IBM

Capital Investment Decisions

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Capital Investment Decisions

- Investment goals and criteria
- Accounting-based returns
- Cash flow-based returns
- Analysis: NPV and IRR
- Sensitivity analysis
- Real options

First Principles

- Invest in projects that **yield a return greater** than the minimum acceptable hurdle rate.
  - The hurdle rate should be higher for riskier projects and reflect the financing mix used - owners' funds (equity) or borrowed money (debt)
  - **Returns on projects should be measured based on cash flows generated and the timing of these cash flows; they should also consider both positive and negative side effects of these projects.**
- Choose a financing mix that minimizes the hurdle rate and matches the assets being financed.
- If there are not enough investments that earn the hurdle rate, return the cash to stockholders.
  - The form of returns - dividends and stock buybacks - will depend upon the stockholders' characteristics.

Objective: Maximize the Value of the Firm

Measures of Return: Earnings versus Cash Flows

- Principles Governing Accounting Earnings Measurement
  - Accrual Accounting: Show revenues when products and services are sold or provided, not when they are paid for. Show expenses associated with these revenues rather than cash expenses.
  - Operating versus Capital Expenditures: Only expenses associated with creating revenues in the current period should be treated as operating expenses. Expenses that create benefits over several periods are written off over multiple periods (as depreciation or amortization)
- To get from accounting earnings to cash flows:
  - you have to add back non-cash expenses (like depreciation)
  - you have to subtract out cash outflows which are not expensed (such as capital expenditures)
  - you have to make accrual revenues and expenses into cash revenues and expenses (by considering changes in working capital).

Measuring Returns Right: The Basic Principles

- Use cash flows rather than earnings. You cannot spend earnings.
- Use "incremental" cash flows relating to the investment decision, i.e., cashflows that occur as a consequence of the decision, rather than total cash flows.
- Use "time weighted" returns, i.e., value cash flows that occur earlier more than cash flows that occur later.

The Return Mantra: "Time-weighted, Incremental Cash Flow Return"

Earnings versus Cash Flows: Disney in Thailand

- The theme parks to be built near Bangkok, modeled on Euro Disney in Paris, will include a "Magic Kingdom" to be constructed, beginning immediately, and becoming operational at the beginning of the second year, and a second theme park modeled on Epcot Center at Orlando to be constructed in the second and third year and becoming operational at the beginning of the fifth year.
- The earnings and cash flows are estimated in nominal U.S. Dollars.

Key Assumptions on Start Up and Construction

- Disney has already spent $ 500 million researching the location and getting the needed licenses for the park.
- The cost of constructing Thai Magic Kingdom will be $ 3 billion, with $ 2 billion invested up front, and $ 1 billion in year 1.
- The cost of constructing Thai "Epcot" will be $ 1.5 billion, with $ 1 billion being spent in year 2 and $ 0.5 billion in year 3.

Key Revenue Assumptions

Revenue estimates for the parks and resort properties (in millions)

Year	Magic Kingdom	"Epcot"	Resort Hotels	Total Revenues
1	$0	$0	$0	$0
2	$1,000	$0	$200	$1,200
3	$1,400	$0	$250	$1,650
4	$1,700	$0	$300	$2,000
5	$2,000	$500	$375	$2,875
6	$2,200	$550	$688	$3,438
7	$2,420	$605	$756	$3,781
8	$2,662	$666	$832	$4,159
9	$2,928	$732	$915	$4,575
10 on	Grows at the inflation rate forever: 3%			

Key Expense Assumptions

- The operating expenses are assumed to be 60% of the revenues at the parks, and 75% of revenues at the resort properties.
- Disney will also allocate the following portion of its general and administrative expenses to the theme parks. It is worth noting that a recent analysis of these expenses found that only one-third of these expenses are variable (and a function of total revenue) and that two-thirds are fixed.

Year	*G& A Costs*	*Year*	*G& A Costs* (in millions)
1	$0	6	$ 293
2	$0	7	$ 322
3	$220	8	$354
4	$242	9	$390
5	$266	10 on	Grow at inflation rate of 3%

Depreciation and Capital Maintenance

Year	*Depreciation*	*Capital Maintenance*
1	$0	$0
2	$375	$150
3	$378	$206
4	$369	$250
5	$319	$359
6	$302	$344
7	$305	$303
8	$305	$312
9	$305	$343
10	$315	$315
After Maintenance	Offsetting: Depreciation = Capital	

Other Assumptions

- Disney will have to maintain net working capital (primarily consisting of inventory at the theme parks and the resort properties, netted against accounts payable) of 5% of revenues, with the investments in working capital being made at the beginning of each year.
- The income from the investment will be taxed at a marginal tax rate of 36%.

View 1: The Earnings View of the Project

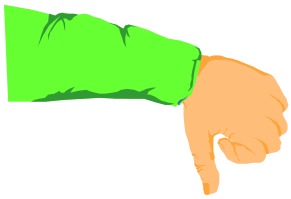
	2	3	4	9	10
Revenues	$ 1,200	$ 1,650	$ 2,000	$ 4,575	$ 4,713
Operating Expenses (Non-Depr)	$ 750	$ 1,028	$ 1,245	$ 2,882	$ 2,969
Depreciation & Amortization	$ 375	$ 378	$ 369	$ 305	$ 315
Allocated G&A Costs	$ 200	$ 220	$ 242	$ 390	$ 401
Operating Income	$ (125)	$ 25	$ 144	$ 998	$ 1,028
Taxes	$ (45)	$ 9	$ 52	$ 359	$ 370
Operating Income after Taxes	$ (80)	$ 16	$ 92	$ 639	$ 658

And the Accounting View of Return

Year	EBIT(1-t)	Beg BV	Deprecn	Cap Ex	End BV	Avge Bv	ROC
0			$0	$2,500	$2,500		
1	$0	$2,500	$0	$1,000	$3,500	$3,000	
2	($80)	$3,500	$375	$1,150	$4,275	$3,888	-2.06%
3	$16	$4,275	$378	$706	$4,604	$4,439	0.36%
4	$92	$4,604	$369	$250	$4,484	$4,544	2.02%
5	$326	$4,484	$319	$359	$4,525	$4,505	7.23%
6	$433	$4,525	$302	$344	$4,567	$4,546	9.53%
7	$494	$4,567	$305	$303	$4,564	$4,566	10.82%
8	$563	$4,564	$305	$312	$4,572	$4,568	12.33%
9	$639	$4,572	$305	$343	$4,609	$4,590	13.91%
10	$658	$4,609	$315	$315	$4,609	$4,609	14.27%
Average							7.60%

Would Lead Us to Conclude That...

- Do not invest in this park. The **return on capital of 7.60%** is lower than the **cost of capital for theme parks of 12.32%**; This would suggest that the project should not be taken.



From Project to Firm Return on Capital

- Just as a comparison of project return on capital to the cost of capital yields a measure of whether the project is acceptable, a comparison can be made at the firm level, to judge whether the existing projects of the firm are adding or destroying value.
- Disney, in 1996, had earnings before interest and taxes of $5,559 million, had a book value of equity of $11,368 million and a book value of debt of $7,663 million. With a tax rate of 36%, we get
  - Return on Capital = 5559 (1-.36) / (11,368+7,663) = 18.69%
  - Cost of Capital for Disney= 12.22%
  - Excess Return = 18.69% - 12.22% = 6.47%
- This can be converted into a dollar figure by multiplying by the capital invested, in which case it is called ***economic value added***
  - EVA = (.1869-.1222) (11,368+7,663) = $1,232 million

EVA

View 2: The *Cash Flow* View of This Project...

	0	1	2	3	9	10
Operating Income after Taxes			$ (80)	$ 16	$ 639	$ 658
+ Depreciation & Amortization	$ -	$ -	$ 375	$ 378	$ 305	$ 315
- Capital Expenditures	$ 2,500	$ 1,000	$ 1,150	$ 706	$ 343	$ 315
- Change in Working Capital	$ -	$ -	$ 60	$ 23	$ 21	$ 7
Cash Flow on Project	$ (2,500)	$ (1,000)	$ (915)	$ (335)	$ 580	$ 651

To get from income to cash flow, we

- added back all non-cash charges such as depreciation
- subtracted out the capital expenditures
- subtracted out the change in non-cash working capital

The Depreciation Tax Benefit

- Depreciation reduces taxable income--and taxes!
- But it does not reduce the cash flows.
- The benefit of depreciation is therefore the tax benefit. In general, the tax benefit from depreciation can be written as:

  Tax Benefit = Depreciation * Tax Rate
- **Proposition 1**: The tax benefit from depreciation and other non-cash charges is greater, the higher your tax rate.
- **Proposition 2**: Non-cash charges that are not tax deductible (such as amortization of goodwill) and thus provide no tax benefits have no effect on cash flows.

The Capital Expenditures Effect

- Capital expenditures are not treated as accounting expenses *but they do cause cash outflows.*
- Capital expenditures can generally be categorized into two groups
  - New (or Growth) capital expenditures are capital expenditures designed to create new assets and future growth
  - Maintenance capital expenditures refer to capital expenditures designed to keep existing assets functioning.
- Both **initial** and **maintenance** capital expenditures *reduce cash flows*

The Working Capital Effect

- Intuitively, money invested in inventory or in accounts receivable cannot be used elsewhere. It thus represents a drain on cash flows
- To the degree that some of these investments can be financed using suppliers credit (accounts payable) the cash flow drain is reduced.
- Investments in working capital are thus cash outflows
  - Any increase in working capital reduces cash flows in that year
  - Any decrease in working capital increases cash flows in that year
- To provide closure, working capital investments need to be salvaged at the end of the project life.
- **Proposition 1**: The failure to consider working capital in a capital budgeting project will overstate cash flows on that project and make it look more attractive than it really is.
- **Proposition 2**: Other things held equal, a reduction in working capital requirements will increase the cash flows on all projects for a firm.

The Incremental Cash Flows On The Project

	0	1	2	3	9	10
Cash Flow on Project	$ (2,500)	$ (1,000)	$ (915)	$ (335)	$ 580	$ 651
- Sunk Costs	$ 500					
+ Non-incr. Alloc Cost (1-t)	$ -	$ -	$ 85	$ 94	$ 166	$ 171
Incremental Cash Flow on Projec	$ (2,000)	$ (1,000)	$ (830)	$ (241)	$ 746	$ 822

To get from cash flow to incremental cash flows, we

- subtract out sunk costs
- add the non-incremental allocated costs (in after-tax terms)

Sunk Costs

- Any expenditure that has already been incurred, and cannot be recovered (even if a project is rejected) is called a sunk cost
- When analyzing a project, sunk costs should not be considered since they are incremental
- By this definition, market testing expenses and R&D expenses are both likely to be sunk costs before the projects that are based upon them are analyzed. If sunk costs are not considered in project analysis, how can a firm ensure that these costs are covered?

Allocated Costs

- Firms allocate costs to individual projects from a centralized pool (such as general and administrative expenses) based upon some characteristic of the project (sales is a common choice)
- *For large firms, these allocated costs can result in the rejection of projects.* To the degree that these costs are not incremental (and would exist anyway), this makes the firm worse off.
- Thus, it is only the incremental component of allocated costs that should show up in project analysis.

Time-Weighted Cash Flows

- Incremental cash flows in the earlier years are worth more than incremental cash flows in later years.
- In fact, cash flows across time cannot be added up. They have to be brought to the same point in time before aggregation.
- This process of moving cash flows through time is
  - *discounting*, when future cash flows are brought to the present
  - *compounding*, when present cash flows are taken to the future

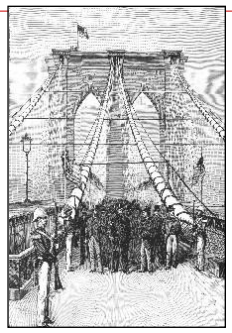
Present Value Computations

Cash Flow Type	Discounting Formula	Compounding Formula
1. Simple CF	$CF_n / (1+r)^n$	$CF_0 (1+r)^n$
2. Annuity	$A\left[\frac{(1+r)^n - 1}{r}\right]$	$A\left[\frac{1 - \frac{1}{(1+r)^n}}{r}\right]$
3. Growing Annuity	$A(1+g)\left[\frac{1 - \frac{(1+g)^n}{(1+r)^n}}{r-g}\right]$	
4. Perpetuity	A/r	
5. Growing Perpetuity	A(1+g)/(r-g)	

Would You Buy the Brooklyn Bridge?

- In 1883 the Brooklyn Bridge cost $15,100,000
- Invested at 5% per annum, that would be $5,268,570,985 today

$15,100,000x(1+.05)^{120} =$5,268,570,985



Discounted Cash Flow Measures of Return

- Net Present Value (NPV): The net present value is the sum of the present values of all cash flows from the project (including initial investment).
  NPV = Sum of the present values of all cash flows on the project, including the initial investment, with the cash flows being discounted at the appropriate hurdle rate (cost of capital, if cash flow is cash flow to the firm, and cost of equity, if cash flow is to equity investors)
  - **Decision Rule: Accept if NPV > 0**
- Internal Rate of Return (IRR): The internal rate of return is the discount rate that sets the net present value equal to zero. It is the percentage rate of return, based upon incremental time-weighted cash flows.
  - **Decision Rule: Accept if IRR > hurdle rate**

Closure on Cash Flows

- In a project with a finite and short life, you would need to compute a **salvage value**, which is the expected proceeds from selling all of the investment in the project at the end of the project life. It is usually set equal to book value of fixed assets and working capital
- In a project with an infinite or very long life, we compute cash flows for a reasonable period, and then compute a **terminal value** for this project, which is the present value of all cash flows that occur after the estimation period ends..
- Assuming the project lasts forever, and that cash flows after year 9 grow 3% (the inflation rate) forever, the present value at the end of year 9 of cash flows after that can be written as:
  - Terminal Value = CF in year 10/(Cost of Capital - Growth Rate)
    = 822/(.1232-.03) = $ 8,821 million

Thailand Disney: NPV Computation...

Year	*Incremental CF*	*Terminal Value*	*PV at 12.32%*
0	$ (2,000)		$ (2,000)
1	$ (1,000)		$ (890)
2	$ (830)		$ (658)
3	$ (241)		$ (170)
4	$ 297		$ 187
5	$ 355		$ 198
6	$ 488		$ 243
7	$ 617		$ 273
8	$ 688		$ 272
9	$ 746	$ 8,821	$ 3,363
Net Present Value of Project =			**$ 818**

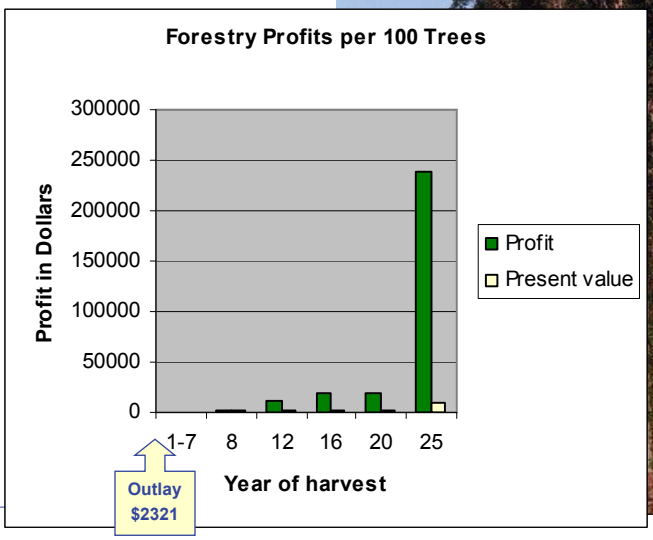
Terminal Value
= CF in year 10/(Cost of Capital - Growth Rate)
= 822/(.1232-.03)
= $ 8,821 million

Which makes the argument that..

- **The project should be accepted**. The positive net present value suggests that the project will add value to the firm, and earn a return in excess of the cost of capital.
- By taking the project, Disney will increase its value as a firm by $818 million.

Would You Buy One of These?

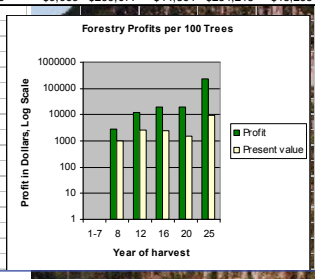
Forestry Application



Forestry Application

Tree Age	Number of Trees Before Harvest	Number of Trees Harvested	Useable Tree Height - Feet	Tree Diameter - Inches	Volume per Tree - Cubic Feet	Marketable Wood per Tree - Board Feet	Value per Tree	Gross Harvest Proceeds	Harvest and Process-ing Costs	Net Harvest Proceeds	Care and Manage-ment Fee	Net Profit per Harvest	Cumulative Net Proceeds	Present Value
Notes:1-3		3, 4	5	5	6	7	8	9				13, 14	15	16
1-7	100	15	(mortality and cull loss)											
8	85	20	20	8	4.5	22	$174	$3,472	$521	$2,951	$177	$2,774	$2,774	$ 994
12	65	20	27	11	11.6	76	$769	$15,382	$2,307	$13,074	$784	$12,290	$15,064	$ 2,636
16	45	10	32	14	22.2	187	$2,372	$23,724	$3,559	$20,165	$1,210	$18,956	$34,019	$ 2,433
20	35	5	35	17	35.9	301	$4,830	$24,151	$3,623	$20,529	$1,232	$19,297	$53,316	$ 1,483
25	30	30	39	20	55.3	465	$9,969	$299,077	$44,861	$254,215	$15,253	$238,962	$292,279	$ 9,667
														$ 17,212

Assumptions			
Initial price per board-foot:		$5	17
Price growth rate:		6%	
Harvest costs:		15%	
Management fee:		6%	
Required rate of return:			
	Riskfree	5%	
	Beta	0.58	18
	Market risk premium	5.50%	
	Country risk premium	5.50%	19
Total from CAPM:		13.69%	
Initial cost per 100 Premium Mix		$ 2,321	20
IRR:		30%	21

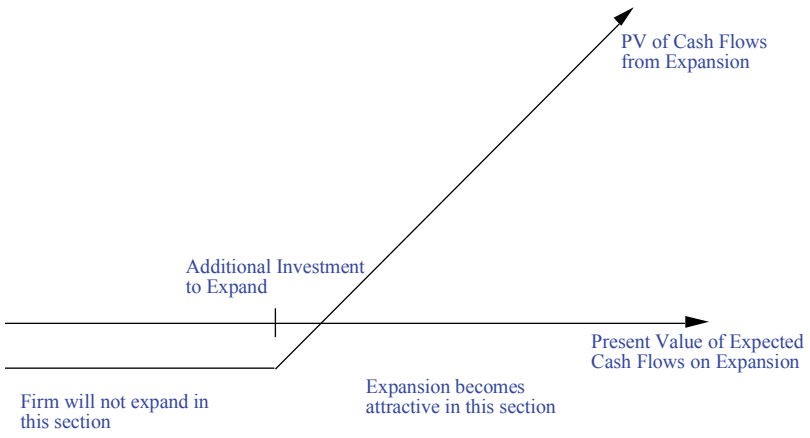


giddy.org/ibmfinance/forestry.xls

The Option to Expand/Take Other Projects

- **Making an investment today may allow a firm to consider and take other valuable projects in the future.**
- Thus, even though a project may have a negative NPV, it may be a project worth taking if the option it provides the firm (to take other projects in the future) provides a more-than-compensating value.
- These are the options that firms often call "strategic options" and use as a rationale for taking on "negative NPV" or even "negative return" projects.

The Option to Expand



An Example of an Expansion Option

- Disney is considering investing $ 100 million to create a Spanish version of the Disney channel to serve the growing Mexican market.
- A financial analysis of the cash flows from this investment suggests that the present value of the cash flows from this investment to Disney will be only $ 80 million. Thus, by itself, the new channel has a **negative NPV of $ 20 million**.
- If the market in Mexico turns out to be more lucrative than currently anticipated, Disney **could expand** its reach to all of Latin America with **an additional investment of $ 150 million** any time over the next 10 years. While the current expectation is that the cash flows from having a Disney channel in Latin America is only $ 100 million, there is considerable uncertainty about both the potential for such an channel and the shape of the market itself, leading to significant variance in this estimate.

Valuing the Expansion Option

- Value of the Underlying Asset (S) = PV of Cash Flows from Expansion to Latin America, if done now =$ 100 Million
- Strike Price (K) = Cost of Expansion into Latin American = $ 150 Million
- We estimate the variance in the estimate of the project value by using the annualized variance in firm value of publicly traded entertainment firms in the Latin American markets, which is approximately 10%.
  - Variance in Underlying Asset's Value = 0.10
- Time to expiration = Period for which expansion option applies = 10 years

Call Value= 100 (0.7915) -150 (exp(-0.065)(10) (0.3400)

= $ 52.5 Million

Considering the Project with Expansion Option

- NPV of Disney Channel in Mexico = $80 Million - $100 Million = -$20 Million
- Value of Option to Expand = $ 52.5 Million
- NPV of Project with option to expand
  - = - $ 20 million + $ 52.5 million
  - = $ 32.5 million
- **Take the project**

Case Study: Rio Algom

- Rio Algom is purchasing a copper mine in Peru.
- The company is arranging $630 bank financing for the project.
- Copper prices are volatile (Annual Vol. = 21%).
- How should it evaluate the exploration license?

Back to First Principles

- Invest in projects that yield a return greater than the minimum acceptable hurdle rate.
- The hurdle rate should be higher for riskier projects and reflect the financing mix used - owners' funds (equity) or borrowed money (debt)
- Returns on projects should be measured based on cash flows generated and the timing of these cash flows; they should also consider both positive and negative side effects of these projects, and additional opportunities that the investment offers.

Contact Information

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