



M&A e Processi di Valorizzazione aziendale

Casi aziendali

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Strategia chiara, numeri affidabili e strumenti digitali

Polo Advisory è il partner dell'imprenditore e dei manager delle PMI, con un approccio operativo e continuativo che dà solidità e prospettiva al futuro dell'impresa.

Un team con oltre **15 anni di esperienza** in diversi settori, capace di integrare competenze di strategia, finanza e digitalizzazione per affrontare le sfide più complesse

Ambiti di intervento



Strategia

Business plan, crescita, operazioni straordinarie



Finance

Pianificazione finanziaria, controllo di gestione, accesso al credito



Digital

ERP selection, automazione processi, business intelligence



Outsourcing CFO/CDG

Gestione diretta dei numeri e dei rapporti con le banche



Formazione

Percorsi mirati su finanza, strategia e digitalizzazione



Strategia



- Visione strategica e business plan
- Passaggi generazionali
- Operazioni straordinarie (M&A, apertura del capitale)
- Modelli organizzativi e governance

Finance



- Pianificazione finanziaria e industriale
- Controllo di gestione e KPI direzionali
- Accesso al credito e finanza agevolata

Digital & Innovazione



- Software/ERP selection
- Digitalizzazione processi e automazione
- Business Intelligence & Data Analytics

Formazione & Advisory Continuativa



- Percorsi su misura per imprenditori e manager
- Workshop e check-up tematici
- Focus cultura manageriale e finanziaria

Il servizio di Outsourcing Controllo di gestione



Controller o CFO, il partner quando serve, senza costi fissi di struttura.

Un modello flessibile che offre alle PMI il controllo dei numeri e la gestione finanziaria necessaria, con continuità e competenza.

Non tutte le PMI possono permettersi una figura interna dedicata al controllo dei numeri o alla gestione finanziaria.

Con il modello di **Outsourcing CdG e CFO**, Polo Advisory affianca l'imprenditore con competenze su misura: dal monitoraggio operativo alla pianificazione strategica e al rapporto con le banche.

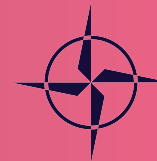
Case study

Contesto: PMI del settore Food con gestione finanziaria frammentata e mancanza di controllo sui margini. Presenza di un responsabile amministrativo molto competente in ambito contabile e fiscale, che non riesce a seguire anche l'area pianificazione e controllo

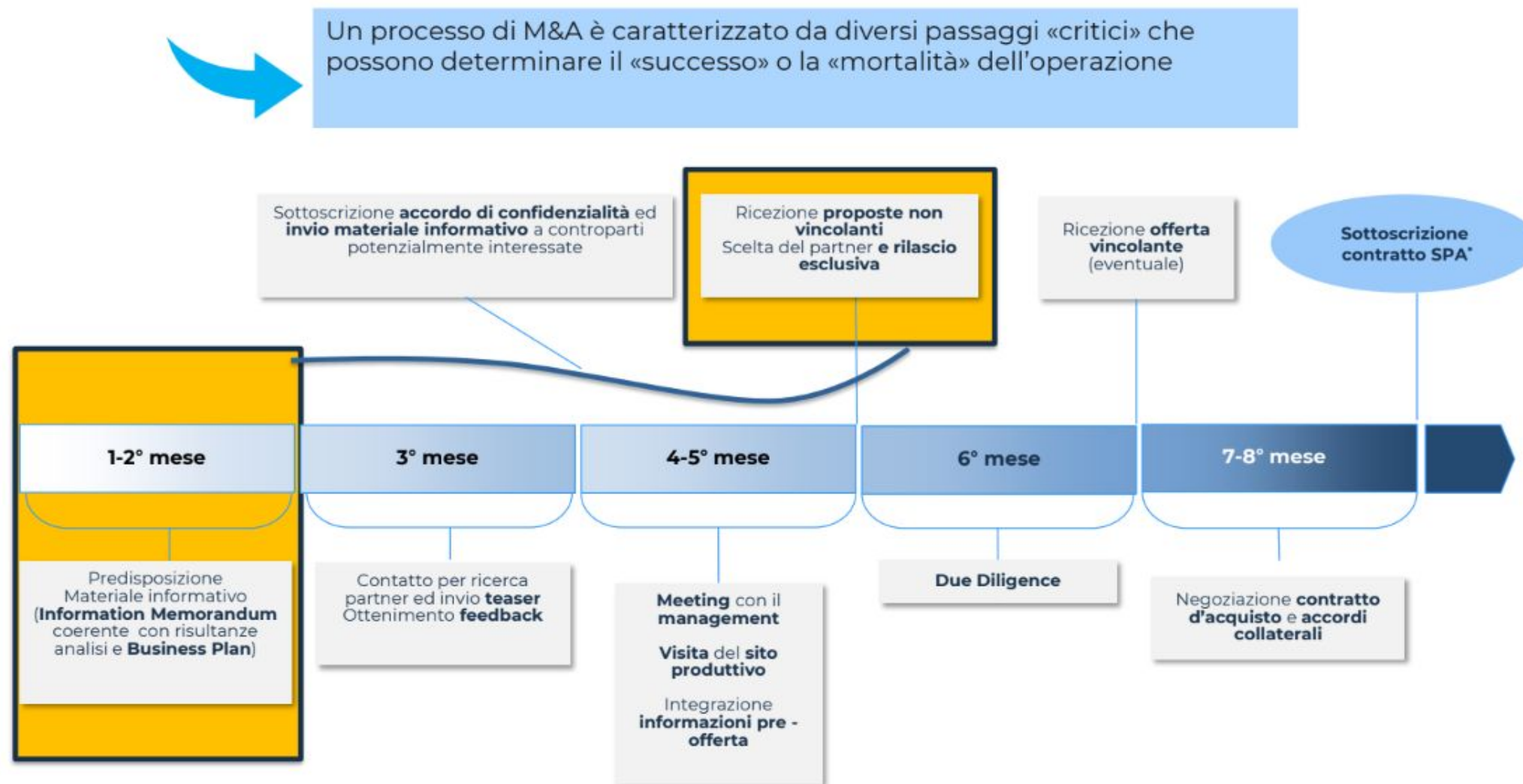
Intervento: Controller per reporting mensile + CFO esterno per rapporto banche

Risultati: numeri sempre aggiornati, migliore capacità decisionale, miglioramento del dialogo con le banche e recupero dell'equilibrio finanziario

Il tipico processo di M&A



TEMPISTICA E ATTIVITÀ TIPICHE DI UN PROCESSO M&A



Il tipico processo di M&A: La Valutazione



Metodologia Patrimoniale Semplice

Metodi patrimoniali: stimano il valore dell'azienda in funzione della consistenza patrimoniale della società stessa. Tale approccio individua il valore economico nella differenza tra le poste dell'attivo patrimoniale e quelle del passivo patrimoniale espresse a valore corrente

Metodologia Reddittuale

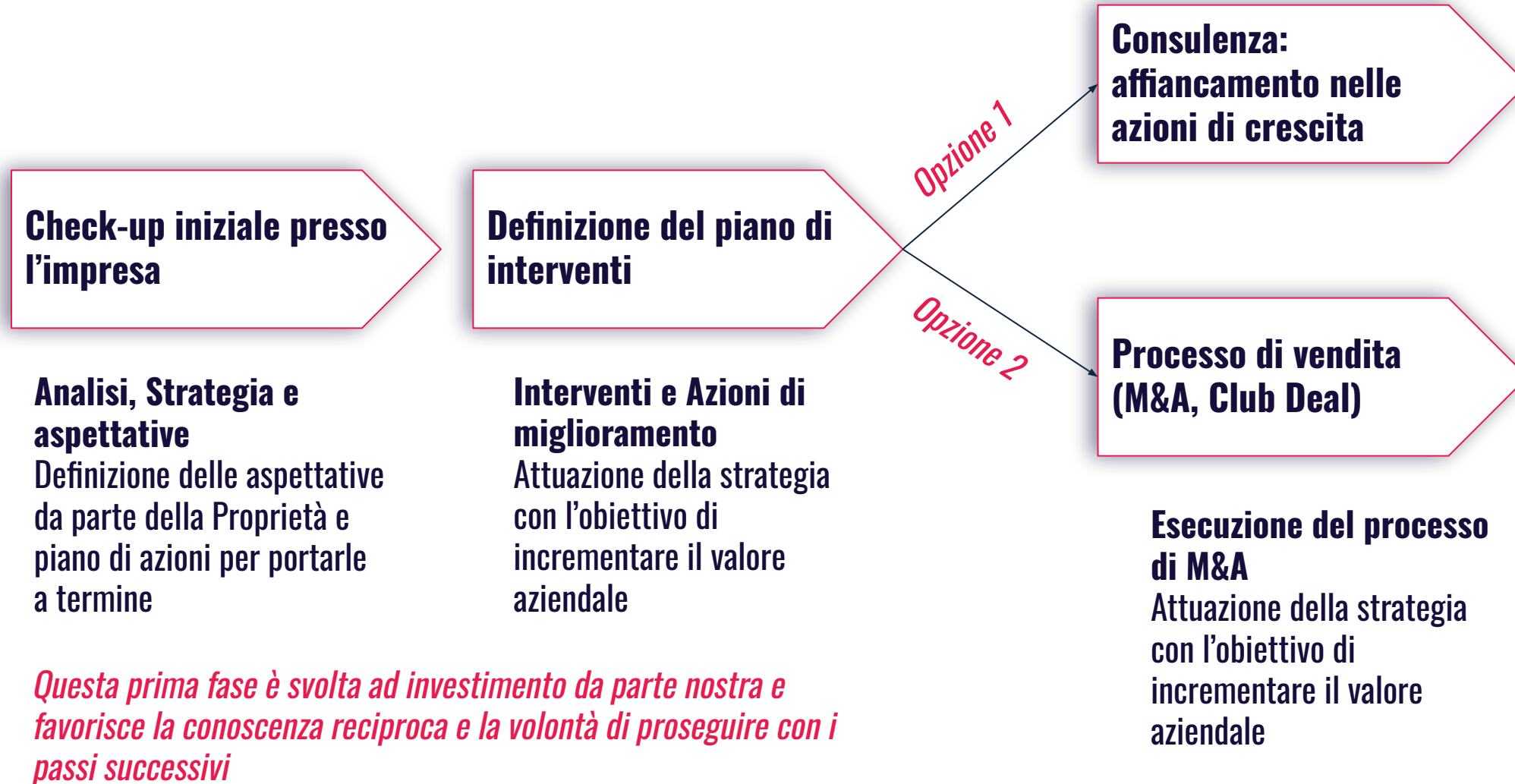
Metodi reddituali: stimano il valore dell'azienda in funzione della redditività che quest'ultima è in grado di generare in chiave prospettica. Tale approccio individua, quindi, nella contrapposizione di ricavi e costi di competenza dell'esercizio il driver fondamentale del valore aziendale. Il valore economico è pari alla somma del flusso dei redditi normali attesi (per un periodo di tempo limitato, ovvero illimitato), attualizzati al tasso di rendimento del capitale di rischio.

Multipli di borsa

I **criteri di mercato** concepiscono il valore del capitale dell'impresa in funzione dei prezzi, espressi dai mercati regolamentati ovvero in negoziazioni private, per quote di capitale dell'azienda medesima o di aziende simili. Tale approccio prescinde, quindi, dagli effettivi valori patrimoniali e reddituali, storici e prospettici. Fanno parte di tale approccio i seguenti metodi:

- **metodo dei multipli di borsa:** tale approccio stima il valore del capitale economico di un'azienda sulla base dei prezzi negoziati nei mercati organizzati per titoli rappresentativi di quote di imprese comparabili.
- **metodo delle transazioni comparabili:** tale metodo si fonda sull'attribuzione ad un'azienda di un valore rilevato su transazioni avvenute, aventi per oggetto quote di controllo del capitale azionario di aziende comparabili.

Il nostro approccio: affiancamento lungo il percorso





1. Passaggio generazionale e rafforzamento manageriale in un'azienda della nautica

ERP, controllo di gestione e business
plan come leve per garantire continuità
e crescita



L'azienda, **attiva da oltre 30 anni nel settore nautico**, stava affrontando una fase cruciale di passaggio generazionale.

Il fondatore, dopo anni di crescita con buone marginalità, intendeva portare gradualmente i figli nella gestione, ma al tempo stesso dotare la società di una struttura organizzativa e manageriale più solida.

L'obiettivo di medio termine era quello di trovare e inserire nel capitale un partner finanziario o industriale per il successivo step di crescita.

Criticità riscontrate:

- **Assenza di un piano industriale** strutturato e condiviso, nonostante la crescita dimensionale.
- **ERP obsoleto**, non integrato con gli altri sistemi e non più adeguato a supportare i processi aziendali.
- **Mancanza** di strumenti di **reporting** gestionale per analizzare le marginalità delle 7 linee di prodotto.
- Buona parte del fatturato sviluppata all'estero **senza un adeguato presidio dei numeri**.



OBIETTIVI

a. Garantire una **transizione** generazionale **ordinata** e **inclusiva**.

b. Rafforzare il **controllo** dei **numeri** a supporto delle decisioni strategiche.

c. Implementare un **piano industriale** per sostenere lo sviluppo futuro.

d. Dotare la società di **sistemi** e **processi organizzativi moderni**.

L'approccio di Polo Advisory

Case study 1



1. Check-up iniziale

Analisi del modello di business, assetto organizzativo, processi core e situazione economico-finanziaria

2. Master plan

Roadmap pluriennale di interventi condivisa con la proprietà e il management

3. Progetti prioritari:

- **ERP e digitalizzazione:** software selection, gara tra fornitori, implementazione nuovo ERP e formazione del personale.
- **Business plan triennale:** costruito su basi numeriche solide e sistemi aggiornati.
- **Controllo di gestione:** introduzione di contabilità analitica, closing mensile e reporting gestionale.

4. Affiancamento continuativo: supporto costante al management e coinvolgimento diretto della nuova generazione in tutti i progetti chiave



SOLUZIONI

ERP moderno

selezionato e implementato in meno di un anno, con successo e piena adozione da parte dell'organizzazione.

Coinvolgimento della nuova generazione

i figli del fondatore hanno partecipato come project manager, favorendo l'integrazione nel business e il trasferimento di competenze.

Business plan triennale

elaborato su analisi di mercato, modello operativo, action plan e proiezioni economico-finanziarie.

Controllo di gestione

introdotto sistema di reporting mensile, analisi delle marginalità per prodotto e closing regolare.

Risultati ottenuti e Take away formativo

Case study 1



RISULTATI

Governance rafforzata, con ruoli chiari e maggiore professionalizzazione.

Processi e sistemi aziendali più solidi e integrati.

Strategia di crescita chiara, sostenuta da numeri affidabili.

Ingresso di un fondo di private equity a fianco della famiglia, con i figli già in ruoli manageriali chiave.

TAKE AWAY FORMATIVO

La digitalizzazione (ERP) può diventare una **leva fondamentale** per favorire il passaggio generazionale.

Il controllo di gestione è essenziale per **collegare i numeri alla strategia**.

Il coinvolgimento diretto della nuova generazione in progetti operativi rafforza la successione.

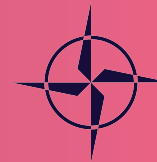


2. Processo di vendita di un'azienda chimica: tra scouting di acquirenti e piano di rafforzamento organizzativo

M&A sell-side, valutazione, information memorandum e scenari alternativi

Contesto

Case study 2



L'azienda, attiva da oltre 40 anni nel settore chimico, con un fatturato sotto i 5 milioni di euro, presentava buone marginalità e una crescita costante.

La proprietà, in assenza di passaggio generazionale, stava valutando la cessione dell'attività (preferibilmente maggioranza o totalitaria) ad un partner industriale, escludendo esplicitamente i fondi finanziari.

Criticità riscontrate:

- **Struttura manageriale debole:** quasi tutte le attività apicali (commerciale, sviluppo prodotto, rapporti con fornitori) erano gestite dall'imprenditore.
- **Organizzazione** composta da operai, staff amministrativo e poche figure di pianificazione, senza veri responsabili o manager di area.
- **Elevata dipendenza dalla figura del fondatore**



OBIETTIVI

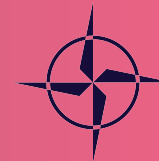
a. Valorizzare la società attraverso un processo di vendita strutturato.

b. Trovare un partner industriale che garantisca continuità al business.

c. Evitare l'ingresso di un fondo finanziario.

L'approccio di Polo Advisory

Case study 2



1. Valutazione preliminare

Analisi dei dati economico-finanziari e costruzione di una valutazione condivisa con l'imprenditore

2. Preparazione materiale M&A

Redazione dell'Information Memorandum, raccolta dati e predisposizione documentazione

3. Scouting acquirenti

Elaborazione di una long list e successiva short list condivisa con l'imprenditore

4. Avvio del processo

NDA firmati, invio dell'IM, primi contatti con potenziali partner

5. Vincolo critico emerso

La debolezza organizzativa ha raffreddato l'interesse di diversi soggetti industriali, consapevoli della necessità di investimenti post-acquisizione in organico e struttura



EVOLUZIONE

Il processo M&A ha evidenziato il valore dell'azienda, ma anche la **necessità** di un **rafforzamento manageriale** per renderla appetibile a potenziali acquirenti.

Con l'imprenditore si stanno valutando due possibili strade:

- **“Piano B” – Crescita interna:** sviluppo di un piano industriale con inserimento di figure manageriali (es. responsabile commerciale, responsabile operations), rafforzamento dei sistemi e investimenti organizzativi.
- **Club Deal:** ricerca di un gruppo di investitori selezionati per accompagnare la società in una nuova fase di sviluppo, in alternativa ad una vendita diretta.

Risultati ottenuti e Take away formativo

Case study 2



RISULTATI

Interesse concreto da parte di vari operatori industriali

Consapevolezza dei gap organizzativi come ostacolo principale alla chiusura del deal.

Definizione di un piano alternativo che apre nuove prospettive: crescita con rinforzo organizzativo oppure apertura ad un club deal.

TAKE AWAY FORMATIVO

Un processo M&A sell-side richiede non solo solidità economico-finanziaria, ma anche una **struttura manageriale in grado di garantire continuità.**

È strategico valutare più scenari per massimizzare le opzioni a disposizione dell'imprenditore.

La debolezza organizzativa può ridurre l'attrattività di un'azienda anche con buoni numeri: serve bilanciamento tra “hard facts” e “soft factors” nella preparazione al deal.



3. Controllo di gestione e pianificazione finanziaria per il risanamento e rilancio di un'azienda food

Dal caos decisionale alla solidità dei numeri per guidare le scelte strategiche per recuperare marginalità e accrescere il valore aziendale





L'azienda, con un **fatturato di circa 30 milioni** e un **brand storico** posizionato nella **fascia medio-alta del mercato**, si trovava in una **fase critica**.

Criticità riscontrate

- **Assenza di un sistema di controllo di gestione:**
 - nessun budget
 - nessun reporting mensile
 - nessuna analisi delle marginalità per cliente, canale e prodotto
- **Mancanza di pianificazione finanziaria** e quindi di adeguati assetti organizzativi.
- **Indebitamento in forte crescita** dovuto a investimenti recenti.
- **Marginalità crollata:** l'azienda ha chiuso l'ultimo esercizio in perdita.
- **Decisioni prese senza numeri affidabili**, con conseguenti inefficienze commerciali e operative.



OBIETTIVI

a. Mettere in sicurezza la continuità aziendale con strumenti di pianificazione finanziaria.

b. Recuperare la marginalità e riportare l'azienda in equilibrio economico.

c. Fornire al management dati chiari e affidabili per prendere decisioni.

L'approccio di Polo Advisory

Case study 3



1. Check-up iniziale

Analisi della situazione economico-finanziaria e dei processi interni

2. Pianificazione finanziaria

Implementato uno strumento con proiezioni di cassa a 12 mesi

3. Piano industriale triennale di risanamento:

Presentato al ceto bancario per rinegoziare e strutturare la posizione debitoria

4. Controllo di gestione - costruzione dei report fondamentali

- analisi marginalità per cliente
- analisi marginalità per prodotto
- analisi marginalità per canale di vendita

5. Affiancamento continuativo

Introduzione del closing mensile e reporting direzionale regolare



SOLUZIONI

Pianificazione finanziaria per garantire la continuità di cassa

Business plan triennale a supporto del dialogo con le banche

Nuovo processo di budgeting e forecasting annuale

Reportistica gestionale mensile con analisi per cliente, canale e prodotto

L'adozione di questi strumenti ha portato alla possibilità di prendere nuove decisioni strategiche:

- **Revisione listini prezzi** su specifici segmenti di clienti e canali.
- **Eliminazione prodotti non profittevoli**, anche se con volumi elevati.
- **Cessione di alcuni clienti** con margine di contribuzione negativo.

Risultati ottenuti e Take away formativo

Case study 3



RISULTATI

Azienda dotata di un sistema di pianificazione finanziaria e controllo coerente con gli adeguati assetti.

Maggiore trasparenza e condivisione dei numeri con la direzione e il management.

Scelte più razionali e coraggiose: taglio delle aree a basso margine e rilancio delle aree profittevoli.

Miglioramento del dialogo con le banche, grazie ad un piano industriale chiaro e numeri aggiornati.

TAKE AWAY FORMATIVO

Senza controllo di gestione le decisioni sono intuitive, ma spesso errate.

Pianificazione finanziaria e reporting sono strumenti vitali non solo per il management, ma anche per la credibilità verso banche e stakeholder.

La disciplina del **closing mensile crea consapevolezza diffusa** e accelera le azioni correttive.



POLO ADVISORY

Strategia. Numeri. Esecuzione.

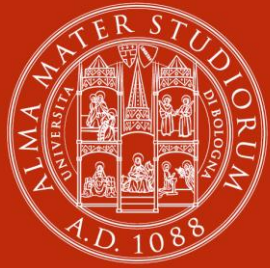
Ti affianchiamo nel percorso di crescita della tua impresa.

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ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

Corporate Finance

Lecture 2

Financial Ratios

Massimiliano Marzo

Dipartimento di Scienze Aziendali

Financial Ratios

- Ratios are designed to meet information needs of investors and creditors
 - purpose is to facilitate comparable measurement of risk and return features across firms
 - ratios are a common way to use financial information in order to make crude comparisons across firms
 - they represent standardized relations of costs and benefits
 - careful analysis of ratios can provide insight into a firm's economics characteristics and competitive advantages
 - the ratios in and of themselves are somewhat meaningless
 - their real role is to indicate where an analyst needs to do more analysis or ask more questions about the firm
 - » identify financial or economic differences across firms



Financial Ratios

- **Common types of ratios**
 - Most common way to use financial information in order to make crude comparisons across firms
 - several kinds of ratios
 - ***leverage or solvency ratios***
 - show proportion of fixed claims (debt) used to finance the firm
 - ***liquidity ratios***
 - measure of cash availability within the firm
 - ***efficiency or activity ratios***
 - indicate how productively the firm uses its assets
 - ***profitability ratios***
 - indicate rate of (accounting) return earned on investments
 - ***market value ratios***
 - indicate how highly firm is valued by investors



A Few Words About Ratios

- Reasons to be somewhat leery of ratios
 - ratios are typically calculated using book values rather than market values
 - in truth we should want to use market values as these are more realistic
 - often more difficult to obtain
 - example: market value of equity includes value of intangible assets
 - » R&D, name recognition, accumulated human capital, future investment opportunities
 - however, these assets not readily saleable and may disappear if firm experiences trouble and book value of assets may be more appropriate
 - other potential problems abound with ratios
 - benchmarks, timing and window dressing, negative numbers, and accounting methods



Ratio Examples

- We will use F/S of Executive Paper

<i>Executive Paper Balance Sheet</i>		Dec 2021	Dec 2022	diff
Assets				
Current Assets:	Cash & Securities	100.0	110.0	10.0
	Receivables	433.1	440.0	6.9
	Inventory	339.9	350.0	10.1
	Total Current Assets	873.0	900.0	27.0
Fixed Assets:	P, P & E	929.8	100.0	-829.8
	Accum Deprec	396.7	450.0	53.3
	Net Fixed Assets	533.1	550.0	16.9
	Total Assets	1,406.1	1,450.0	43.9
Liabilities and Equity				
Current Liabs:	Debt due in 1 year	96.6	100.0	3.4
	Payables	349.9	360.0	10.1
	Total current liabilities	446.5	460.0	13.5
	Long term debt	400.0	400.0	0.0
	Shareholders equity	559.6	590.0	30.4
	Total Liabilities and Equity	1,406.1	1,450.0	43.9



Ratio Examples

- I/S and Statement of Cash Flows for Executive Paper

Executive Paper Income Statement (2022)

	\$ millions
Revenues	2,200.00
Costs of Goods Sold	1,500.00
Other Costs	480.00
Depreciation	53.30
EBIT	166.70
Interest	40.00
Tax	50.70
<i>Net income</i>	76.00
Dividend	45.60
Retained earnings	30.40
Earnings per share, dollars	5.37
Dividend per share, dollars	3.22

Executive Paper - Other Data

Estimated replacement cost of assets
Market value of equity
Average number of shares, millions
Share price, dollars

Sources and Uses of Funds (2022)

Sources:	\$ millions
Net Income	76.00
Depreciation	53.30
Operating cash flow	129.30
Borrowing	-
Stock issues	-
Total sources	129.30
Uses:	
Increase in net working capital	13.50
Investment	70.20
Dividends	45.60
Total uses	129.30

2021	2022
1110	1231
598	708
14.16	14.16
42.25	50



Leverage Ratios

- Determining possibility of financial distress

$$\text{Debt ratio} = (\text{LT debt} + \text{PV of leases}) / (\text{LT debt} + \text{PV of leases} + \text{equity})$$

- leases are included as they also represent a fixed claim on the firms future cash flows
 - for Executive Paper (EP) this ratio is $400/(400+590) = .40$
 - » typical range for US firms is .3 - .6
 - greater ratio => greater probability of financial distress
 - also depends on volatility of income
 - also often expressed as a debt-equity ratio
- $$\text{debt-equity ratio} = (\text{LT debt} + \text{PV of leases}) / \text{equity}$$
- EP's ratio = $400/590 = .68$ (this ratio is around 1 for average US firm)
- there are many other ways this ratio can be calculated
 - you should know how the ratio is calculated before saying its too big or too small



Leverage Ratios

- Times interest coverage
 - this is extent to which the firm is able to meet its interest payments

$$\text{times interest coverage} = (\text{EBIT} + \text{depreciation}) / \text{interest expense}$$

- EP's times interest coverage = $(166.7 + 53.3) / 40 = 5.5$
 - thus EP had pre-tax cash flows of 5.5 times their interest expense for the period
 - » clearly higher ratios are better
 - » if this ratio is below 1, the firm will either need to borrow to pay interest or default on its fixed claim obligations
 - » if this ratio is really high, it suggests room for additional borrowing
 - we measure this ratio on pre-tax income because interest payments are made from pre-tax income
 - » interest payments are tax deductible



Liquidity Ratios

- Liquidity ratios provide an indication of a firm's ability to get their hands on cash
 - this is extremely important to short term creditors
- several different ratios

current ratio = current assets / current liabilities

$$= 900/460 = 1.9$$

- ratio of cash like assets to near term payments
 - clearly higher is safer
- affected by short term securities and short term debt
 - a firm borrows ST \$100 and invests in T-bills
 - Net working capital is unaffected by current ratio decreases
 - » sometimes we remove short term borrowings and investments



Other Liquidity Ratios

- Quick ratio (acid-test ratio)

- because some ST (Short Term) assets are less like cash than others
some like to look at only near cash assets

$$\text{Quick ratio} = (\text{cash} + \text{ST securities} + \text{receivables}) / \text{current liabilities}$$

- EP's quick ratio = $(110 + 440) / 460 = 1.2$
- creditors like to see this ratio around 1

- even more narrowly, we have the cash ratio

$$\text{Cash ratio} = (\text{cash} + \text{ST securities}) / \text{current liabilities}$$

- EP's cash ratio - $110 / 460 = .24$
- one concern with liquidity ratio is that they do not take into account firm's reserve capacity to borrow
 - who cares if you have no cash around if you have a line of credit available to you?



Efficiency Ratios

- These ratios indicate how well the firm is managing their assets
 - most common is sales turnover ratio
 - it measures how hard the firm's assets are working to produce revenues

$$\text{Asset turnover ratio} = \text{Sales} / \text{Average Total Assets}$$

- EP's Sales/asset ratio = $2,200 / ((1460 + 1450) / 2) = 1.54$
 - » each dollar of assets produced \$1.54 of sales
 - high ratios are better but there is likely a capacity limit
- note we average assets as they are likely to change over the period
 - occasionally we might look at sales to some component of assets
 - » like sales/fixed assets or sales/net working capital



Short Term Efficiency Ratios

- One important aspect of efficient operations is inventory and receivables management

$$\text{Inventory Turnover} = \text{Cost of Good Sold} / \text{Average Inventory}$$

- for EP this ratio = $1500 / ((339.9 + 350) / 2) = 4.35$
 - thus EP's inventory turns over just over 4 times per year

$$\text{Average Days of Inventory} = 365 / \text{Inventory Turnover}$$

- EP's average days of inventory = $365 / 4.35 = 83.9$ days



Short Term Efficiency Ratios

Accounts Receivables Turnover = Sales / Average A/R

- EP's A/R turnover = $2,200 / ((433.1 + 440)/2) = 5.04$
- thus receivables turn over just over 5 times per year

Average Days of A/R Outstanding = $365 / \text{A/R Turnover}$

- EP's days A/R outstanding = $365 / 5.04 = 72.42$ days
- » lower is better as this is how long EP waits to collect its payments



Profitability Ratios

- These next set of ratios indicate where profits are coming from (or not coming from)

$$\text{Gross Margin} = \text{Gross Profit/Sales} = (\text{Sales} - \text{COGS}) / \text{Sales}$$

- for EP this ratio = $(2200 - 1500)/2200 = 700/2200 = 32\%$

$$\text{Operating Margin} = \text{EBIT/Sales}$$

- for EP this ratio = $166.7/2200 = 7.6\%$
 - this ratio is a measure of profitability than is independent of financing and tax position of the firm



Profitability Ratios

$$\text{Profit Margin} = \text{Net Income} / \text{Sales}$$

- for EP this ratio is $76 / 2200 = 3.45\%$
 - this is the simplest profitability ratio to calculate but the most problematic in terms of comparability across firms



Comparable Profitability Ratios

- Problem in comparing profitability margins
 - firms have different levels of interest payments
 - since net income is after interest payments, different financial structures (debt/equity ratios) will result in different levels of net income
 - even if they have the same operating income
 - thus profitability ratios are better based on EBIT

$$\text{Net Profit Margin} = (\text{EBIT} - \text{taxes}) / \text{Sales}$$

- however, interest is tax deductible, so different levels of interest payments imply different tax bills
 - to make profitability more comparable, we should calculate the taxes including the tax shield from the interest payments
 - » interest tax shield = net interest payment x tax rate

$$\text{Adjusted Net Profit Margin} = (\text{EBIT} - (\text{taxes} + \text{interest tax shields})) / \text{Sales}$$



Example of Comparability

- Firm 1 and 2 have EBIT of \$100, \$200, resp.
 - firm 1 has interest expense of \$10 and Sales of \$1000
 - firm 2 has interest expense of \$60 and Sales of \$2100
 - tax rate is 30%
- Net Profit Margin Analysis

	Firm 1	Firm 2
EBIT	\$100	\$200
Interest Expense	<u>10</u>	<u>60</u>
EBT	\$ 90	\$ 140
Taxes (EBT x 30%)	<u>27</u>	<u>42</u>
Net Income	\$ 63	\$ 98
Profit Margin (NI/Sales)	6.3%	4.6% (firm 1 better)
EBIT – taxes	\$ 73	\$ 158
Net Profit Margin	7.3%	7.5% (firm 2 better)
Interest tax shield	$\$10 \times .30 = \$3$	$\$60 \times .30 = \$18$
EBIT – (taxes + int tax shld)	\$ 70	\$ 140
Adjusted net profit margin	7%	6.7% (firm 1 better)



Performance Measures

- Return on assets (ROA)

$$\text{Return on assets} = (\text{EBIT} - \text{tax}) / \text{Average total assets}$$

- EP's ROA ratio = $(166.7 - 50.7) / ((1406.1 + 1450) / 2) = 8.1\%$
 - since the denominator is all assets, the numerator should reflect the earnings to all assets (debt + equity)
- to correct for the influence of interest deductibility we should really use the adjusted net income measure

$$\text{EBIT} - (\text{taxes} + \text{interest tax shield})$$

- recall that assets are measured as book value rather than market value

- Return on equity (ROE)

$$\text{Return on equity} = \text{Net Income} / \text{Average equity}$$

- return on equity often higher than market's required return as equity is book value (historic dollar values)*



Market Value Ratios

- Ratios based upon market values
 - sometimes rather than depending entirely on accounting figures, some ratios use market values

$$\text{P / E ratio} = \text{stock price} / \text{earnings per share}$$

- represents price investor is willing to pay per dollar of earnings
- EP's P/E ratio = $50/5.37 = 9.3$
 - average P/E ratio of US market is around 20 - 25
 - » P/E is meaningless if earnings are negative
 - » beware that P/E is infinite when earnings go to zero
 - should use forward looking earnings estimates rather than historic
 - » can find these on analyst pages for most companies

$$\text{Dividend yield} = \text{dividend per share} / \text{stock price}$$

- EP's dividend yield = $3.22 / 50 = 6.4\%$
 - this is the return one can expect even if there is no price appreciation



Market Value Ratios

- Market to book ratio

Market to Book ratio = stock price / book value per share

- EP's market to book ratio = $50 / (590/14.16) = 1.2$
 - this ratio indicate the factor by which the market values the equity of the firm relative to how the accountants measure it
 - typically the market value is higher since the market values intangible assets (R&D, brand names, employee training)
- *can be done either on per share basis or total basis*
 - EP's market to book ratio = $(50 \times 14.16)/590 = 1.2$
 - market to book ratios are commonly used to help determine the price to pay when a company goes public
 - market price is book value times comparable market to book ratio
 - consider value of similar firm to EP with book value of equity of \$300m
 - estimate of market price of firm = $\$300\text{m} \times 1.2 = \$360\text{m}$



Choosing Benchmarks

- Ratio analysis is only useful in that they can be compared to some benchmark
 - typically ratios are compared to a set of similar firms
 - these are referred to as “comparables”
 - important that the firms are similar to the target
 - alternatively ratios can be compared to industry benchmarks
 - these are published by various financial services
 - sometimes industry groups can be too broad
 - another choice is to compare the ratios to previous year’s ratios
 - this allows evaluation of how the firm is performing over time
 - bottom line:
 - ratio analysis is only as good as the benchmarks against which the comparisons are made
 - as much thought needs to go into getting the right benchmark



Relations Among Ratios

- **Ratios are not independent of one another**
 - DuPont system: ROA breakdown

$$\text{ROA} = \text{Sales to Assets ratio} \times \text{profit margin}$$
$$(\text{EBIT} - \text{Tax})/\text{Assets} = \text{Sales}/\text{Assets} \times (\text{EBIT} - \text{Tax})/\text{Sales}$$

- all firms would like to earn a higher ROA
- this can be done only by
 1. working assets harder (better sales to asset ratio)
 2. increasing profitability (higher income to sales)
- firms are typically constrained in one or both of these dimensions
 - firms with high asset turnover (i.e. restaurants) tend to have low profit margins
 - firms with high profit margins (i.e., luxury goods) tend to have low asset turnover
- each requires a different approach to improve performance



Ratios and Firm Growth

- **Ratios can also be used to get some idea of how a firm might be expected to grow**
 - with only internal financing the firm's expected growth rate can be expressed as

$$\text{Internal growth rate} = \text{retained earnings} / \text{assets}$$

- growth rate the firm can achieve without external financing
- EP's internal growth rate = $30.4/960 = 3.17\%$

- this can be re-expressed as

$$\begin{aligned} \text{Internal growth rate} &= \text{retained earnings/net income} \times \text{net income/equity} \times \text{equity/assets} \\ &= \text{plow back ratio} \times \text{ROE} \times \text{equity/assets} \end{aligned}$$

- if EP wants to grow faster than 3.17% without raising additional capital it needs to plow back (re-invest) a higher percentage of earnings, earn a higher return on equity, or have a higher equity to assets ratio (less debt)

$$\text{Sustainable growth rate} = \text{plowback ratio} \times \text{ROE}$$



Summary

- Basic components of financial statements
 - **balance sheet** - snap shot of accounts
 - **income statement** - flow of profits
 - **statement of cash flow and owners' equity**
 - denote source and uses of funds and changes in equity
- Financial Ratios
 - purpose and dangers
 - types of ratios
 - benchmarks
 - interdependence of ratios
 - ratios and growth





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ALMA MATER STUDIORUM
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Corporate Finance

Lecture 7

Cost of Capital and Capital Budgeting

Massimiliano Marzo

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Capital Budgeting

- Capital budgeting is the process a firm goes through to determine what projects it will invest in
 - this involves determining expected cash flows for the proposed project and discounting them at an appropriate cost of capital
 - in this lecture we will discuss how to determine correctly evaluate a project and understand
 - how to measure the appropriate cost of capital for a project
 - understand project versus total firm cost of capital issues
 - » when to use which
 - how to estimate the cash flows from market projections
 - how to turn forecasts of revenues and costs into cash flows



Cost of Capital

- Often we define cost of capital (CoC) for a firm
 - for example, Hewlett Packard's cost of capital might be 19%
 - this is the required return on HP equity
 - a common perception is that because this is HP's opportunity cost of capital, it should accept all projects with $NPV > 0$ with $r = 19\%$ and reject all others
 - **this is not correct!**
 - the company's average cost of capital is only appropriate for an investment that has risks similar to the average risk of the company
 - the correct approach is that each project should be evaluated at the opportunity cost of capital appropriate for the riskiness of that project



Projects as a Mini-Firms

- **The way to insure this is to evaluate each project as its own mini firm**
 - then use the value additivity rule of PV
$$\mathbf{PV(A+B) = PV(A) + PV(B)}$$
 - project A and B are evaluated as if they were separate mini-firms, even if together they make up the assets of one firm
 - *consider a firm composed of projects A and B*
 - the firm considers a new project C
 - the firm should evaluate project C as if it were a separate firm that its shareholders could invest in
 - we value project C by discounting its expected cash flows by the opportunity cost of capital appropriate for the risk of project C, which may not be the same as the risk of projects A and B
 - *the cost of capital depends on the use to which it will be put*



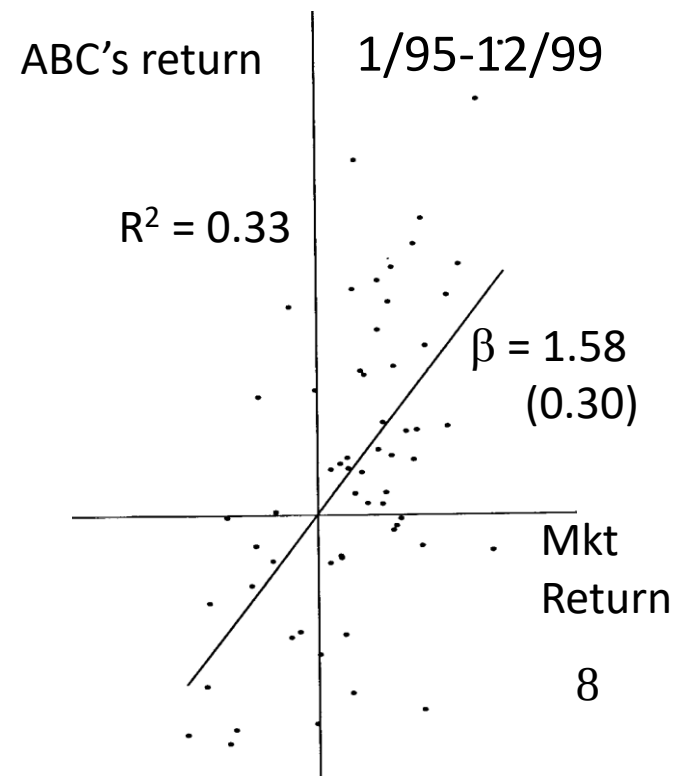
Company Cost of Capital

- Lets suppose a firm, ABC is considering a scale expanding project
 - or you want value the entire existing firm
 - since the relevant risk is by definition the risk of the company's assets we can use the company's cost of capital for the project
 - **lets assume initially that ABC is financed with all equity**
 - we'll deal with how the use of debt affects CoC later
 - HP's cost of capital will be a function of ABC's beta
 - beta = measure of sensitivity of asset's return to market return
 - ABC's beta will be a weighted average of the betas of its assets
 - suppose HP has three different classes of assets
 - » 1/3 assets have beta = 0.80
 - » 1/3 assets = 1.50
 - » 1/3 assets have beta = 2.80
 - the average beta of ABC's assets
$$= 1/3(0.80) + 1/3(1.50) + 1/3(2.80) = 1.70$$



Estimating ABC's Company-wide CoC

- Too much trouble to estimate each asset's β
 - *lets estimate ABC's cost of capital directly*
 - begin by **estimating the beta of ABC or portfolio of comparable companies**
 - $\text{cov}(R_{ABC}, R_M) = 0.001504$
 - $\text{var}(R_M) = 0.000964$
 - $\text{beta} = 0.001504/0.000964 = 1.58$
 - regress ABC's returns on market portfolio
 - regression produces β estimate
 $\text{cov}(R_{ABC}, R_M)/\sigma^2_{R_M}$
 - $R^2 = \%$ of variance explained by the market = 33%
 - standard error of β , $\sigma_\beta = 0.30$
 - » confidence interval for $\beta = \pm 2\sigma$
 - 95% confidence that actual β is between and $2.18 = 1.58 + 0.60$



Company Cost of Capital

- **ABC's beta likely to lie between 0.98 and 2.18**

- you can narrow this down by estimating betas in earlier periods
- you can estimate beta for portfolio of companies similar to ABC
 - estimate of industry $\beta = 1.35$, $\sigma_{\beta} = 0.15$
 - notice that industry portfolios have more precisely estimated betas
- assume $r_f = 5.5\%$ and $E(r_m - r_f) = 8\%$
 - best estimate of ABC's cost of capital (equity)

$$E(r_{ABC}) = r_f + \beta_{ABC}(r_m - r_f) = 5.5 + 1.58 \times 8 = 18.1$$
 - best estimate of industry cost of capital

$$E(r_{IND}) = r_f + \beta_{IND}(r_m - r_f) = 5.5 + 1.35 \times 8 = 16.3$$
- which estimate to use for project that is a scale expansion of ABC's assets?
 - depends on your assessment of extent of market risk of ABC relative to rest of industry
 - **if ABC's risk is similar to rest of industry then use industry number, if reason to believe it is higher than use ABC's number**



Capital Structure and Company CoC

- For a firm financed with all equity, the risk of the equity is the same as the business risk of the assets
 - when a firm is all-equity financed the cost of capital for scale expanding projects is the firm's cost of equity
 - thus the **required return on assets is the same as the required return on equity**
 - however, firms sometimes finance projects with debt
 - debt causes the equity to bear financial risk in addition to business risk
 - financial risk is the fact that the company may default
 - this makes the remaining equity more risky
 - **debt raises the beta of the equity and raises its required return**
 - » but it does not change the required return on the assets themselves



Impact of Leverage on CoC

- The use of debt creates financial leverage
 - the choice of the amount of debt a firm uses is known as **the capital structure decision**
 - we will talk more about this later
 - ***the use of debt and the creation of default risk causes the required return on equity to rise***
 - equity must provide compensation for business risk of assets and financial risk created by leverage
 - » this financial risk arises because in some states of the world when the firm cannot pay off its debt, equity will get nothing
 - use of increasing amounts of debt also cause the cost of debt to rise due to increasing default risk
 - *in the case of a firm that uses debt, the firm's CoC (opportunity cost of its assets) cannot be determined from the cost of equity alone*
 - the cost equity in a leveraged firm will overstate the cost of capital for the firm's assets



Changing Capital Structure and Required Returns

- *The company's cost of capital is the opportunity cost of capital for its existing assets*
 - *if you owned the entire firm (all debt and all equity) you would get all the cash flows from the assets*
 - thus the leveraged firm's cost of capital for its assets must be a weighted average of the required return on the firm's debt and leveraged equity
 - Weighted Average Cost of Capital (WACC) (with no taxes)

$$r_{\text{assets}} = \text{WACC} = r_{\text{debt}} (D/V) + r_{\text{equity}} (E/V)$$

- where r_{assets} = required return on assets
 r_{debt} = interest rate on debt
 r_{equity} = required return on leveraged equity
 D , E , and V = market value of firm's debt, equity, and total firm value
- Recall that by definition $V = D + E$



Estimating the CoC with Leverage

- To determine the opportunity cost of the assets we need the beta for the assets, β_{assets}

- with β_{assets} we can use CAPM to get r_{assets}

$$r_{\text{assets}} = r_f + \beta_{\text{assets}} E(r_m - r_f)$$

- *the beta of the assets is also the weighted average of the betas of the debt and equity*

$$\beta_{\text{assets}} = (D/V) \beta_{\text{debt}} + (E/V) \beta_{\text{equity}}$$

- when $D = 0$ then $\beta_{\text{equity}} = \beta_{\text{assets}}$
 - this is why we like to make an all-equity assumption
- when $D > 0$ then $\beta_{\text{equity}} > \beta_{\text{assets}}$
 - in these cases we need to do some work to estimate the asset beta
- note that just like r_{assets} , β_{assets} does not change with leverage



Obtaining the Beta for the Assets

- Typically, the equity beta we estimate from data is a leveraged beta
 - estimated from returns to leveraged equity
 - from firms that have some debt in their capital structure
 - in order to determine the beta for the assets, we need to adjust the estimated equity beta for effects of financial leverage
 - since $\beta_{\text{assets}} = (D/V) \beta_{\text{debt}} + (E/V) \beta_{\text{equity}}$
 - if we assume that $\beta_{\text{debt}} = 0$, then
$$\beta_{\text{assets}} = (E/V) \beta_{\text{equity}}$$
 - » this is a simply way to adjust the equity beta
 - from this asset beta we can estimate the opportunity cost of capital for the assets

$$E(r_{\text{assets}}) = r_f + \beta_{\text{assets}} (r_m - r_i)$$

this just drives home the fact that the opportunity cost of capital is determined by the business risk of the assets



Example of WACC

- Suppose ABC has 40% leverage
 - thus $D/V = 40\%$
 - $r_{\text{debt}} = 10\%$ and $r_{\text{equity}} = 23.3\%$ (from beta with leverage of 2.2)
 - expected return on ABC's assets
 - $$r_{\text{assets}} = r_{\text{debt}} (D/V) + r_{\text{equity}} (E/V)$$

$$= 10\% (40\%) + 23.3\% (60\%) = 18\%$$
 - the opportunity cost of capital for a project with the same average risk as ABC's existing assets is **18%**
 - **now what would happen to ABC's company cost of capital if it issued 10% more equity and repaid debt?**
 - since the assets did not change the firm's opportunity cost of capital should not change
 - the change in capital structure simply alters the required return on the firm's debt versus equity
 - **for now the opportunity cost of capital is determined by the riskiness of the investment, not how it is financed**



Change of Capital Structure

- With no change in assets, $r_{\text{assets}} = 18\%$
 - *there will be changes in required return on debt and leveraged equity due to capital structure change*
 - D/V goes from 40% to 30%,
 - new capital structure has less leverage, so equity has less financial risk, debt has less default risk
 - let's assume r_{debt} falls to 9.5%
 - since $r_{\text{assets}} = 9.5\% (.30) + r_{\text{equity}} (.70) = 18\%$
 - we can calculate that the required return on the leveraged equity, $r_{\text{equity}} = 21.6\%$
 - as one might surmise as D/V falls to zero, r_{equity} falls to 18%
 - similarly the equity beta under the new leverage must be higher than with no debt
- $\beta_{\text{equity with } D = .3} = 2.0$ compared to $\beta_{\text{equity with } D = 0} = 1.58$



Cash Flows

- Determining the cash flows from a risky project is the most difficult task of capital budgeting
 - it involves understanding several issues
 - market size and demand conditions
 - competitive environment, both now and future
 - demand curves and elasticities
 - cost structures and cost sensitivities
 - potential future opportunities
 - many of these things are uncertain
 - as a result we carefully attempt to form an estimate of what the future cash flows will be
 - lets look at some general rules of estimating cash flows



Estimating Cash Flows

- **What we want to discount in capital budgeting is incremental expected cash flows**
 - this suggest some important rules
 - 1. cash flows, not accounting income are what is relevant**
 - need to adjust earnings for non-cash expenses
 - 2. always estimate cash flows in each state of the world on an incremental basis**
 - measure only new cash flows created by project
 - 3. deal with uncertainty in cash flows by taking expected cash flows, not the most likely cash flows**
 - lets consider each of these separately



Use Cash Flows Not Income

- **Cash flow is: cash in - cash out**
 - cash flow differs from earnings as measured by financial statement
 - **earnings reflect certain non cash items**
 - these items are called accruals and are charges or receipts recorded now for revenues and expenses not received or paid in that period
 - a common example is depreciation
 - » rather than expense capital expenditures, accountants amortize them over a specified time during the life of the asset
 - **earnings do not reflect when cash is received and when it is paid**
 - earnings reflect sales that have not been collected (accounts receivable) and expenses that have not been paid (accounts payable)
 - costs of goods sold involve inventory costs that may have been paid for in earlier periods
 - » this leads to timing differences between earnings and cash flows which can affect PV calculations



The Basics of Measuring Cash Flow

- **The cash flow of a project requires we measure the cash available to investors each period**
 - in a simple setup this depends only on
 - **Sales (revenues) - income from sales of goods/services**
 - **Cash costs - (expenses)**
 - Cost of Goods Sold (COGS) - these are the actual cash costs incurred to produce the goods/services created that period
 - Other cash costs - these are other costs actually incurred such as administrative, advertising and other selling costs
 - **Depreciation** - this is a special charge to allow the firm to recover the initial cost of the investment
 - it is a “non-cash” expense that must be adjusted for in measuring actual cash flows
 - » it reduces taxes, but not actual cash flow
 - **Taxes** - this is the part of “profits” that goes to the government
 - we only focus on income taxes as other taxes are part of COGS



Depreciation

- **Some rules for depreciation**
 - *depreciation is a nominal accounting charge for the original capital investment*
 - **it is a non cash expense** meant to reflect a portion of the cost of the original investment in the asset
 - accountants do not recognize capital expenditures as expenses
 - » instead they use depreciation as an accrual charge
 - depreciation is important to account for because it reduces taxable income but not the cash flow
 - it prevents collection of taxes on the return on the initial investment
 - *assets are depreciated over different numbers of years depending on their useful life*
 - **straight line depreciation** is the simplest form
 - there are also forms of accelerated depreciation
 - » these compensate for fact that depreciation not adjusted for inflation
 - » also allow greater tax savings earlier in the asset's life



Calculating Depreciation

- **Example of straight line depreciation**

- if an asset's life is 10 years and it can be fully depreciated, the annual depreciation allowance = initial investment / 10
 - generally, if an asset can be depreciated over some period T, down to some specified residual value, the annual depreciation charge is

$$(1/T) \times (\text{purchase price} - \text{residual value})$$

- the residual value is often estimated by the firm (or tax law)
 - it may differ from the asset's salvage value or market price
 - if the market price is different from the residual value, the difference is taxable (either as gain or loss)



Calculating Depreciation

- example: firm pays \$10m for asset with 6 year life and \$0.5m residual value
 - annual depreciation charge = $(1/6) \times (10\text{m} - 500,000) = \$1.583\text{m}$
 - this is the annual amount of tax shield
 - » if they sell the asset in year 6 for \$1m, then they must pay tax on the difference (\$1m - \$0.5m) .



Measuring Cash Flows

- Given this information we can calculate cash flows in either of two ways

$$\text{CF} = \text{Sales} - \text{cash costs} - \text{actual taxes}$$

- where actual taxes are

$$(\text{Sales} - \text{cash costs} - \text{depreciation}) \times (\tau)$$

- where cash costs = COGS + other cash costs, t = tax rate

– this is the same as

$$\text{CF} = (\text{Sales} - \text{cash costs} - \text{depreciation}) \times (1 - t) + \text{depreciation}$$



Measuring Cash Flows

alternatively we can express cash flows as

$$CF = (\text{Sales} - \text{cash costs}) \cdot (1-t) + (t \times \text{depreciation})$$

- *any of these approaches will give you the same answer for the available cash flow*



Free Cash Flows

- Free cash flows differ from cash flows in that some earnings are reinvested in the project
 - *capital expenditures*
 - *some of the cash flow from the project is re-invested to replace worn out equipment or purchase new equipment to allow the firm to grow*
 - this is the maintenance and replacement expenditures
 - these are cash flows that are not available for distribution to the investors
 - *working capital*
 - *some of the earnings from the project must be retained to provide additional working capital for the project*
 - this is the liquid funds needed to cover imbalances in receipts and payments



More on Working Capital

- What is this working capital?
 - ***working capital is the money needed to fund short term assets necessary to make the project viable***
- Working Capital = Cash + Inventory + Accts Rec**
- *net working capital (NWC) is difference between this amount and the amount financed through short term debt (payables)*
- Net Working Capital = Cash + Invent + Accts Rec - Accts Payable**
- it is the funds the firm needs to finance its inventory and accounts receivable less the funds they save by creating accounts payable



More on Working Capital

- as a project's sales grow its working capital needs grow, thus working capital is like an investment in the project's operations
 - these funds are freed up when the operation shuts down
- each year net working capital increases by

$$\Delta \text{NWC} = \Delta \text{Cash} + \Delta \text{Invent} + \Delta \text{Accts Rec} - \Delta \text{Accts Payable}$$

$$\text{FCF} = \text{Sales} - \text{cash costs} - \text{actual taxes} - \text{cap ex} - \text{DNWC}$$



Creating Cash Flows

- We are interested in creating a measure of the free cash flows, **FCF**, available to the firm to pay debt holders or equity holders
 - when we estimate cash flows we do not consider how the project is to be financed
 - we separate the investment decision from the financing decision
 - with well functioning capital markets the financing decision has no impact on the value of the investment
 - » we will consider situations when this is not the case later
 - we often begin with projections of sales and costs provided by a market analyst
 - lets consider the case of a new iced tea product called **Honest Tea**



Project: Honest Tea

- Project details
 - \$10m to purchase plant, and equipment
 - cost of capital for project is 15%
 - beta = 1.25, $r_f = 5\%$ $E(R_m - r_f) = 8\%$
 - 6 years of production
 - salvage value for assets at end of year 6
 - expected salvage value of asset \$1.5m



Project: Honest Tea

– depreciation assumptions

- recall depreciation is the expensing of the original investment over the life of the assets
 - depreciation is straight line over 6 years with residual value of \$500,000 at end of year 6

– working capital

- working capital is cash basis to keep company running
 - working capital is \$500,000 for year 1 and grows with sales



Depreciation

- **Depreciation calculation**
 - recall depreciation is a nominal accounting charge for the original capital investment in plant and equip
 - it is a non-cash expense meant to reflect a portion of the cost of the original investment in the asset
 - its importance is that it reduces taxable income but not cash flow
 - annual depreciation for Honest Tea project
 - investment = \$10m
 - estimated residual value = \$500,000
 - depreciation over 6 years
 - annual depreciation charge:
$$1/6 (\$10\text{m} - 0.5\text{m}) = \$1.583\text{m}$$
 - for each of the next six years the firm has a depreciation charge of \$1.583m



Honest Tea Projections

- Pro forma income statement and asset statement
 - gives basic information for cash flow analysis
 - all values in nominal terms (000s)

Period	0 (today)	1 (EOY)	2	3	4	5	6	6 (Disp)
(1) Sales		6,000	15,000	26,000	40,000	30,000	20,000	1,500
(2) - COGS		3,600	9,000	15,600	24,000	18,000	12,000	
(3) - Other costs		3,200	4,800	6,600	7,200	3,600	2,400	
(4) - Depreciation		1,583	1,583	1,583	1,583	1,583	1,583	500
(5) = Pre-tax profit (1 - 2 - 3 - 4)		-2,383	-383	2,217	7,217	6,817	4,017	1,000
(6) - Tax @35%		-834	-134	776	2,526	2,386	1,406	350
(7) = Reported Earnings (5 - 6)		-1,549	-249	1,441	4,691	4,431	2,611	650
(8) Capital Investment	10,000							-1,500
(9) Accumulated Deprec		1,583	3,166	4,749	6,332	7,915	9,500	
(10) Book Value	10,000	8,417	6,834	5,251	3,668	2,085	500	0
(11) Working Capital		500	1,250	2,167	3,333	2,500	1,667	
(12) Total Book Value	10,000	8,917	8,084	7,418	7,001	4,585	2,167	0
(Δ in Net Work Cap)		500	750	917	1,167	-833	-833	-1,667



Free Cash Flow Calculations

- CF = Sales - COGS - other cash costs - actual taxes - chg in working capital - capital expenditures

Period	0 (today)	1 (EOY)	2	3	4	5	6	6 (Disp)
(1) Sales		6,000	15,000	26,000	40,000	30,000	20,000	
(2) - COGS		3,600	9,000	15,600	24,000	18,000	12,000	
(3) - Other costs		3,200	4,800	6,600	7,200	3,600	2,400	
(4) - Taxes paid ((6) above)		-834	-134	776	2,526	2,386	1,406	350
(5) = Cash Flow from Operations (1 - 2 - 3 - 4)		34	1,334	3,024	6,274	6,014	4,194	
(6) + Δ in NWC		-500	-750	-917	-1,167	833	833	1,667
(7) + Capital Expenditures	-10,000							
(8) + Capital Disposal (After tax)								1,150
(9) = Free Cash Flow (5 + 6 + 7 + 8)	-10,000	-466	584	2,107	5,107	6,847	5,027	2,817
(10) PV at 15%	-10,000	-405	442	1,386	2,920	3,404	2,173	1,218
(11) NPV =		1,138						

Note: line (8) is \$1,500 sale price less \$350 taxes paid



Alternative Method to get FCF

- $CF = (\text{Sales} - \text{cash costs}) \times (1 - \text{tax}) + (\text{tax} \times \text{depreciation})$
 - chg in working capital - capital expenditures

Period	0 (today)	1 (EOY)	2	3	4	5	6	6 (Disp)
(1) Sales		6,000	15,000	26,000	40,000	30,000	20,000	
(2) - COGS		3,600	9,000	15,600	24,000	18,000	12,000	
(3) - Other costs		3,200	4,800	6,600	7,200	3,600	2,400	
(4) = Operating Income		-800	1,200	3,800	8,800	8,400	5,600	
(5) - Taxes on OP Inc (4 x 35%)		-280	420	1,330	3,080	2,940	1,960	
(6) + Depreciation x tax rate		554	554	554	554	554	554	
(7) = Cash Flow from Operations								
(4 - 5 + 6)	0	34	1,334	3,024	6,274	6,014	4,194	
(8) + Δ in NWC		-500	-750	-917	-1,167	833	833	1,667
(9) + Capital Expenditures -10,000								
(10) + Capital Disposal (After tax)								1,150
(11) = Free Cash Flow								
(7 + 8 + 9 + 10)	-10,000	-466	584	2,107	5,107	6,847	5,027	2,817
(12) PV at 15%	-10,000	-405	442	1,386	2,920	3,404	2,174	1,218
(13) NPV =		1,138						

Same FCF (line (11)) as other method on previous slide



More Careful Treatment of FCF

- Previous examples had negative tax payments
 - negative taxes are tax advantages
 - *the previous treatment is only relevant if firm has income from other projects against which to apply the losses*
 - or taxes paid in previous few years
 - government does not reimburse taxes on losses as cash
 - they provide a tax loss for use at alternative time
 - can be applied to against taxes paid in previous years or carried forward for use at time when tax liability becomes positive



More Careful Treatment of FCF

- **to correctly measure actual cash flows we must account for the timing of the tax losses**
 - they need to be carried forward until such time as actual tax liability exists for them to be used
 - the tax losses are nominal amounts and do not grow over time
 - thus waiting to be able to use them reduces their time value and lowers the NPV of the project



FCF with Tax Loss Carryforwards

- Carefully delineate exactly when tax are paid
 - no taxes actually paid in years 1 and 2 as project produces losses (no taxable income)
 - no taxes paid in year 3 as tax losses from previous year sufficient to offset taxes due
 - remainder of tax losses carried forward and used in year 4

Period	0 (today)	1 (EOY)	2	3	4	5	6	6 (Disp)
(1) Sales		6,000	15,000	26,000	40,000	30,000	20,000	
(2) - COGS		3,600	9,000	15,600	24,000	18,000	12,000	
(3) - Other costs		3,200	4,800	6,600	7,200	3,600	2,400	
(4) - Depreciation		1,583	1,583	1,583	1,583	1,583	1,583	
(5) = Pre-tax profit								
(1 - 2 - 3 - 4)		-2,383	-383	2,217	7,217	6,817	4,017	1,000
(6) Tax @35%		-834	-134	776	2,526	2,386	1,406	350
(6A) Tax loss Carryforward		834	134	-776	-192	0	0	0
(6B) TLC Balance		834	968	192	0	0	0	0
(6C) Actual taxes paid		0	0	0	2,334	2,386	1,406	350



FCF with Tax Loss Carryforwards

- Use **first** definition of FCF
 - *use actual taxes paid at time they are paid*
 - this reduces the NPV of the project through the loss of time value on (having to wait to use) the tax losses

Period	0 (today)	1 (EOY)	2	3	4	5	6	6 (Disp)
(1) Sales		6,000	15,000	26,000	40,000	30,000	20,000	
(2) COGS		3,600	9,000	15,600	24,000	18,000	12,000	
(3) Other costs		3,200	4,800	6,600	7,200	3,600	2,400	
(4) Actual Taxes paid (6C above)		0	0	0	2,334	2,386	1,406	350
(5) Cash Flow from Operations (1 - 2 - 3 - 4)		-800	1,200	3,800	6,466	6,014	4,194	
(6) Δ in NWC		-500	-750	-917	-1,167	833	833	1,667
(7) Capital Expenditures	-10,000							
(8) Capital Disposal (After tax)								1,150
(9) Free Cash Flow (5 + 6 + 7 + 8)	-10,000	-1,300	450	2,883	5,299	6,847	5,027	2,817
(10) PV at 15%	-10,000	-1,130	340	1,896	3,030	3,404	2,173	1,218
(11) NPV =		931						



More General Points on Cash Flows

- The relevant cash flows to a project are those that are the result of the project
 - we refer to these as **incremental cash flows**
 - these are **new cash flows created by the project**
 - need to think broadly about incremental cash flows
 - often cash flows resulting from the project appear elsewhere in the firm
 - cash flow creation - new cash flows created elsewhere in the firm that are a result of the new project
 - **example - profits on inputs produced by other part of company**
 - **cash flow destruction** - cash flows elsewhere in the company that will be destroyed by the project
 - *example: new plant to service the West coast might eliminate some sales of existing plant in Midwest that currently are sent to West coast*



Other Features of Incremental Cash Flows

- Other important issues in identifying relevant cash flows
 - ignore sunk costs
 - *spilt milk principle: past expenses or losses are not relevant for future investment decision making*
 - what is past is past => look forward on incremental cash flows difference between cash flows pre and post project
 - corollary: *do not assign costs to the project that would exist even if the project were not undertaken*
 - » for example, charges for overhead expenses are not relevant



Other Features of Incremental Cash Flows

- include opportunity costs in addition to cash costs
 - be sure all resources are charging at least cost of next best use
 - for example if you own the land you will use for a plant, be sure to charge the project the rental cost of the land



Determining Expected Cash Flows

- **Most cash flows are uncertain**
 - to correctly reflect this uncertainty we want to use **expected cash flows** rather than most likely cash flows

consider a farmer

net proceeds from crop

with 60% probability - “normal year”	500
with 20% probability - “good year”	700
with 20% probability - “bad year”	100

- the most likely cash flow is 500
 - » that it will be a normal year (prob = 60%)
- however because the cash flow is uncertain we must determine its expected value
- the expected cash flow is 460
 - $60\% (500) + 20\% (700) + 20\% (100) = 460$
- *it is important to take into consider set of possibile outcomes when determining the cash flows to discount*



Summary

- **Capital budgeting**
 - 2 important components
 - cost of capital
 - estimate of opportunity cost of capital specific assets being considered
 - if scale expanding project or valuing existing assets then can focus on firm's cost of capital
 - impact of capital structure is to alter return on debt and equity not to change business risk of assets
 - capital structure effects equity and debt beta, not asset beta
 - estimating opportunity costs of capital for assets
 - purely a function of business risk of assets
 - estimating incremental expected cash flows
 - **DO NOT USE ACCOUNTING INCOME**
 - measure only incremental effects
 - with uncertainty take expected value



Reviewing for Exam

- **What to study**
 - be sure to read chapters in book
 - look over problem sets
 - Try to understand how problems are set up and solved
- **Exam structure**
 - 2 hours
 - all you need is calculator and writing utensil
 - numerical and conceptual questions
 - all relevant formulas provided on exam
 - get a good night's sleep on Thursday !!!!!

GOOD LUCK





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ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

Corporate Finance

Lecture 8

Practical Problems in Capital Budgeting

Massimiliano Marzo

Department of Management

Capital Budgeting for Projects

- **More important issues in capital budgeting calculations**
 - it is important that managers understand how the project works
 - the project should not be a “black box”
 - too many business disasters have occurred because the managers were not aware of how the project behaved
 - this requires rolling up your sleeves and getting inside the project to understand its structure, strengths and weaknesses and its sensitivities
 - to do this we will discuss
 - **sensitivity analysis and simulation**
 - **decision trees**
 - **management incentives and performance measurement**



Definitions

- **Sensitivity Analysis**

- analysis of the effects of changes in sales, costs, etc. on the NPV of a project

- **scenario analysis**

- analysis of the project given a particular combination of assumptions

- » most times people use “most likely” scenario

- **simulation analysis**

- estimation of the probabilities of different possible outcomes
 - this allows you to obtain an expected outcome which is the correct way to proceed

- **Decision trees**

- a way to map out subsequent investment decisions imbedded in project

- often refer to these as “**real options**”



Dealing with Uncertainty

- Sensitivity analysis

- *the NPV of a project depends heavily on the assumptions made in generating the cash flow estimates*

- also to some degree the estimate of cost of capital

- consider Otobai's electric scooter project

- cash flow forecasts in table
 - cost of capital = 10%
 - NPV = ¥3.43b

- you want to delve into these forecasts and identify key variables behind $NPV > 0$

all in ¥	year 0	year 1 -10
Investment	-15	
Sales		37.5
Variable Costs		30
Fixed Costs		3
Depreciation *		1.5
Pretax profit		3
Taxes @ 50%		1.5
Profit after tax		1.5
Operating cash flow		3.0
Net Cash Flow	-15	3

* 10 yr straight line depreciation



Some Important Relations

- Project features

- **unit sales = market share x size of market**

- forecast = 10% x 1million = 100,000 units

- **revenue = unit sales x price per unit**

- forecast = 100,000 x ¥375,000 = ¥37.5b

- **unit costs**

- production engineers estimate unit costs of ¥300,000
 - these costs are incurred only if scooters are produced



Some Important Relations

- Project features

- **total costs = unit costs x unit sales**

- forecast = ¥300,000 x 100,000 = ¥30b

- **fixed costs = ¥3b**

- these are the costs that do not change as production changes

- knowing these things we can consider some sensitivity analysis on the project



Sensitivity Analysis

- Simple approach
 - optimistic and pessimistic values for each variable
 - change each variable one at a time and look and impact on NPV

Variable	Range		
	Pessimistic	Expected	Optimistic
Market Size	.9 m	1m	1.1m
NPV	+¥1.1b	+¥3.5b	+¥5.7b
Market Share	.04	.1	.16
NPV	-¥10.4b	+¥3.5b	+¥17.3b
Unit price	350,000	375,000	380,000
NPV	-¥4.2b	+¥3.5b	+¥5.0b
Unit Variable Costs	360,000	300,000	275,000
NPV	-¥15.0b	+¥3.5b	+¥11.1b
Fixed Cost	4 bil	3 bil	2 bil
NPV	+¥0.4b	+¥3.5b	+¥6.5b
Cost of Capital	14%	10%	7%
NPV	+¥0.65b	+¥3.5b	+¥6.1b



Value of Additional Information

- *Sensitivity analysis helps you decide where you might want to invest in additional information*
 - clearly market share and unit costs are the most important variables for NPV given your degree of uncertainty about them
 - suggests several things
 - 1. potential importance of marketing expenditures**
 - » as long as you expect marketing dollars to have an influence on your market share
 - 2. more careful investigation of production process and possible costs**
 - less important to spend time or money sharpening estimates of market size, fixed costs or cost of capital
 - project is positive NPV even under pessimistic assumptions for these variables



Investigating Uncertainty

• Example:

- suppose part of pessimistic unit costs is fear that some component of design is flawed and alternative production process will be required
 - possibility is only 1 in 10
- alternative design process costs ¥ 20,000 more per unit
 - if occurred it would reduce after tax cash flows each year by 100,000 units x 20,000 cost/unit x (1 - 50% tax rate) = ¥1b /yr
 - reduce NPV by ¥6.14b (across all 10 years)
- what if a ¥300m investment in a pre-test of the design will reveal whether this problem will arise
 - would this be a good investment?
 - ¥300m investment to eliminate a 10% chance of ¥6.14b fall in NPV looks like a good investment
 - NPV of this pre-test investment is
 - - ¥200m + 0.10 x ¥6,140m = +¥314m



Limits to Sensitivity Analysis

- Ultimately, sensitivity analysis depends on private assessments
 - what does pessimistic or optimistic mean?
 - is it defined by the group with knowledge about the issue
 - market size - marketing group
 - unit costs - production group
 - uncertain variables are likely to be related
 - things don't change one at a time
 - it's not possible to get pessimistic or optimistic values for total project cash flows from the previous table
 - *to do this we must consider scenarios in which we be explicit about the relation between variables*
 - this is called **scenario** analysis
 - consider potential value impact of alternative exogenous events
 - example: impact of oil shock on scooter project



Break Even Analysis

- Sometimes managers want to know how bad some variable can get before the project loses money
 - this is known as break-even analysis
 - suppose we are interested in the break-even unit sales
 - plot out PV of inflows and outflows based upon different unit sales

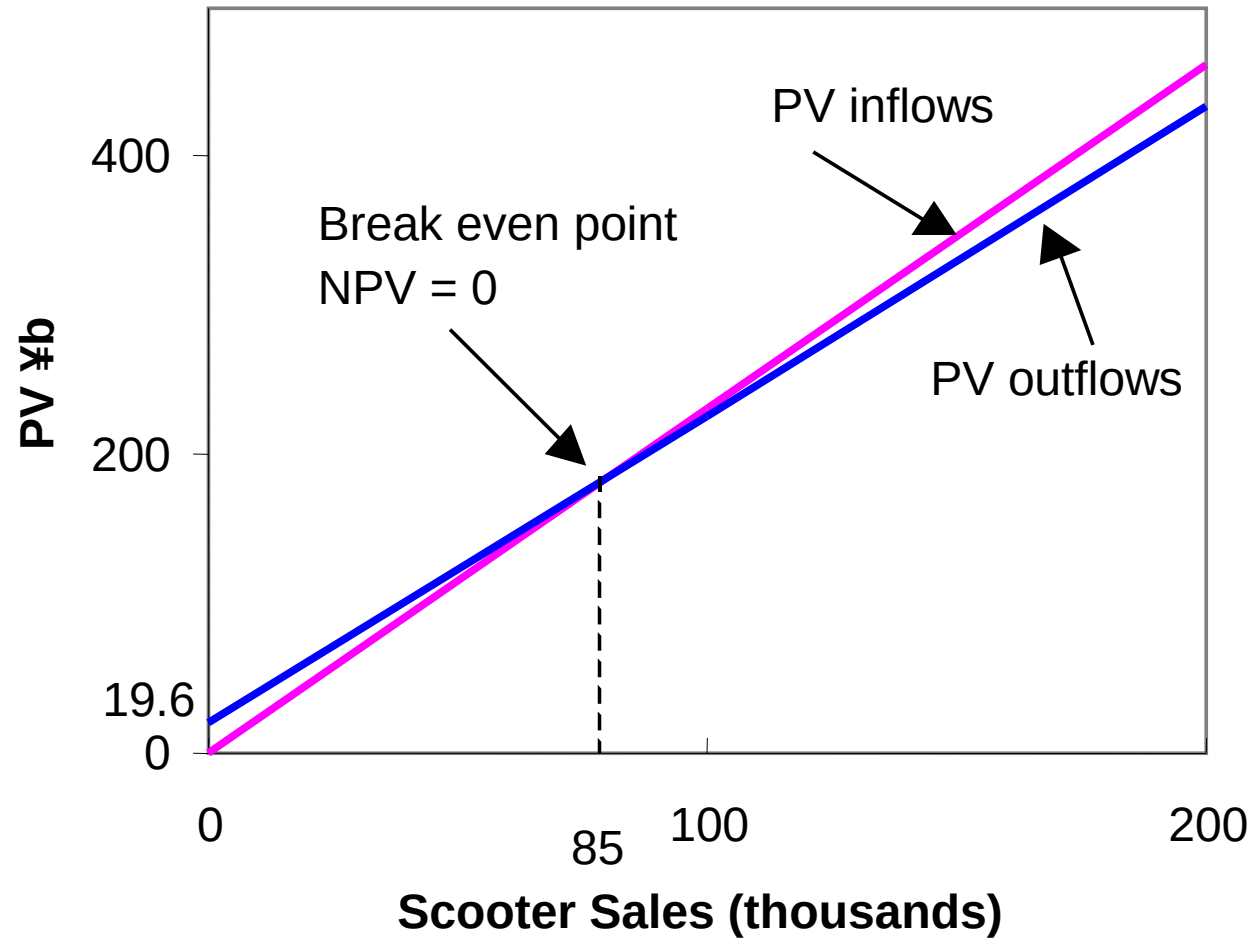
all flows in ¥b

Unit Sales	Inflows		Outflows			PV Inflows	PV Outflows	NPV
	Rev 1-10	Invest	Var Cost	Fix Costs	Taxes			
0	0	15	0	3	-2.25	0	19.6	-19.6
100	37.5	15	30	3	1.5	230.4	227.0	3.4
200	75.0	15	60	3	5.25	460.8	434.4	26.4

- at what level of sales is PV inflows = PV outflows?



Break Even



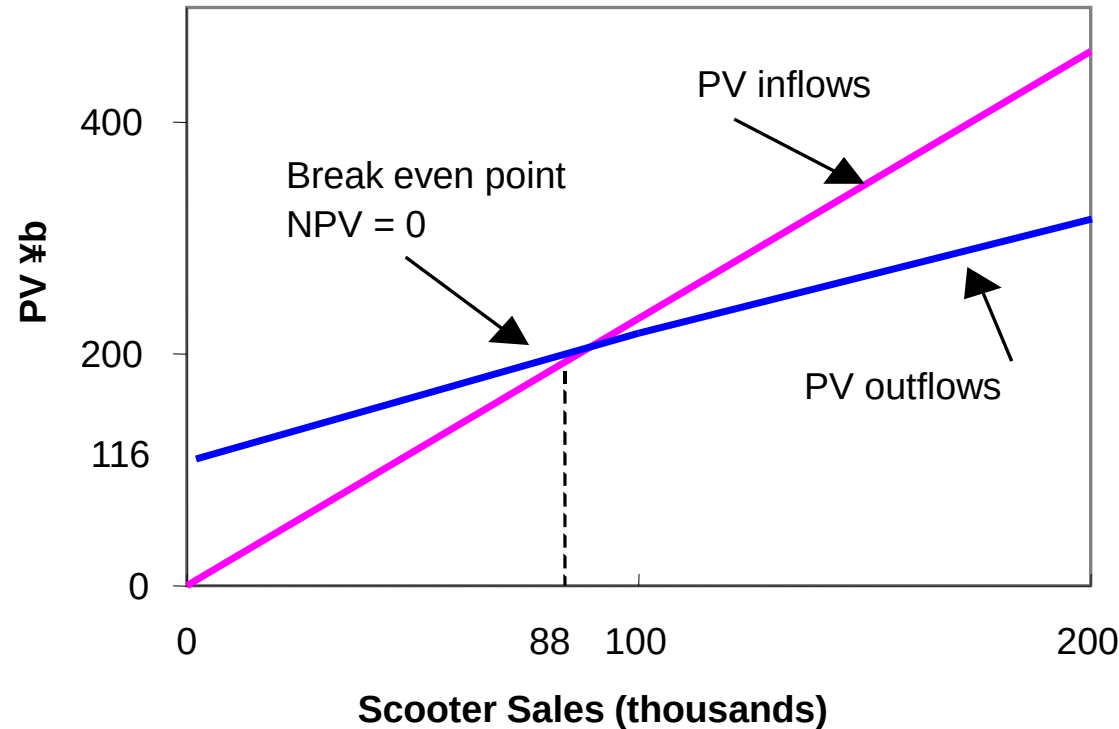
- break-even sales are 85,000 scooters

Break-Even and Operating Leverage

- Break-even analysis is useful to understand the operating leverage of the project
 - operating leverage is the function of the mix of fixed versus variable costs in the project's cost structure
 - high operating leverage implies more fixed costs and less variable costs and higher operating risk
 - suppose Otobai has choice of different production technology with lower variable, but higher fixed costs
 - new technology: variable costs = ¥120,000 per unit (versus ¥300,000) and fixed costs of ¥19b
 - notice that total cost are lower
 - $¥120,000 \times 100,000 \text{ units} + ¥19\text{b} = ¥31\text{b}$ (versus ¥33b for orig tech)
 - profitability and NPV of project improve with new technology
 - but break-even sales point rises to 88,000 from 85,000



Impact of Operating Leverage



- increased operating leverage increases the breakeven point for sales reflects increased operating risk of new technology
 - break even point rises even though total production costs fall
- which technology is better?
- *need to determine new cost of capital for assets with higher operating risk*



Simulation

- Simulation is a technique for considering all possible outcomes
 - in simulation you let the computer randomly draw possible outcomes for uncertain variables from pre-defined distributions
 - you must pre-define the distributions for uncertain variables
 - computer just plays game lots of times to show you the possible outcomes of this uncertainty on value
 - *steps*
 - *develop a careful model of the project with specified sources of uncertainty*
 - *specify nature of uncertainty in terms of statistical distribution*
 - *identify output whose variability you are interested in measuring*



Simulating Otobai's Scooter Project

- Start with model

cash flow = (rev - cash costs)*(1-tax) + depr x tax

rev = market size x market share x unit price

cash costs = (mkt size x mkt share x var unit cost) + fixed costs

– **specify uncertainty**

ex: $\text{mkt size}_t = E(\text{mkt size}_t) \times (1 + \text{forecast error}_t)$

- where forecast error is a random variable with a mean of zero and a high and low of $\pm 10\%$
 - perhaps normally distributed or uniformly distributed

– **be aware of potential linkages in uncertainty**

- links between demand and price

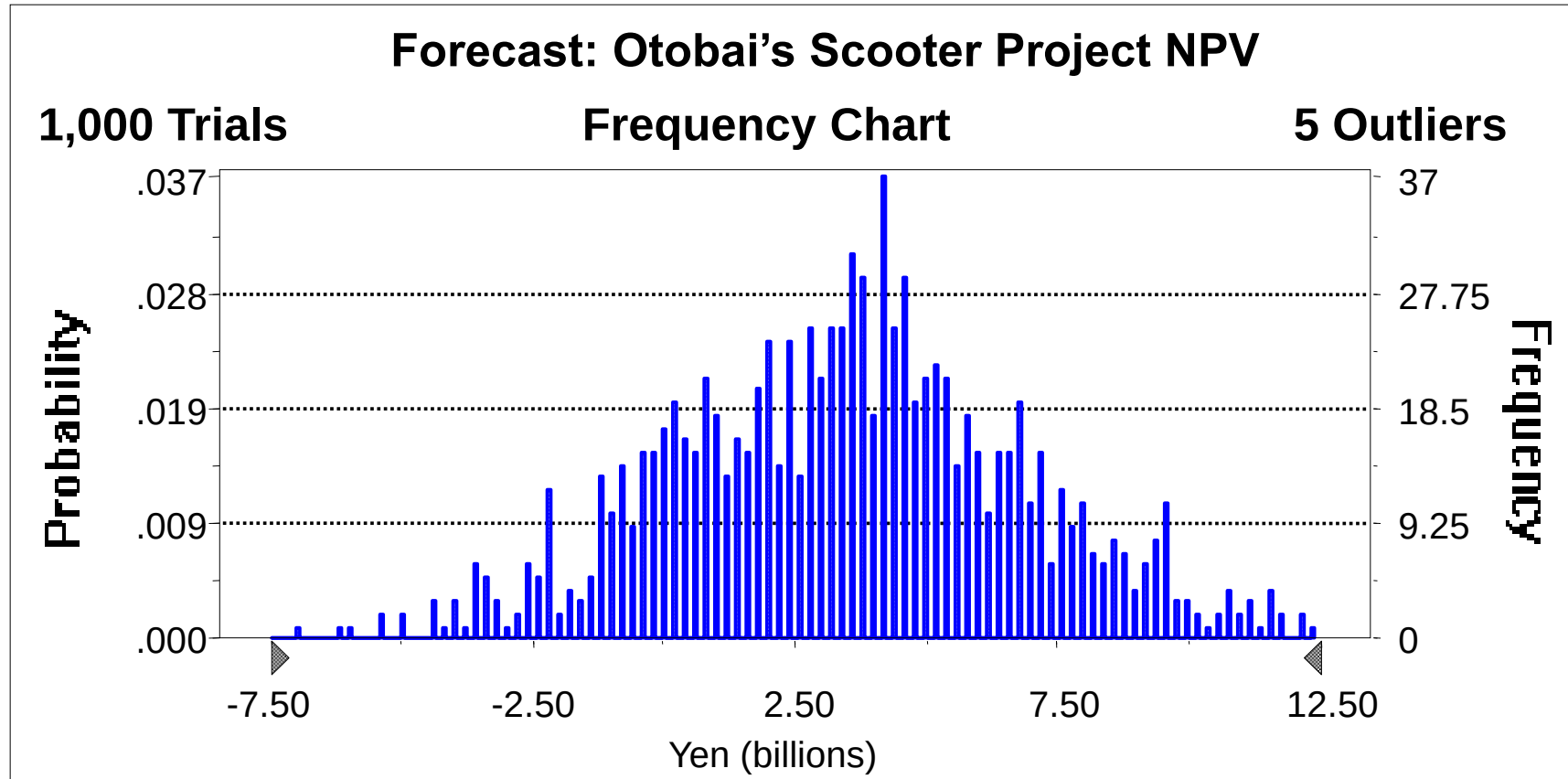
- ex: $\text{unit price}_t = E(\text{unit price}_t) \times (1 + 0.3 \times \text{mkt size forecast error}_t)$

– **then run model several thousand times**

- look resulting distribution of NPV or annual cash flows



Monte Carlo Simulation



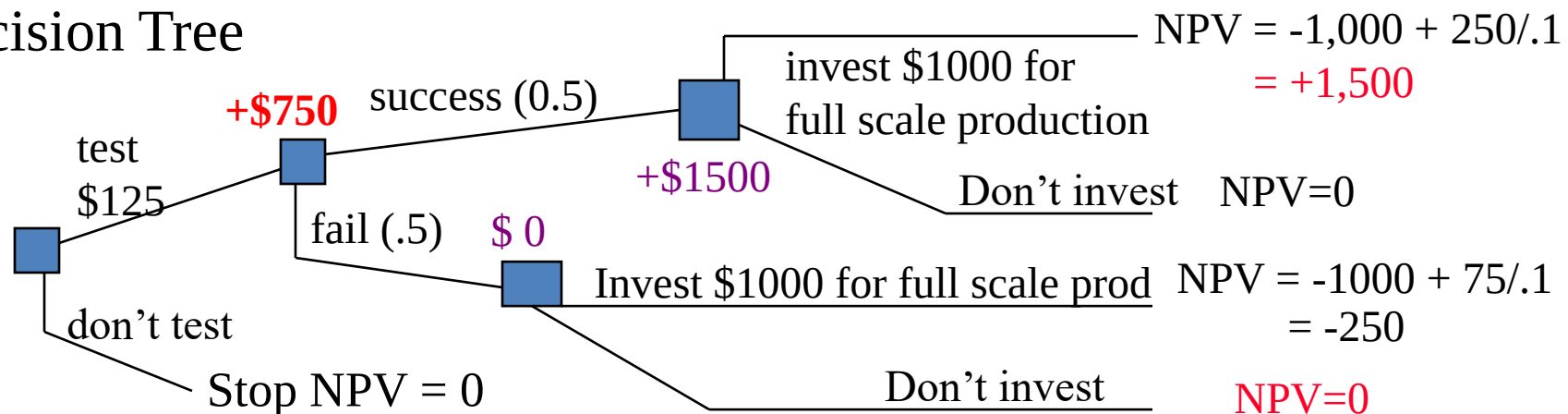
ran 1,000 trials of simple model
distribution of NPV runs from around -6b to + 12b yen



Decision Trees

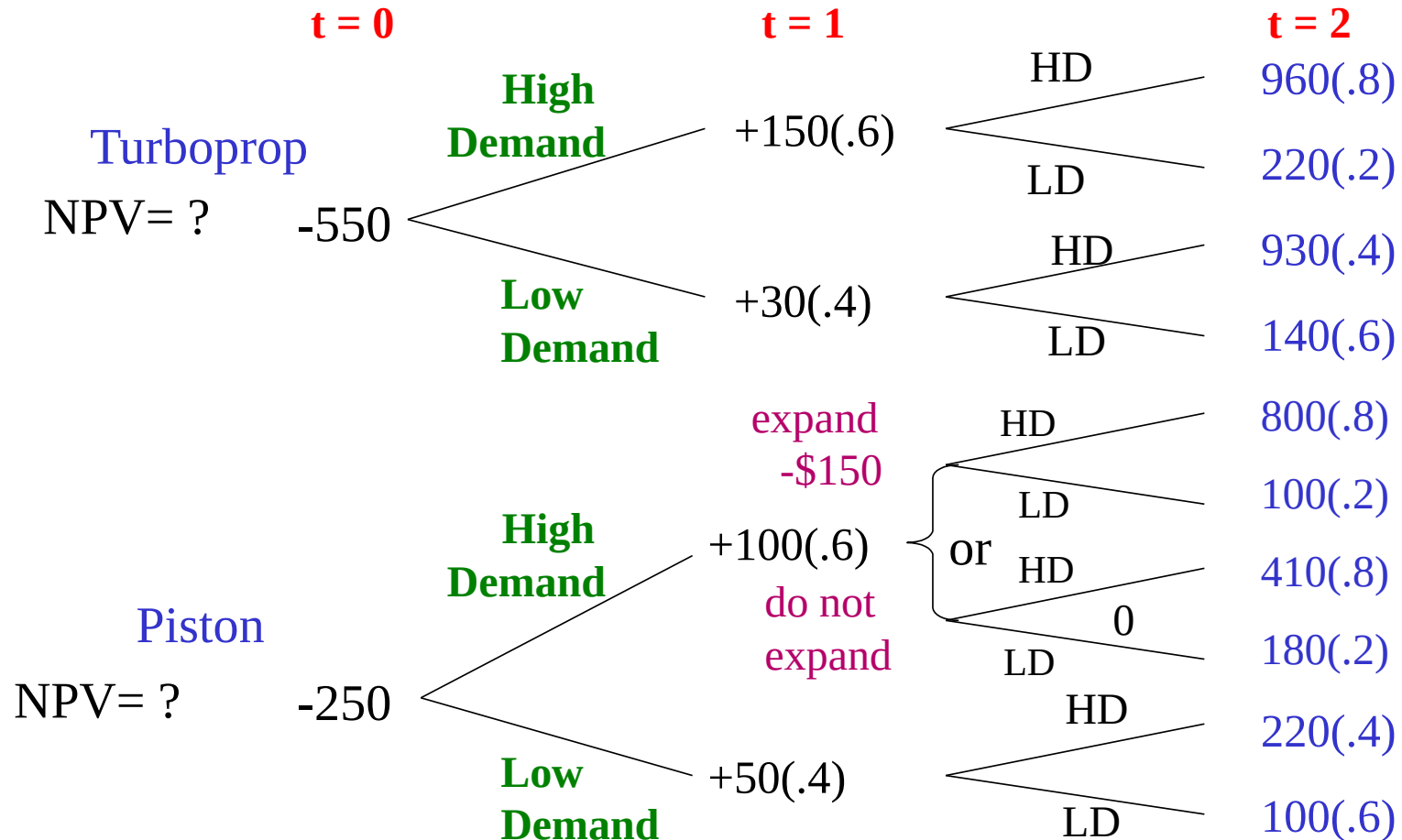
- Often investments have subsequent decisions that depend on the decisions made today
 - to deal with these situations we use a **decision tree** framework
- example of Vegetron and the electric mop
 - preliminary trials cost \$125,000 50-50% chance of success
 - if successful Vegetron builds a \$1m plant and earns \$250,00 a year forever
- 2nd stage decision: invest if test is successful; don't invest if not
 - so first stage decision is to invest \$125 to get 50% chance of \$1500

Decision Tree



More Complex Sequential Decisions

- Consider the case of Magna Charter
 - airline deciding on turboprop or piston engine planes
 - cost of capital = 10%

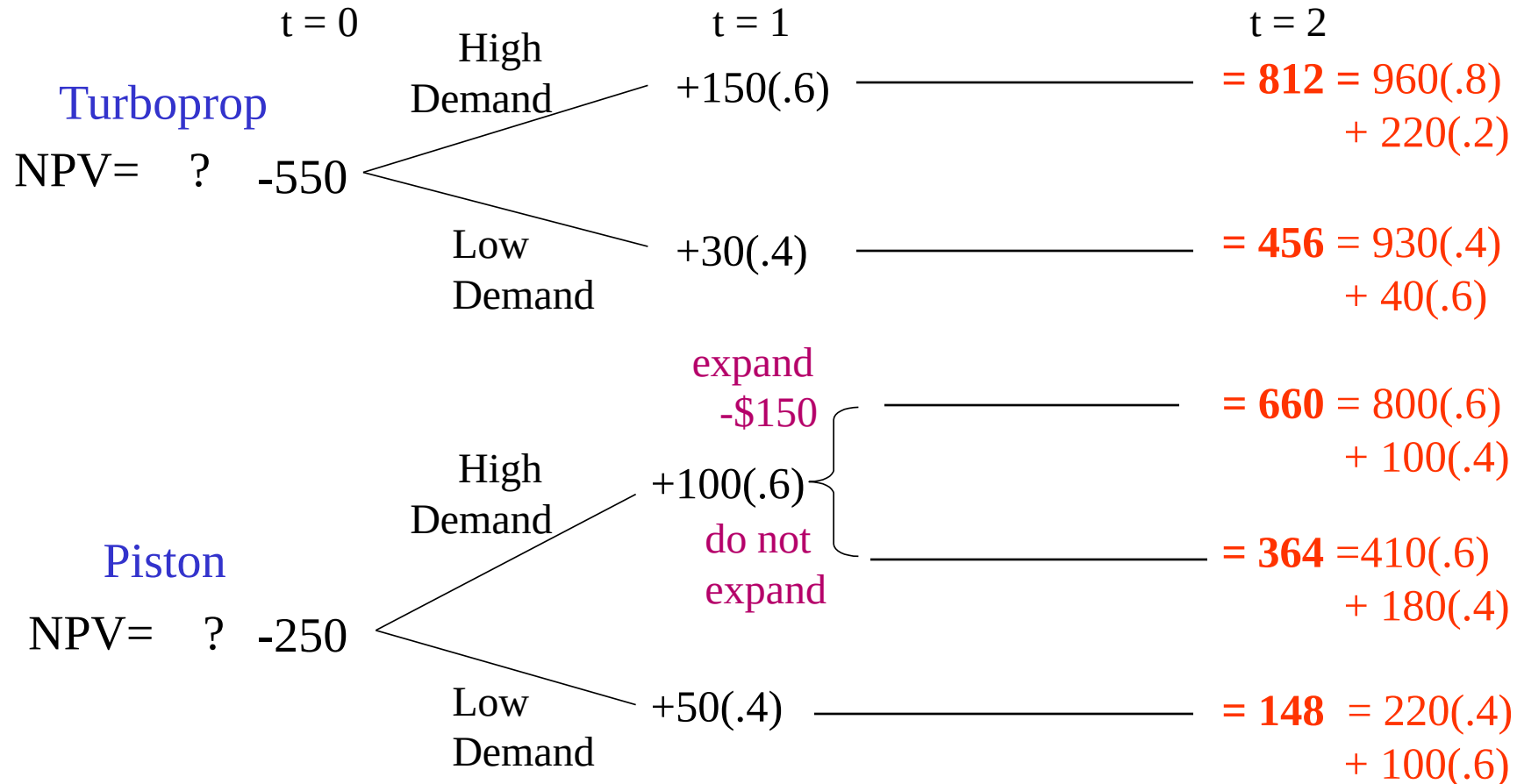


Collapse Outer Branches

- Collapse last set of branches using expected value
 - used expectations for last period

$$E(CF) = CF_{HD} \times \text{Prob}(HD) + CF_{LD} \times \text{Prob}(LD)$$

Expected values of
2nd period CF

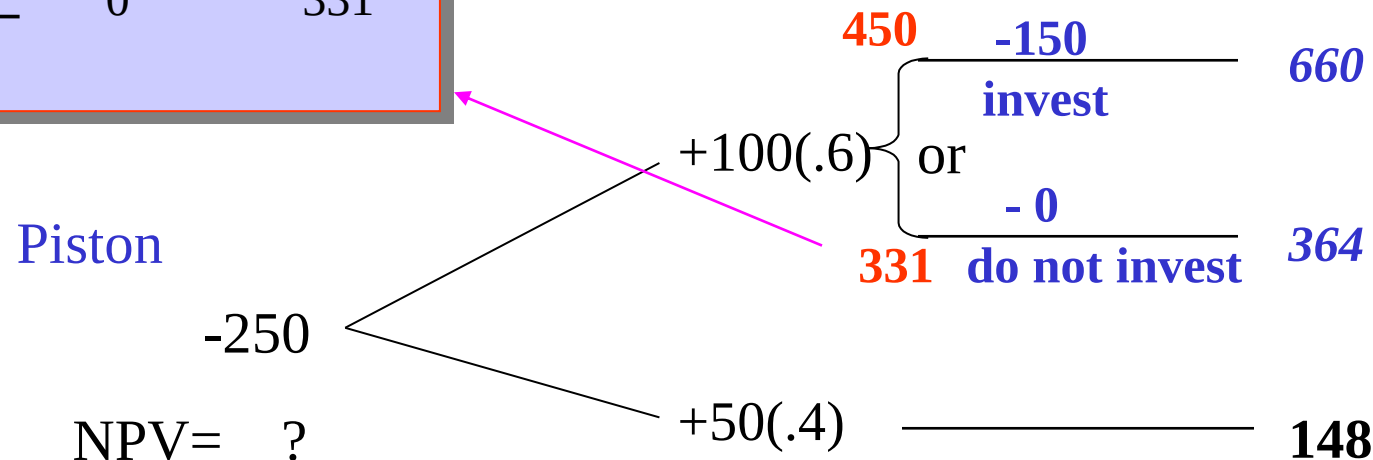


Consider Optional Decision

- Firm has option to add additional piston plane for \$150 if demand is strong
 - determine optimal decision
 - we would invest in plane as NPV is greater
 - this eliminates do not invest branch

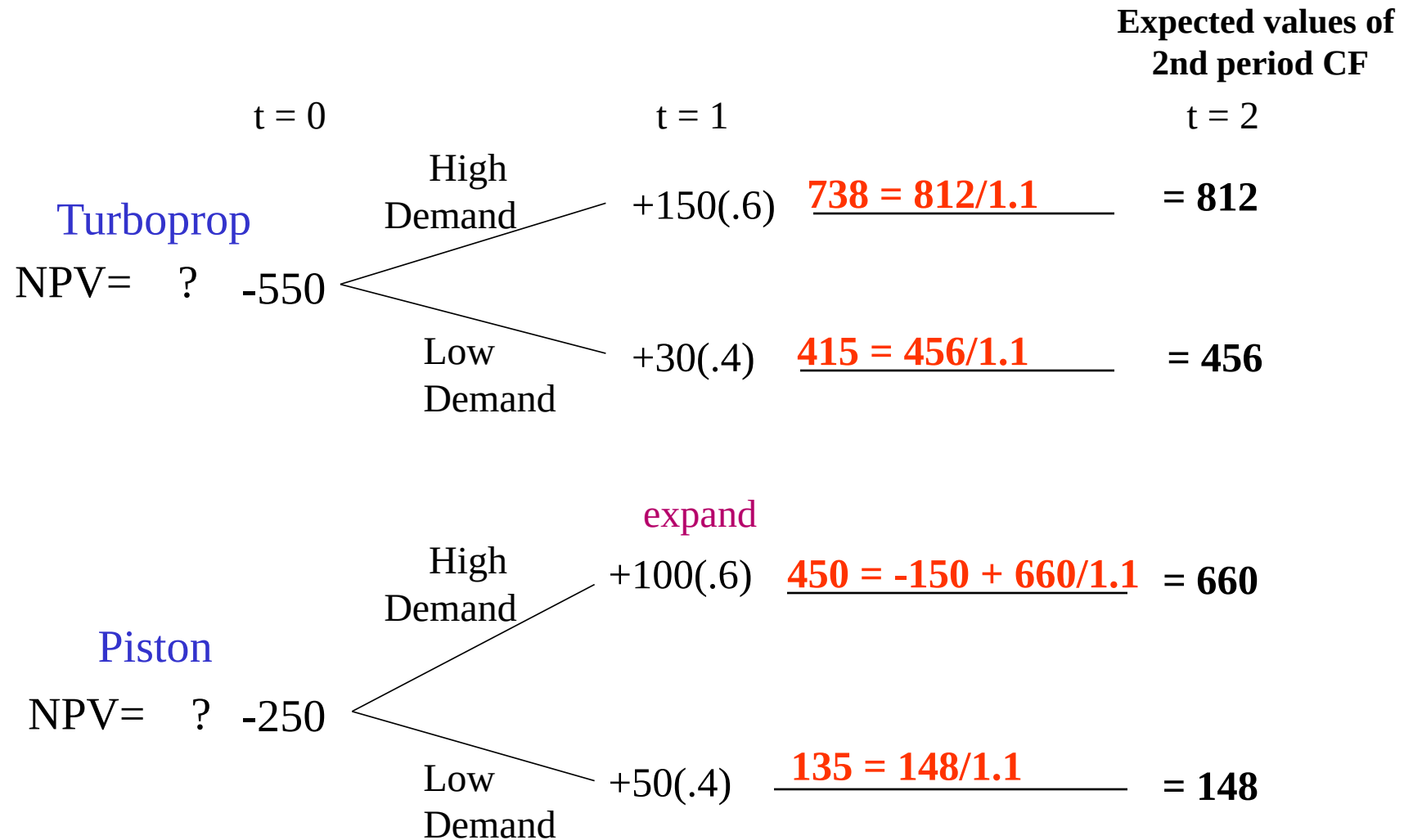
$$\frac{364}{1.10} - 0 = 331$$

$$\frac{660}{1.10} - 150 = 450$$



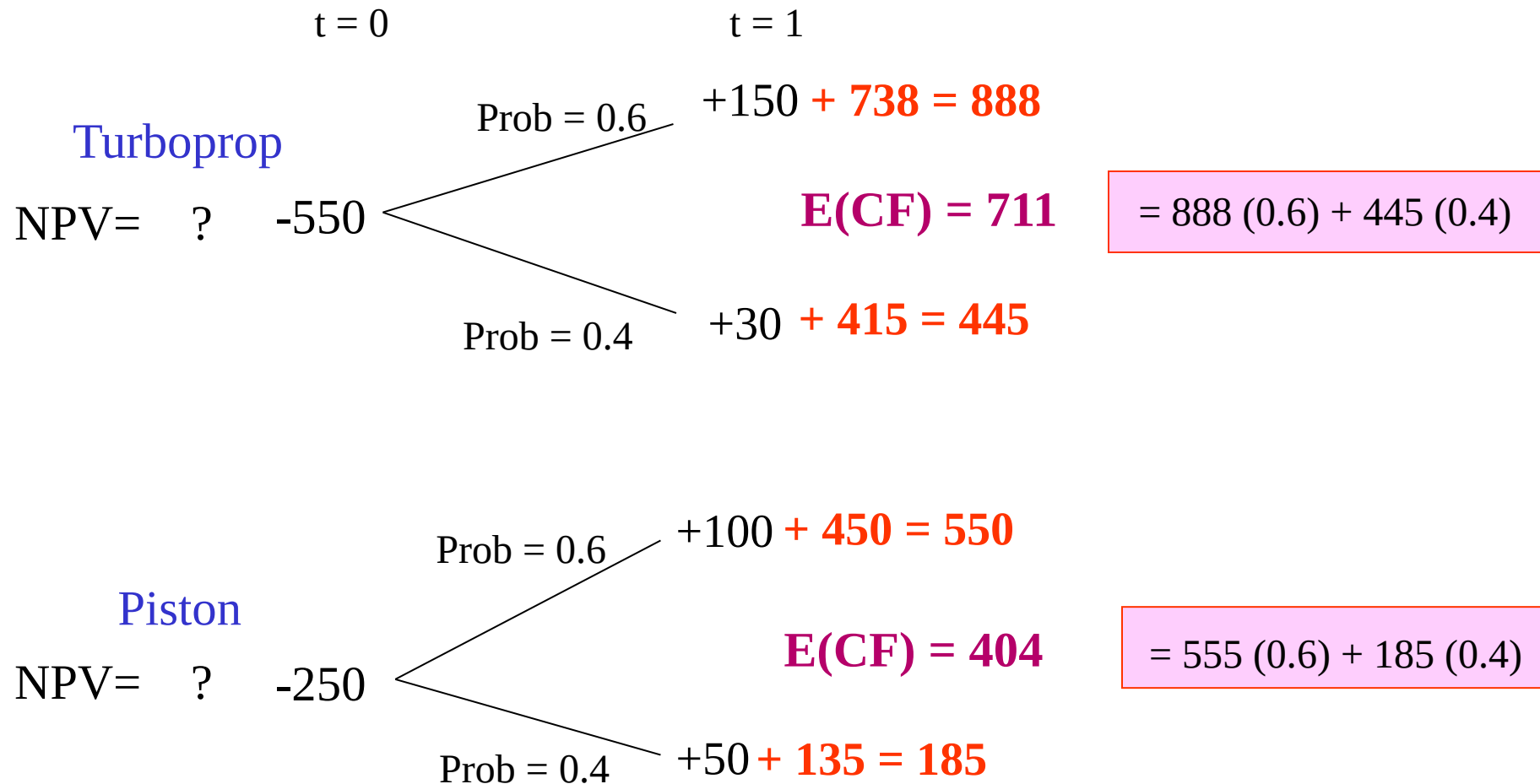
Collapse Outer Branches

- Discount period 2 E(CF)s back to period 1



Collapse Next Set of Branches

- Determine $E(CF)$ s for period 1
 - used expectations for first period



Do Final NPV Calculations

- Now one is left with a simple NPV calculation
 - the piston plane with the option to expand is a more valuable investment than the turboprop
 - NPV of piston without expansion decision = 83
 - thus value of option to expand is worth 34 (117 - 83)
 - this is important part of value of project

t = 0 t = 1

Turboprop

NPV= -550 ————— E(CF) = 711

$-550 + 711/1.1 = 96$

Piston

NPV= -250 ————— E(CF) = 404

$-250 + 404 = 117$



Making Sure Managers Maximize NPV

- The capital budgeting process involves many steps
 - this includes
 - *developing ideas and authorizing evaluation of specific projects*
 - *gathering information and forecasts*
 - *carrying out project evaluations (spreadsheets)*
 - *making sure incentives are structured to achieve expected outcomes*
 - *careful measurement of project performance so as to insure appropriate compensation of managers*
 - lets consider the last two issues in more detail



Incentives

- Shareholders are often not able to manage projects themselves
 - ownership may be too disburse for all to get involved
 - professional managers are hired to oversee projects
 - this is good as it allow people with appropriate expertise to be brought into manage project
 - shareholders concern that outside manager will work in their interests
 - part of structuring project is being concerned that the interests of outside managers are aligned with the interests of SHs
 - *this is done mainly through compensation structure*
 - this is the business version of the classical principal- agent problem
 - **SH is the principal** and the **manager is the agent**



Structuring Compensation

- Suppose we compensate managers using just salary
 - managers have incentives to
 - slack off and not provide top effort
 - over-consume on company perks
 - » office accommodations, season tickets, cars, company travel
 - empire build
 - » bigger projects allow them to ask for more salary
 - make entrenching investment
 - » pursuing investments that favor their own skills rather than better investments that requires skills they do not have
 - avoid risk
 - » preference towards safe projects to avoid collapse and loss of salary

all of these behaviors reduce the value of the firm for the SH !



Dealing with Incentive Problems

- We could hire someone to watch the manager all the time
 - this would work but is expensive
 - some monitoring is desirable
 - example: review committees from Board of Directors
 - alternatively we can alter the compensation package
 - make compensation increase when manager works in interest of shareholders
 - compensation increases when firm value increases
 - pay managers with stock and/or stock options
 - » this is increasingly common in large firms and small start ups
 - » small start ups pay more in stock and options because they do not have the cash to pay salary
 - full incentive compatibility requires that compensation falls when performance lags



Measuring Performance

- Most of the time measurement of performance is based upon accounting results
 - accounting results are biased in that they can be manipulated and do not include the cost of capital
 - they do have advantages
 - based upon absolute performance rather than relative performance
 - can be decomposed to measure performance of sub units of firms to evaluate lower level managers
 - **but tying compensation to accounting performance can cause managers to try to manage or manipulate accounting earnings**
 - earnings management
 - » asset sales
 - » accruals manipulation
 - example of occasional blood baths



Ways to Measure Performance

- A common way to measure performance is to measure residual income
 - also known as *Economic Value Added (EVA)*
 - what are the true earnings of the firms after capital has been paid its market wage
- **EVA = income earned - income required to pay assets**
= income earned - (cost of capital x investment)



Ways to Measure Performance

- **EVA = income earned - income required to pay assets**
= income earned - (cost of capital x investment)

Example

- firm earns net income of \$130m after taxes
- firm has \$1,000m of assets with CoC of 12%
- $EVA = \$130m - (12\% \times \$1,000m) = +\$10m$
- firm generated \$10m in economic value over the period
 - if CoC were 20% the firms would have $EVA = -\$70m$
 - it would have destroyed value despite making an accounting profit of \$130m
 - » SHs would have been better off investing money in the market



Review

- There are several extensions of simple capital budgeting that are common in practice
 - **sensitivity analysis**
 - **break even analysis**
 - » consider only one form of uncertainty at a time
 - **scenario analysis**
 - » single outcome of all uncertainties
 - **simulation**
 - Monte Carlo simulation of all uncertainty simultaneously
 - ***decision trees***
 - **dealing directly with subsequent decisions of current investments**
 - collapse all branches of tree to find real NPV
 - ***incentives and performance evaluation***
 - **role of stock options and dangers of accounting profits**





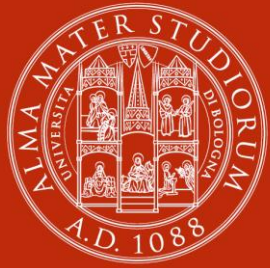
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ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

Corporate Finance

Lecture 9

Advanced Capital Budgeting

Massimiliano Marzo

Department of Management

Financing Decisions and Value

- **In the real world, financing decisions can add value to a project**
 - *interest payments provide tax shields*
 - but significant debt use reduces E(CF) due to bankruptcy
 - how do we account for this added value?
 - start with expected, incremental, after-tax cash flows as if project is all equity financed
 - then we make some adjustments for value of the tax shields
 - *1. adjust the discount rate downward*
 - use after-tax WACC rather than opportunity cost of capital
 - *2. adjust the present value*
 - add additional term that captures the PV of tax shields
 - » based upon additional borrowing capacity of investment
 - *Adjusted Present Value = base case NPV + NPV of financing decisions caused by project's acceptance*
 - » recall that NPV of project is sum of NPV of pieces



WACC

- With no taxes we have

$$WACC = r_D \times (D/V) + r_E \times (E/V) = r_A$$

- r_A is the opportunity cost of capital, a constant independent of D/E
 - this is the rate at which to discount the after tax cash flows
- how does one learn this rate?
 - we work backwards from the the project's cost of debt and cost of leveraged equity

- in a world **with taxes**

$$WACC = D/V \times (1 - \tau_C) r_D + E/V \times r_E$$

- where τ_C = marginal corporate tax rate
- tax advantage of debt reflected in lower post-tax cost of debt
- *WACC is typically calculated for the firm as a whole using the firm's market value of D, E, and V*
 - however, this rate is appropriate for project valuation only if the project has the same risk as the “average” asset of the firm



Example

- **Sangria Corp**

- details for firm:

- $V = 125$, $D = 50$, $E = 75$, $r_D = 8\%$, $r_E = 14.6\%$ $\tau_C = 35\%$
- $WACC = 8\% (1-.35) (50/125) + 14.6\% (75/125) = 10.8\%$

- ***consider a project with similar risk as existing assets***

- both business risk and financial risk (same D/V ratio as firm)
- $C_0 = -10$ and $C_t = 2.085$ for $t = 1$ to infinity (a perpetuity)
- after tax cash flows = $2.085 \times (1 - .35) = 1.355$

$$NPV = -10 + 1.355/.108 = +\$2.50$$

- ***thus if Sangria set up the project as a mini-firm with 40% debt and 60% equity***

- value of firm = 12.5 (i.e, $10 + 2.5$), $D = 5$ and $E = 7.5$
 - cash flow to equity holders = CF - after tax interest
 - » interest payment = $5 \times .08 = .4$
 - » CF to equity = $1.355 - (.4 \times (1-.35)) = 1.095$
 - » return on equity $r_E = 1.095/7.5 = 14.6\%$ so $E = 1.095/.146 = 7.5$



WACC and Return on Equity

- Notice that the use of WACC guaranteed that equity holders earned a return of 14.6%
 - this is the return they require for the particular business risk and financial risk of Sangria's existing assets
 - **this approach of using parent's WACC only works for evaluating a project if:**
 - the project's business risks are the same as average assets
 - the project supports the same D/V ratio as existing firm
 - if business risk were higher than equity would require higher rate of return than 14.6%
 - if project leads to permanent material change in D/E ratio then 14.6% not the right r_E
 - WACC works only when firm acts to maintain a constant D/V ratio for the firm
 - » *if this is not the case then WACC is only approximately correct*



Tricks to Using WACC

- *How do we account for financing other than long term debt and equity?*
 - add new financing with its weight and required return
 - example is use of preferred stock
 - if firm has preferred stock P, with required return r_p
 - **$WACC = r_D (1 - \tau_C) \times D/V + r_p \times P/V + r_E \times E/V$**
 - where r_p is required return on preferred stock
 - **$V = D + P + E$ (use market values)**
 - what about short term debt?
 - if ST debt is used just to finance current assets (like cash and A/R) then we can omit ST debt from WACC calculations
 - it is not important to operating assets if used only for current assets
 - **real question is whether firm is net short term borrower**



Dealing with ST Debt

- **Financing with ST debt**

- we are interested only in the use of ST debt for financing operational assets

- short term debt is part of current liabilities
- first we net current liabilities financing current assets

- any surplus is net working capital (cur assets - cur liabilities)

- accounting vs economic balance sheet of firm

Assets	L & O/E	Assets	L&O/E
Cur Assets	Current Liab	NWC	Debt
F Assets	LT Liab	F Assets	Equity
	Equity		

- this typically leaves only long term financing (LT Debt + E) on LHS of B/S,

» **we often call the long term financing *total capitalization***

- but if ST debt (SD) is important part of firm's financing, it is part of economic definition of Debt (D) and we must add it to WACC



- **$WACC = SD/V \times (1 - \tau_c)r_{SD} + LD/V \times (1 - \tau_c)r_{LD} + E/V r_E$**



Estimating Costs of Financing Elements

- *We use the market rates as the costs of the financing components*
 - r_E is estimated from stock market data
 - r_D for debt is observed from IRR of firm's bonds
 - along with D and E make WACC determinable for most firms
 - **what about if the firm used convertible debt?**
 - *this is a combination of debt and equity and much more difficult to determine expected return*
 - depends on probability of conversion
 - what about junk debt
 - when firm has higher default risk it must offer higher promised returns
 - however, this higher promised return will not always be realized
 - » thus **IRR depends** on perceived probability of default
 - no easy way to determine “expected return” on junk debt



Valuing A Company

- **When valuing an entire firm, WACC is normally used**
 - **requires assumption about stable D/V ratios**
 - **WACC is hurdle rate or discount rate for all cash flows**
 - when valuing a company, just treat it as one big project
 - but recall important issues
 - **formulate expected cash flows but do not deduct interest,**
 - » **treat CF as if all equity financed (but do worry about depreciation)**
 - » **tax benefit of interest tax shields (ITS) is captured in WACC**
 - **company lasts forever, but we seldom forecast out forever, so we often use a terminal value assumption**
 - » often based upon a growing perpetuity (growth rate g , discount rate r)
 - » **Terminal Value _{t} = $CF_{t+1}/(r - g)$**
- lets look at how this would work more closely ...



Terminal Value Calculations

- *Rather than forecast cash flows out forever, we often make a terminal value assumption*
 - TV should be an estimate of what the market is willing to pay for the firm at that point
 - **financial theory says this value should = PV of future cash flows to owner**
 - since we are valuing all cash flows under WACC approach, we often just make a **simple perpetuity assumption**
 - example after year 10, after-tax cash flows will grow from the year 10 level at some constant rate, g

year	10	11	12	13	14
CF	X	$X(1+g)$	$X(1+g)^2$	$X(1+g)^3$	$X(1+g)^4 \dots$

$$TV_{10} \text{ (CF}_{11} \text{ onward)} = X(1+g) / (WACC - g)$$
- *estimates of g should be based upon long run equilibrium*
 - not current growth by permanent sustainable growth rate
 - » often proxied by expected real GDP growth



Valuing Companies

- *Expected CF are discounted at after-tax WACC*
 - *after-tax WACC = $D/V r_D (1 - \tau_c) + E/V r_E$*
 - *E = market value of equity (price x shares outstanding)*
 - *D = market value of debt (typically total long term liabilities)*
 - » *can include any short term portion of long term debt or any short liabilities in excess of short term assets*
 - *note this is lower than $r_A = D/V r_D + E/V r_E$ by value of permanent tax shields from proportion of debt D/V*
 - value of the firm

$$V = \sum_{t=1}^T \frac{E_0 (CF_t) (1 - \tau_c)}{(1 + WACC)^t} + \frac{TV_T}{(1 + WACC)^T}$$

- this is the total value of the firm
 - *to obtain the value for the equity, we must subtract of the current market value of the debt*
 - » *$V = D + E$ so if interested in just E then we must subtract off D*



Valuing the Equity of the Firm

- Value of equity portion of firm, E
 - first determine V using cash flows to all assets using WACC and then subtract off D ($E = V - D$)
 - *alternatively we could value the equity by just discounting the cash flows to equity (after interest payments) at the required return on equity*
 - this is called the flows-to-equity method

$$E = \sum_{t=1}^{\infty} \frac{E_0(\text{ATCF to Equity}_t)}{(1 + r_E)^t}$$

- if the D/V ratio is constant over time the flows to equity method and WACC should give the same answer
- if leverage changes then the flows to equity method is difficult as changes in leverage change the required return to equity
 - discounting flows to equity at today's cost of equity will not give the right answer



Mistakes People Make using WACC

- **While WACC is convenient it is also dangerous**
 - **if a manager has a pet project they try to use low WACC**
 - one way to do this is to **lean towards using more debt**
 - with firm $r_D=8\%$ and $r_E=15\%$, with D/V ratio of 0.4, suppose project decides to use D/V=.9 and E/V=.1
 - $WACC = .08(1-.35)(.9) + .15(.1) = .062$ (vs. 12.2 for company)
 - at 6.2% WACC the project will likely look really good!
 - **3 problems with this:**
 - 1. WACC only works for projects that are carbon copies of firm**
 - 2. Project increases leverage of firm and this raises firm's r_E**
 - **this is a cost to the rest of the firm and must be charged to project**
 - **increased leverage can also lower expected cash flows (lower V)**
 - 3. The source of funds has no relation with required return**
 - **\$1 invested in project does not add ability to borrow \$.90 of debt**
 - » **the project is borrowing against existing assets of the firm**
 - » **the project should be charged for this by raising required return**



Determining After-Tax WACC When Capital Structure Changes

- **What if project has will change debt capacity of firm?**
 - *there will be a change in after-tax WACC*
 - *need to determine required return on equity with new leverage*
 - » *this is what makes WACC tricky*
 - start with **WACC** for case of all equity ($D/V = 0$)
 - in this case $r_E = r_A = \text{opportunity cost of capital} = \text{WACC} = 12\%$
 - new $D/V = 0.4$
 - so new $D/E = 0.66$, $r_D = 0.08$, so calculate new r_E

$$r'_E = r_A + D/E (r_A - r'_D) \quad (\text{use market values})$$

$$r'_E = 12\% + .66 (12\% - 8\%) = 14.6\%$$
 - now calculate WACC at new financing weights
 - example: current info is $D/V = .4$, $r_D = .08$, $r_E = .146$
 - $r_A = .4 (.08) + .6 (.146) = .12$ (same as above)
 - but new after-tax WACC = $.4 (.08) (1-.35) + .6(.146) = 10.8\%$
 - » WACC is now lower because firm now has interest tax shields



Another Way to Adjust WACC for New D/V

- **Determining after tax WACC for new leverage**
 - directly estimate r_E for new D/V
 - simply unlever and then relever the equity beta
 - given the newly leveraged beta we estimate the cost of equity from the CAPM
 - **to unlever beta we recall rule:**

$$\beta_A = \beta_D (D/V) + \beta_E (E/V) \quad (D + E = V)$$
 - this fact, along with an estimate of the debt beta, β_D , and the original D/V value provides us an estimate of β_A
 - often as an approximation for low risk debt we assume $\beta_D = 0$
 - **then we re-lever the asset beta using the new D/V ratio to obtain an estimate of the new leveraged equity beta**

$$b_E^{NEW} = b_A + (D/E)^{NEW} (b_A - b_D)$$



Re-levering Equity Betas

– use the β_E^{NEW} to determine the r_E^{NEW}

- the required return on the new leveraged equity is then

$$r_E^{NEW} = r_F + \beta_E^{NEW} \times (r_M - r_F)$$

- and using the firm's new r_D , the new after-tax WACC is

$$WACC = D/V \times (1-t_c)r_D + E/V r_E^{NEW}$$

– example

- original $D/V = 0$, $r_F = 6\%$, $r_M - r_F = 8\%$, $\beta_A = \beta_E = 0.75$

– unlevered equity beta = asset beta = 0.75

$$r_E = r_A = 6\% + 0.75 \times 8\% = 12\%$$

- new $D/V = 0.4$, $r_D = 0.08$ so $\beta_D = 0.25$

$$\beta_E^{NEW} = \beta_A + (D/E)^{NEW} (\beta_A - \beta_D) = 0.75 + 0.66 (0.75 - 0.25) = 1.08$$

$$r_E^{NEW} = 6\% + 1.08 \times 8\% = 14.6\%$$

- now calculate WACCs at new financing weights**

– **$WACC = r_A = .4 (.08) + .6 (.146) = .12$ (same as above)**

– **$but\ new\ after-tax\ WACC = .4 (.08) (1-.35) + .6(.146) = 10.8\%$**



Using the Re-Levering Technique

- **The delevering technique is useful for determining the asset beta for a project**
 - *suppose we need the asset beta for a food processing project*
 - *we obtain an estimate of b_E from a representative firm's returns or from a (industry) portfolio of related firms*
 - lets say the estimate of the equity beta is $\beta_E = 0.85$
 - these firms will have a certain degree of leverage, say $D/V = 0.55$, reflected in the estimate of their equity beta
 - **if we want to know the asset beta for food processing we can delever this equity beta to obtain an asset beta**

$$b_A = b_D (D/V) + b_E (E/V)$$
 - if we assume that $\beta_D = 0.1$ then

$$\beta_A = 0.1 (.55) + 0.85 (.45) = 0.44$$
 - from this asset beta we can determine r_A



Adjusted Present Value

- *Rather than make adjustments to the discount rate for the tax shield benefits of debt, we can simply value the shields as an new term*
 - this is the Adjusted Present Value (APV) approach
 - steps to APV
 - *step 1 consider project as separate mini-firm all equity financed*
 - after-tax cash flow calculation the SAME as with WACC
 - » ignore any interest deductibility
 - discount these cash flows at an all-equity cost of capital
 - *step 2: adjust base case for any issue costs for desired financing strategy*
 - subtract any issuance costs of issuing new debt or equity
 - *step 3: determine PV of determine tax shields of interest payments provided given borrowing capacity of project*



Borrowing Capacity

- *With APV we don't worry about how much debt is used to finance the project itself*
 - *we worry about how much debt the value of the project would allow the firm to carry given its D/E ratio*
 - this amount of debt is known as the borrowing capacity of the project
 - *it is the amount of debt for which we calculate the interest tax shields*
 - Example:
 - project has initial capital investment of \$100
 - firm desires to have initial capitalization be 40% debt
 - » project supports \$40 worth of debt
 - if firm's borrowing rate is 8% then project offers firm \$3.2 of interest
 - with a marginal tax rate of 35% this project therefore offer the firm \$3.2 $(.35) = \$1.12$ of tax shield each period (for straight debt)

thus value of project = based case NPV - issue costs + PV(tax shields)



Interest Tax Shields

- Assume project is \$10m, firm issues \$5m debt
 - loan repaid in 10 equal installments at 8%
 - this way loan amount falls with depreciating value of asset

Year	Debt BOY	Interest (@8%)	Tax Shield (35%)	PV of ITS @8%
1	\$5,000	\$400	\$140	\$129.6
2	4,500	360	126	108.0
3	4,000	320	112	88.9
4	3,500	280	98	72.0
5	3,000	240	84	57.2
6	2,500	200	70	44.1
7	2,000	160	56	32.6
8	1,500	120	42	22.7
9	1,000	80	28	14.0
10	500	40	14	6.5
(all figs in (000))				Total \$576

- *this estimate almost surely over-estimates PV of ITS*
 - *are we sure that tax shields will have this value?*
 - » *probably not*



Realistic Valuation of ITS

- Reason tax shields are worth less than \$576
 - *can only use tax shields if you have sufficient taxable income*
 - firm unlikely to be sure that every period will have enough income to use entire interest tax shield
 - *actual tax shields of project will depend on project performance*
 - if future debt levels tied to project performance that tax shields are as risky as operating flows
- **how do we reflect the fact that this approach to tax shields is optimistic?**
 - we can use an artificially lower tax rate
 - assume that $\tau_c = 25\%$ as opposed to 35%
 - » this will lower estimation of tax shields
 - we can also alter the discount rate for taking PV
 - » *currently we assume the tax shields are only as risky as the interest payments generating them (we use the borrowing rate)*
 - » *instead, if the future debt levels depended on performance, then the ITS are estimates which are as risky as the operating flows themselves so we should use r_A*



Comparing WACC and APV

- Lets consider both approaches on same project
 - *consider earlier project with cost \$10 and perpetual pre-tax cash flows of \$2.085*
 - project as similar risk and D/V as rest of firm
 - $r_D = 8\%$, $r_E = 14.6\%$, $D/V \text{ (mkt)} = .4$, so $r_A = 12\%$
 - $\tau_c = 35\%$ so after tax WACC = 10.8%
 - $D/V \text{ (book)} = .5$ so firm will borrow \$5m
 - **APV calculations**
 - *after tax cash flows (no financing) = $2.085 \times (1-.35) = 1.355$*
 - *initial investment = 10 and $r = r_A = r_E$ (all equity) = 12%*
 - *base case NPV = $-10 + 1.355/.12 = +\$1.29m$*
 - this looks good independent of financing
 - *but project's \$10m investment supports \$5m debt*
 - *at $r_D = 8\%$ and $\tau_c = 35\%$ this produces ITS of \$.140 each year*
 - » *what are these tax shields worth?*



Financing Rules

- **Value of tax shields depends on financing rule**
 - **2 common rules**
 1. *Debt is fixed - borrow fixed fraction of initial investment and repay over some pre-set schedule (perhaps never)*
 2. *Debt rebalanced - adjust the debt in each future period to keep D/V constant*
 - **impact of rule #1**
 - ***\$5 million of debt at all times forever***
 - \$.140m of ITS per year forever
 - since these ITS are fixed, they are as risky as interest payments
 - » suggest discounting at borrowing cost = 8%
 - $PV(ITS) = \$0.140 / 0.08 = \$1.75m$
 - $APV \text{ of project} = \$1.29m + \$1.75m = \$3.04m$
 - value of ITS would be lower if we repaid initial debt in 10 years and never borrowed again off project's cash flows
 - » thus the debt ratio of project would vary over time



Financing Rules

- **What about impact of financing rule #2**
 - *debt is re-balanced to 40% of project's market value*
 - *debt level reassessed at the end of each period*
 - thus future debt levels are not known with certainty at the start of the project
 - this means that they are as risky as the overall value of the project
 - » the ITS pickup the project's business risk, $r = 12\%$
 - if \$5m is expected to be 40% of the value of the project then we can value these tax shields as

$$PV(ITS) = \$140/.12 = \$1.17m$$
 - uncertainty about level of tax shields is reflected in discount rate

$$APV \text{ of project} = 1.29 + 1.17 = \$2.36m$$
 - » lower than rule 1 because debt is rebalanced and ITS are less certain
 - **NPV using WACC**

- after tax WACC = $(.08) (1 - .35) (.4) + (.146)(.6) = .108$

$$NPV = -10 + \$1.355/.108 = +\$2.5$$



Comparing Valuations

- **Three different valuations of project**
 - APV (rule #1) = +\$3.1m
 - APV (rule #2) = +\$2.4m
 - NPV (WACC) = +\$2.5m
 - **APV (#1) is highest as it assume the debt is fixed and not rebalanced, so ITS are safe cash flows**
 - but why don't APV(#2) and NPV(WACC) both which assume rebalanced debt with ($D/V = .4$) agree?
 - *in case when debt is rebalanced, future interest payments are uncertain, but the coming year's interest payments are set today by the initial level of debt*
 - » *these interest tax shields are not uncertain*
 - » *at each point in time the current year's ITS should be discounted by .08, rather than .12 and the future ITS by .12*
 - » **this reasoning repeats each year of the analysis as the current ITS shields is certain given the debt rebalancing from the previous year**



Adjusting APV(#2)

- We must make an adjustment to ITS under APV(#2)
 - 2 steps
 1. Approximate discounting ITS shields at r_A
 2. Multiply resulting PV by $(1+r_A)/(1+r_D)$
 - *this is because the ITS shields are fixed one period before receipt*
 - for our project we have perpetual expected ITS of \$.140
 - 1. PV (approx) = $\$.140 / .12 = \$1.17\text{m}$
 - 2. PV (exactly) = $\$1.17 \times (1.12 / 1.08) = \$1.21\text{m}$
 - APV (#2) of project with adjustment is
 - base case NPV + PV(tax shield) = $\$1.29\text{m} + \$1.21\text{m} = \$2.50\text{m}$
 - thus using APV with financing rule #2 is the same as using WACC



Which Financing Rule to Assume

- *In practice, the exact valuation of ITS is not really important*
 - better to focus on operating cash flows of project
 - but when a choice is to be made about a financing rule it depends on firm's policy
 - *sometime firm has goal of paying down debt to some desired level*
 - example is LBO (leveraged buyout) when management borrows large amount of debt to buy back firm from public
 - *or other times firm have policy that project can borrow so much and must pay off debt over time*
 - » in these cases using rule #1 is acceptable
 - more likely that rebalancing (#2) is a better rule
 - firms often use increases in value to obtain more debt financing
 - but it is naive to assume that the firm rebalances debt to maintain $(D/V)^*$ every period as is assumed in rule #2 or WACC



Hurdle Rates

- **APV to determine break-even rate of return**
 - find point at which APV = 0 (assume project is perpetuity)
 - **APV = annual income/ r - investment + PV(ITS) = 0**
 - for previous project
 - **APV = annual income / .12 - 10 + PV(ITS) = 0**
 - but what is ITS in this case?
 - It will be less than PV(ITS) above because with APV = 0, the project is only worth \$10m, so the project will only support \$4m in debt as opposed to \$5
 - » thus we have to reduce PV(ITS) by 20% from \$1.21m to \$.97m
 - now $APV = \text{annual income} / .12 - 10 + .97 = 0$
 - annual income = 1.084m or 10.8% of initial investment of \$10m
 - » **thus the break-even IRR is $r^* = 10.8\%$**
 - **now we know that if we see other project with similar risk and D/V of .4, an $IRR > 10.8\%$ will mean $APV > 0$**
 - **we call this rate the adjusted cost of capital or hurdle rate**
 - » **it incorporates both business risk and debt capacity**



Costs of Capital - Be Careful

- **There are thus 2 concepts of cost of capital**
 - **concept 1**: **the opportunity cost of capital (r)**
 - *the expected return offered in capital markets by equivalent risk assets*
 - *depends on risk of projects cash flows*
 - *this is correct discount rate if the project is all-equity financed*
 - **concept 2**: **the adjusted cost of capital (r^*)**
 - *an opportunity cost or hurdle rate that reflects the financing side effects of the investment project*
 - *people often just refer to either of these as the “cost of capital”*
 - sometimes its clear to which they are referring
 - other times they may not be sure themselves and this creates some confusion
 - **if you don't know the adjusted cost of capital you must use APV**
 - *if you know r^* then you can just calculate NPV using r^**



Final Thoughts

- What actually gets used
 - use of WACC based upon firm or industry basis is most common
 - industry WACC less noisy than firm based WACC estimates
 - but recall that company WACC is only appropriate for scale expanding projects
 - if a firm is a conglomerate, it should use an industry specific WACC for different projects
- What if project is not scale expanding
 - think about project specifically
 - risks are specific to the assets of the investment
 - focus on the projects contribution to the firm's borrowing capacity, not its immediate financing
 - if a project WACC is to be used rather than APV, be sure to adjust WACC as done earlier



Summary

- **This is a deep lecture !**
 - few people really understand all of these issues clearly
 - *keep in mind, all we have been doing is different ways to adjust from assumption of all-equity financing*
 - debt has value because of tax shields
 - but DON'T forget that too much debt has costs that cause expected pre-tax cash flows to fall
 - » we did not account for this possibility in this lecture
 - **we considered 2 approaches**
 - **WACC where we adjust the cost of capital downward to reflect benefits of debt usage**
 - » focus on debt capacity of project rather than actual debt usage
 - **APV where value of debt is valued as a separate item**
 - » alternative assumptions about debt usage
 - » fixed debt over life of project or debt rebalancing
 - » adjusted rebalancing assumption leads to same result as WACC





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