FINANCE 401/FINANCE 567

LECTURE 3b

Lecture Plan

1. Cash flows in capital budgeting.
2. Mutually exclusive decisions
3. Optimum duration read Copeland & Weston.

3a. Mathematical programming and capital budgeting.

4. Use of risk-adjusted discount rates.
5. CAPM and capital budgeting.
6. Inflation and capital budgeting.
7. Results of surveys.
8. Porter's recent work and others at Harvard.

To recap - the difference between the economic and the accounting definition of profit:

Assume we have an all-equity financed firm and there are no taxes. Sources of funds are revenue and proceeds from new equity issues (Rev_t and $M_t S_t$). Uses of funds are wages, salaries, materials and services, W+S, investment - I and dividends Div.

Equality between sources and uses of funds

$$Rev_t + M_tS_t = Div_t + (W+S)_t + It \qquad (1)$$

Assume the firm issues no new equity

$$M_tS_t = 0$$

Now we can write dividends as

$$Div_t = Rev_t - (W+S)_t - It \qquad (2)$$

which is the simple cash flow definition of profit.

We can rewrite shareholders' wealth as

$$So = \sum_{t=0}^{\infty} \frac{Rev_t - (W+S)t - It}{(1+k)^t} \qquad (3)$$

The accounting definition of profit does not deduct gross investment I_t as investment outlays are made. Instead, the book value of new investment is capitalised on the balance sheet and written off at some depreciation rate Dep.

The accounting definition of profit is net income

$$NI_t = Rev_t-(W+S)_t - dep_t \quad (4)$$

Let ΔA_t be the net change in book value of assets during a year. The net change will equal gross new investment during the year I_t, less the change in accumulated depreciation during the year dep_t.

$$\Delta A_t = I_t - dep_t \quad (5)$$

The accounting definition of profit NI_t can be adjusted to be equivalent to the economic definition Div_t by subtracting net investment.

$$So = \sum_{t=0}^{\infty} \frac{Rev_t - (W+S)_t - dep_t - (I_t - dep_t)}{(1+k^t)} = \sum_{t=0}^{\infty} \frac{NI_t - \Delta A_t}{(1+k)^t} \quad (6)$$

The economic definition focuses on cash flows when they occur.

Basic investment decision rules

All cash flows should be considered.

The cash flows should be discounted at the opportunity cost of funds.

The technique should select from a set of mutually exclusive projects the one which maximises shareholder wealth.

Managers should be able to consider one project independently from all the others - the value additivity principle.

The value additivity principle implies that the value of the firm is the sum of the value of the projects which make it up.

$$V = \sum_{j=1}^{n} V_j \qquad (7)$$

Non DCF investment appraisal techniques.

Payback and accounting rate of return - tend to be dismissed by economists because they are not consistent with considering all a project's cash flows or the time value of money.

DCF techniques - popular applications are NPV and IRR - we discussed these last week.

Cash flows for capital budgeting

Pro-forma Income Statement

Rev	Revenue	1,300
-VC	Variable Costs	-600
-FCC	Fixed cash costs	0
-dep	Non-cash charges (Depr)	-200
EBIT	Earnings before interest and taxes	500
$-K_dD$	Interest expenses	-50
EBT	Earnings before taxes	450
-T	Taxes at 50%	-225
NI	Net Income	225

Assume a firm is going to be created from scratch. It will require an initial investment of $1,000 for equipment it will depreciate at $200 per year. The owners have decided to borrow $500 at 10% interest. The expected cash flows on the project are shown in the previous table. Assume the shareholders' required rate of return is 30% and all cash flows are perpetual. The next table sets out the cash flows if the project is held for five years and then sold.

Total Cash flows for project

Year	Inflow	Outflow	Depr.	Replacement Investment	Interest	Tax	Net Income	Residual Cashflow
0	1000	-1000						
1	700		200	-200	-50	-225	225	225
2	700		200	-200	-50	-225	225	225
3	700		200	-200	-50	-225	225	225
4	700		200	-200	-50	-225	225	225
5	700	-500	200	-200	-50	-225	225	225+1250

Current cash flows are $300 provided by equity holders and 500 from creditors. Outflows are $1000 on equipment.

In years 1 to 5, the project returns $700 in cash after the cash costs of production ($600) are subtracted from revenues ($1300). Then depreciation $200 a non cash charge is deducted, leaving $500 before interest and taxes. The deduction of $50 of interest expenses leaves taxable income of $450. After taxes, there is $225 in net income. To compute free cash flows available for payment to shareholders. Depreciation ($200) a non-cash charge must be added back, and replacement iinvestment ($200) a cash outflow must be subtracted.

The residual cash flow available to the shareholder is $225 per year.

Shareholder wealth (s) can easily be calculated. Remember we assumed a perpetual stream.

$$S = \frac{\text{Residual Cashflow}}{K} = \frac{\$225}{.3} = \$750$$

The present value of the bondholders' interests (B)

$$B = \frac{\text{Interest}}{Kd} = \frac{\$50}{.10} = \$500$$

The market value of the firm

$$V = B + S = \$500 + \$750 = \$1250$$

Rather than using this approach, it is easier to analyse the project's cash flows for capital budgeting purposes and discount them at the firm's weighted average cost of capital.

$$K = WACC = K_d(1-tc)\frac{B}{B+S} + K_s\frac{S}{B+S} \tag{8}$$

$$= .10(1-.5)(.4) + .30(.6) = 20\%$$

The appropriate definition of cash flows for capital budgeting purposes, is after-tax cash flows from operations, assuming the firm has no debt and net of gross investment ΔI. Marginal operating cash flows are the changes in Rev - minus change in variable costs VC and change in fixed costs FCC.

Marginal operating cash flows = ΔRev-ΔVC-ΔFCC

free operating cash flows are net of investment ΔI.

Free operating cash flows = ΔRev-ΔVC-ΔFCC-ΔI.

Taxes on operating cash flows = TC(ΔRev-ΔVC-Δdep-ΔFCC)

NCF for capital budgeting

= (ΔRev-ΔVC-ΔFCC)-tc(ΔRev-ΔVC-ΔFCC-Δdep)-ΔI

= (ΔRev-ΔVC-ΔFCC)(1-tc)+tc(dep)-ΔI

One of the advantages of discounting the firm's cash flows at the after-tax weighted average cost of capital is that this approach separates the investment decision from the financing decision.

Cash flows for capital budgeting

Year	Operating Cash Flow	Depreciation	Tax*	NCF = Cash flow
0	-1000			-1000
1	700	200	250	250
2	700	200	250	250
3	700	200	250	250
4	700	200	250	250
5	700	200	250	250+1250

* The tax is the tax on operating income, i.e., .5(500)

NPV of Cash flows

Year	Cash Flow	PV factor at 20%	PV
0	-1000	1.000	-1,000.00
1	250	.833	208.33
2	250	.694	173.61
3	250	.579	144.68
4	250	.482	120.56
5	250	.401	100.47
5	1250	.401	502.35
			250.00

Recall that in year 5, the firm is sold for a market value of $1250. This is the value of the cash flows from year 5 in perpetuity $250/.20$.

Mutually exclusive projects with different length of lives use the annuity formula on the NPV to turn them into **annual equivalent factors**.

S.C. Myers, "Financial Theory and Financial Strategy"

1. Finance theory and traditional approaches to strategic planning may be kept apart by differences in language and "culture".

2. DCF analysis may have been misused and consequently not accepted, in strategic applications.

3. DCF may fail in strategic applications, even if it is properly applied.

Problems in standard finance theory

Applications of DCF will encounter four major problems:

1. Estimating the discount rate.

2. Estimating the project's cash flows.

3. Estimating the project's impact on the firm's other cash flows, i.e., cross-sectional link of project.

4. Estimating the project's impact on the firm's future investment opportunities.
   - time series links between projects.

The first three issues are difficult ones, but the fourth is probably the most problematic.

Suppose a firm invests in a negative NPV project in order to establish a foothold in an attractive market. You cannot really apply DCF to these decisions because the second stage is an option.

- Investing in Stage 1 purchases on intangible asset - a call option on Stage 2.

- the limits of DCF

1. DCF is standard for valuing bonds and fixed income securities.

2. DCF is sensible and widely used for valuing safe stocks paying regular dividends.

3. DCF is not as helpful in valuing companies with significant growth opportunities.

4. DCF is never used for traded calls or puts - OPMS are applied.

Corporate analysis

1. There are fewer problems in applying DCF to value safe flows, i.e., flows from financial leases.

2. DCF is readily applied to cash cows - relatively safe business.

3. DCF is less useful in valuing businesses with substantial growth opportunities.

4. DCF is no help at all for pure R&D.

   Implications for corporate strategy.

   1. acquiring options - investing in R&D, quality improvement.

   2. Abandoning options that are too far out of the money to pay to help.

   3. Exercising valuable options at the right time.

M.E. Porter, Capital choices: Changing the way America invests in industry", *Journal of Applied Corporate Finance*

Porter argues that to remain competitive, companies must continually upgrade their competitive advantages.

This requires sustained investment in a wide variety of forms - not just physical assets but R&D, employee training, skill development - information systems, etc.

Argues that the US system of allocating investment capital within and across companies appears to be failing.

US companies invest too little in assets and capabilities critical for competitiveness - claims Porter.

He suggests that the effectiveness of the entire system of allocating investment capital is in question.

The US system of capital allocation creates a divergence of interests between owners and corporations that interferes with the flow of capital to those corporate investments which offer the highest long-run pay-offs.

Importance of Investment: the appropriate rate of investment in one form often depends on making complementary and required investment in others.

The optimal rate of investment for society as a whole may differ from that for the individual firm because of spill-overs or externalities.

These lead to social returns

The US Investment Problem

claims US industry invests at a lower rate and on a shorter-term basis than German and Japanese industry in many areas.

The competitive position of significant parts of the US economy seems to have declined relative to other nations.

Aggregate investment in property, plant, R&D, and intangible assets such as training is lower in the US than in Japan and Germany.

Leading US firms in many industries, i.e., automobiles, computers, tyres are out-invested by their Japanese counterparts.

R&D portfolios of US firms include fewer long-term projects than Japanese firms.

Hurdle rate used by US firms appears higher than estimates of their cost of capital.

American CEOs believe their firms have shorter investment horizons.

Average holding periods of stocks has declined to about two years.

On the positive side:

US does well in funding start-up investments.

Average profitability of US industry is higher than in Japan or Germany.

But US industry appears to have over-invested in unrelated acquisitions.

Yet the US has advanced efficient capital markets - why is there a problem?

Determinants of investment

The macro-economic environment - stability, growing economy, positive expectations of growth, etc.

Capital allocation mechanisms- external capital market - supplies of debt and equity.

Internal capital market - within companies.

Project specific conditions - argues that specialised skills, technology, infrastructure, sophisticated demanding local customers, capable suppliers, competitive local companies.

These attributes combine to produce a self-reinforcing system.

The external capital market

1. Pattern of share ownership and agency relationships.

2. The goals of owners and agents influence investment - ability to own debt and equity jointly.

3. Approach and information used by owners or their agents in monitoring and valuing companies.

4. Ways in which owners and agents influence management behaviour.

Differences in national capital markets

US system characterised by fluid capital - moves rapidly from one company to another. Institutions one sixth of total equity in 1990. Average holding 1.9 years. Investors are driven by the system to rely on measurable company attributes. Current earnings, patent approvals, proxies for value - Porter claims this can lead to under-investment in some industries or in certain kinds of investment.

Divides companies into three groups:

1. Established companies in mature industries.

2. Companies in emerging or hi-tech areas.

3. Companies in the throes of a discontinuity.

The latter two types are difficult to value using standard proxies.

Dedicated capital

Japan and Germany have systems defined by dedicated capital in which the funds of principal owners remain invested in companies over long periods of time. The dominant owners are principals rather than agents and hold significant ownership stakes.

Their goals are more relationship than transaction driven. They have the initiative and the means to engage in extensive and on-going information gathering about the companies they own.

Share prices and pressure from non-government owners do not have much influence traditionally on Japanese managers.

The Internal Capital Market

Influences are:

1. Corporate goals
2. Organisational principles governing the relationship between senior management and business units.
3. The information and methods used to value and monitor investment options.
4. The nature of intervention by senior management into investment projects.

Maximising investment returns - the US system can be characterised as one structured to maximise measurable investment returns, maximising shareholder value. ROI plus increasing stock prices.

Compensation and option rewards tend to be linked to earnings and stock prices.

Many US companies have become very decentralised - highly autonomous with little flow of information between unit or understanding of the nature of the business by top management.

Capital budgeting largely takes place through numbers systems.

Intangible investments such as training are difficult to track in this type of system.

Securing Corporate Positions

In the Japanese and German systems, the dominant goal is to secure the perpetuation of the enterprise. They tend to be less diversified - have better information flows through the component parts. Managers are more likely to have a technical background and long tenure in the firm.

Total quality management and greater cross-funding co-ordination leads to better information flows in the Japanese system.

Comparative Capital Allocation Systems

Effects on investment behaviour

Claims US system is less supportive of investment-emphasis on current stock price? I do not follow this point.

The US system favours those investments for which the returns are most readily measurable.

The US system favours investment in discrete projects.

The US system heavily favours acquisitions.

Trade-offs amongst system

US system good at re-allocating capital. Japanese and German systems encourage upgrading of investment and diversification into related fields. May lead to tendency to over-invest - produce too many products, stay in market too long.

The Japanese and German systems appear to come closer to optimising long-term private and social returns.

Porterís recommendations for reform

- Improve the macroeconomic environment
- Expand true ownership
- Better align the goals of the parties concerned
- Improve the information used in decision-making
- Foster more productive modes of interaction and influence among capital providers, corporations and business units.
- See slides