment A, or more affordable equipment B.

A: investment of 4,000, operating cost of 100/year and life of 10 years

B: investment of 1,000, operating cost of 500/year and life of 5 years

	NPV	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
A	-4,614	-4,000	-100	-100	-100	-100	-100	-100	-100	-100	-100	-100
B	-2,895	-1,000	-500	-500	-500	-500	-500					
A	-4,614	-4,000	-100	-100	-100	-100	-100	-100	-100	-100	-100	-100
B	-4,693	-1,000	-500	-500	-500	-500	-1,500	-500	-500	-500	-500	-500
A	-4,614		-751	-751	-751	-751	-751	-751	-751	-751	-751	-751
B	-2,895		-764	-764	-764	-764	-764					

r: 10%

Practitioners' perspective

Pruitt & Gitman (1987) surveys Fortune 500 firms (VP Finance or Treasurer; respondents in agreement/disagreement in parenthesis)

- Revenue forecasts are typically overstated (79%/12%)
- Revenue overstatement is intentional (37%/46%)
- Revenue overstatement due to lack of forecasting experience (36%/35%)
- Revenue (cost) forecasts deviate most from outcomes when project departs from established corporate operations (81%-82%/8%-6%)
- Cost forecasts are typically understated (43%/38%)
- Cost understatement is intentional (27%/54%)
- Cost understatement due to lack of forecasting experience (35%/33%)
- Decision makers consider forecasts to be optimistic and adjust them accordingly (59%/20%)
- Postaudits show forecasts to be more optimistic than outcomes (76%/12%)
- Actual profitability of projects is typically higher than forecasted (7%/61%)

Experienced decision makers have developed a healthy skepticism regarding the cash flow forecasts put forward to justify investing in new projects.

Practitioners' perspective

Pohlman & al. (1988) also surveys Fortune 500 firms (CFOs; % of all firms).

- Firms with higher risk are more likely to follow systematic approaches to forecasting cash flows (greater accuracy in those forecasts is then achieved).
- 77% have someone responsible for coordinating and supervising cash flow estimation.
- 85% have standard procedures for estimating taxes, depreciation, investment tax credit, and salvages values.
- 66% require the use of a standard model for cash flow forecasting.
- 78% have standard worksheets for reporting cash flow and other investment information.
- 56% use single-dollar estimates, 8% use a range of estimates, and 36% use both.

Experienced decision makers have put in place a healthy range of measures to promote unbiased forecasting of cash flows.

Chapter 8 of the textbook

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Textbook sections covered

- 8.1 to 8.7

Worked examples

- 12 worked examples are provided in chapter 8 of the textbook.

Exercises

- 23 exercises are provided in chapter 8 of the textbook.
- You should practice your Excel skills with a few of those.
- Suggest 8.3, 8.13 and 8.16
 - ▶ Hint: 8.3 continue to rent
 - ▶ Hint: 8.13 combined drug has lowest NPV
 - ▶ Hint: 8.16 Mixer Y

8.3 Solution

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Purchase Price	\$1,450,000
Rent	\$61,000
Rental period (years)	15
CCA Building	5%
CCA Mods (s/l years)	15
CCA Equipment	20%
Tax	34%
r	12%

	Product A	Product B
Cash outlay for building	\$95,000	\$125,000
Cash outlay for eq.	\$195,000	\$230,000
Pretax cash revenues	\$180,000	\$215,000
Pretax cash exp.	\$70,000	\$90,000
Restoration	\$55,000	\$80,000

8.3 Solution

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Product A	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Operations																
Revenue		\$180,000	\$180,000	\$180,000	\$180,000	\$180,000	\$180,000	\$180,000	\$180,000	\$180,000	\$180,000	\$180,000	\$180,000	\$180,000	\$180,000	\$180,000
Foregone Rent		-\$61,000	-\$61,000	-\$61,000	-\$61,000	-\$61,000	-\$61,000	-\$61,000	-\$61,000	-\$61,000	-\$61,000	-\$61,000	-\$61,000	-\$61,000	-\$61,000	-\$61,000
Expenditures		-\$70,000	-\$70,000	-\$70,000	-\$70,000	-\$70,000	-\$70,000	-\$70,000	-\$70,000	-\$70,000	-\$70,000	-\$70,000	-\$70,000	-\$70,000	-\$70,000	-\$70,000
Restoration costs																-\$55,000
EBITDA		\$49,000	\$49,000	\$49,000	\$49,000	\$49,000	\$49,000	\$49,000	\$49,000	\$49,000	\$49,000	\$49,000	\$49,000	\$49,000	\$49,000	-\$6,000
CCA Building		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
CCA Equipment		\$19,500	\$35,100	\$28,080	\$22,464	\$17,971	\$14,377	\$11,502	\$9,201	\$7,361	\$5,889	\$4,711	\$3,769	\$3,015	\$2,412	\$1,930
CCA Modifications		\$6,333	\$6,333	\$6,333	\$6,333	\$6,333	\$6,333	\$6,333	\$6,333	\$6,333	\$6,333	\$6,333	\$6,333	\$6,333	\$6,333	\$6,333
EBIT		\$23,167	\$7,567	\$14,587	\$20,203	\$24,695	\$28,290	\$31,165	\$33,465	\$35,306	\$36,778	\$37,956	\$38,898	\$39,652	\$40,255	-\$14,263
Tax		\$7,877	\$2,573	\$4,959	\$6,869	\$8,396	\$9,619	\$10,596	\$11,378	\$12,004	\$12,504	\$12,905	\$13,225	\$13,482	\$13,687	-\$4,849
EBIAT		\$15,290	\$4,994	\$9,627	\$13,334	\$16,299	\$18,671	\$20,569	\$22,087	\$23,302	\$24,273	\$25,051	\$25,673	\$26,170	\$26,568	-\$9,414
Operating Cash Flow		\$41,123	\$46,427	\$44,041	\$42,131	\$40,604	\$39,381	\$38,404	\$37,622	\$36,996	\$36,496	\$36,095	\$35,775	\$35,518	\$35,313	-\$1,151
Investments																
Change in WC		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Modifications	-\$95,000															
Equipment	-\$195,000															
Investment Cash Flow	-\$290,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Cashflow	-\$290,000	\$41,123	\$46,427	\$44,041	\$42,131	\$40,604	\$39,381	\$38,404	\$37,622	\$36,996	\$36,496	\$36,095	\$35,775	\$35,518	\$35,313	-\$1,151
NPV	-\$22,784															

8.3 Solution

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Product B																
Operations	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Revenue		\$215,000	\$215,000	\$215,000	\$215,000	\$215,000	\$215,000	\$215,000	\$215,000	\$215,000	\$215,000	\$215,000	\$215,000	\$215,000	\$215,000	\$215,000
Foregone Rent		-\$61,000	-\$61,000	-\$61,000	-\$61,000	-\$61,000	-\$61,000	-\$61,000	-\$61,000	-\$61,000	-\$61,000	-\$61,000	-\$61,000	-\$61,000	-\$61,000	-\$61,000
Expenditures		-\$90,000	-\$90,000	-\$90,000	-\$90,000	-\$90,000	-\$90,000	-\$90,000	-\$90,000	-\$90,000	-\$90,000	-\$90,000	-\$90,000	-\$90,000	-\$90,000	-\$90,000
Restoration costs																-\$80,000
EBITDA		\$64,000	\$64,000	\$64,000	\$64,000	\$64,000	\$64,000	\$64,000	\$64,000	\$64,000	\$64,000	\$64,000	\$64,000	\$64,000	\$64,000	-\$16,000
CCA Building		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
CCA Equipment		\$23,000	\$41,400	\$33,120	\$26,496	\$21,197	\$16,957	\$13,566	\$10,853	\$8,682	\$6,946	\$5,557	\$4,445	\$3,556	\$2,845	\$2,276
CCA Modifications		\$8,333	\$8,333	\$8,333	\$8,333	\$8,333	\$8,333	\$8,333	\$8,333	\$8,333	\$8,333	\$8,333	\$8,333	\$8,333	\$8,333	\$8,333
EBIT		\$32,667	\$14,267	\$22,547	\$29,171	\$34,470	\$38,709	\$42,101	\$44,814	\$46,984	\$48,721	\$50,110	\$51,221	\$52,110	\$52,822	-\$26,609
Tax		\$11,107	\$4,851	\$7,666	\$9,918	\$11,720	\$13,161	\$14,314	\$15,237	\$15,975	\$16,565	\$17,037	\$17,415	\$17,718	\$17,959	-\$9,047
EBIAT		\$21,560	\$9,416	\$14,881	\$19,253	\$22,750	\$25,548	\$27,786	\$29,577	\$31,010	\$32,156	\$33,073	\$33,806	\$34,393	\$34,862	-\$17,562
Operating Cash Flow		\$52,893	\$59,149	\$56,334	\$54,082	\$52,280	\$50,839	\$49,686	\$48,763	\$48,025	\$47,435	\$46,963	\$46,585	\$46,282	\$46,041	-\$6,953
Investments																
Change in WC		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Modifications	-\$125,000															
Equipment	-\$230,000															
Investment Cash Flow	-\$355,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Cashflow	-\$355,000	\$52,893	\$59,149	\$56,334	\$54,082	\$52,280	\$50,839	\$49,686	\$48,763	\$48,025	\$47,435	\$46,963	\$46,585	\$46,282	\$46,041	-\$6,953
NPV	-\$11,755															

8.13 Solution

Headache	0	1	2	3
<u>Operations</u>				
Revenue		\$25,050,000	\$25,050,000	\$25,050,000
Price		\$8.35	\$8.35	\$8.35
Quantity		3,000,000	3,000,000	3,000,000
Variable Cost		\$12,300,000	\$12,300,000	\$12,300,000
Cost		\$4.10	\$4.10	\$4.10
CCA (simplification)		\$2,875,000	\$5,031,250	\$3,773,438
EBIT		\$9,875,000	\$7,718,750	\$8,976,563
Taxes		\$3,357,500	\$2,624,375	\$3,052,031
EBIAT		\$6,517,500	\$5,094,375	\$5,924,531
Operating Cash Flow		\$9,392,500	\$10,125,625	\$9,697,969
<u>Investments</u>				
Change in W/C	\$0	\$0	\$0	\$0
Investments	-\$23,000,000			
Investments CF	-\$23,000,000	\$0	\$0	\$0
Total Cash Flow	-\$23,000,000	\$9,392,500	\$10,125,625	\$9,697,969
NPV:	\$2,538,582			

8.13 Solution

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Headache & Arthritis	0	1	2	3
<u>Operations</u>				
Revenue		\$37,575,000	\$37,575,000	\$37,575,000
Price		\$8.35	\$8.35	\$8.35
Quantity		4,500,000	4,500,000	4,500,000
Variable Cost		\$20,925,000	\$20,925,000	\$20,925,000
Cost		\$4.65	\$4.65	\$4.65
CCA (simplification)		\$4,000,000	\$7,000,000	\$5,250,000
EBIT		\$12,650,000	\$9,650,000	\$11,400,000
Taxes		\$4,301,000	\$3,281,000	\$3,876,000
EBIAT		\$8,349,000	\$6,369,000	\$7,524,000
Operating Cash Flow		\$12,349,000	\$13,369,000	\$12,774,000
<u>Investments</u>				
Change in W/C	\$0	\$0	\$0	\$0
Investments	-\$32,000,000			\$1,000,000
Investments CF	-\$32,000,000	\$0	\$0	\$1,000,000
Total Cash Flow	-\$32,000,000	\$12,349,000	\$13,369,000	\$13,774,000
NPV:	\$2,461,811			

8.16 Solution

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	0	1	2	3	4	5	6	7	8
Mixer X	-\$500,000	\$120,000	\$120,000	\$120,000	\$120,000	\$120,000			
NPV	-\$77,932								
Eq. payments	-\$22,157								
Mixer Y	-\$650,000	\$140,000	\$140,000	\$140,000	\$140,000	\$140,000	\$140,000	\$140,000	\$140,000
NPV	\$21,828								
Eq. payments	\$4,549								