FINANCE ECF5103 Investments Finance V

Lecture 1

Security valuation

Bond valuation

Risks associated with investment in bonds:

- Interest rate risk
- re-investment risk
- default risk
- call risk
- inflation risk
- foreign exchange rate risk
- marketability risk

Overview of framework for evaluating bonds

Can use government securities as a benchmark

Price of a comparable treasury bond

minus

Value of the risk premium for accepting the credit risk associated with the issue

minus

Value of any options the bondholder grants to the issuer

plus

Value of any options the issuer grants to the bondholder

minus

Value of the risk premium required for accepting foreign exchange - rate risk for a non-dollar-denominated bond

plus

Value of any tax advantage associated with the issue

minus

Value of the premium required for accepting marketability risk.

The same framework can be re-cast in terms of yield (assuming the same maturity and coupon).

- Yield on a comparable treasury bond

plus

Yield premium required for accepting the credit risk associated with the issue

plus

Yield premium required for any options the bondholder grants to the issuer

minus

Yield give up for any options the issuer grants the bondholder

plus

Yield premium required for accepting foreign exchange rate risk for a dollar denominated bond

plus

Yield premium required for accepting marketability risk

- Notice the inverse relationship between price and yield.

Pricing the bond

In general, the price of a bond can be computed from the following formula:

$$P = \frac{c}{(1+r)^1} + \frac{c}{(1+r)^2} + \frac{c}{(1+r)^3} + \ldots + \frac{c}{(1+r)^n} + \frac{m}{(1+r)^n}$$

or

$$P = \sum_{t=1}^{n} \frac{C}{(1+r)^t} + \frac{M}{(1+r)^n} \qquad (1)$$

where

P = price (in $)

C = Semi-annual coupon payment (in $)

M = maturity value

n = number of periods (number of years x 2)

r = periodic interest rate (required annual yield divided by 2)

Duration as a measure of price volatility

To determine the appropriate change in price for a small change in yield, the first derivative of equation (1) can be computed:

$$\frac{dp}{dy} = \frac{(-1)C}{(1+y)^2} + \frac{(-2)C}{(1+y)^3} + \ldots + \frac{(-n)C}{(1+y)^{n+1}} + \frac{(-n)m}{(1+y)^{n+1}} \qquad (2)$$

Re-arranging equation (2), we obtain

$$\frac{dp}{dy} = -\frac{1}{(1+y)}\left[\frac{1c}{(1+y)^1} + \frac{2c}{(1+y)^2} + \ldots\ldots + \frac{nc}{(1+y)^n} + \frac{nm}{(1+y)^n}\right]\frac{1}{p} \qquad (4)$$

The expression in brackets divided by the price, (or multiplied by the reciprocal of the price), is commonly referred to as the Macaulay duration.

i.e., Macaulay Duration

$$\frac{\dfrac{1c}{(1+y)^1} + \dfrac{2c}{(1+y)^2} + \ldots + \dfrac{nc}{(1+y)^n} + \dfrac{nm}{(1+y)^n}}{p}$$

$$\text{Macaulay duration} = \sum_{t=1}^{n} \frac{\dfrac{tc}{(1+y)^t} + \dfrac{nM}{(1+y)^n}}{p} \qquad (5)$$

Substituting Macaulay duration into equation (4) for the approximate percentage price change gives

$$\frac{dp}{dy}\frac{1}{p} = -\frac{1}{(1+y)} \text{ Macaulay duration} \qquad (6)$$

Investors commonly refer to the ratio of the Macaulay duration to (1+y) as modified duration, that is

$$\text{modified duration} = \frac{Macaulay \text{ duration}}{(1+y)} \qquad (7)$$

Substitution equation (7) into equation (6) gives $\frac{dp}{dy}\frac{1}{p}$ = modified duration.

Valuing equity

J B Williams and M J Gordon developed a model relating an equity share's value to its dividend income.

$$Po = \sum_{t=1}^{\infty} \frac{dt}{(1+k)^t} = \frac{d1}{(1+k)} + \frac{d2}{(1+k)^2} + \ldots \qquad (8)$$

where

Po = present value or price

k = the capitalisation rate which is appropriate for the firm's risk class.

If dividends grow at some constant rate of growth denoted g, then future dividends are related to current dividends as shown below

$$Po = \sum_{t=1}^{\infty} \frac{do(1+g)^t}{(1+k)^t} \qquad (9a)$$

$$Po = do\sum_{t=1}^{\infty} \frac{(1+g)^t}{(1+k)^t} \qquad (9b)$$

$$= do\left(\frac{1+g}{(1+k)}+\frac{(1+g)^2}{(1+k)^2}+\frac{(1+g)^3}{(1+k)^2}+\ldots\right) \tag{9c}$$

multiplying equation (9c) by $\left[(1+k)/(1+g)\right]$ gives

$$Po\left[\frac{1+k}{1+g}\right]=do\left[1.0+\frac{1+g}{1+k}+\frac{(1+g)^2}{(1+k)^2}+\ldots\right] \tag{9d}$$

Subtracting equation (9c) from (9d) gives equation (9e).

$$\left[\left(\frac{1+k}{1+g}\right)-1\right]Po=do \tag{9e}$$

by assuming that k>g, this can be rearranged:

$$\left[\frac{(1+k)-(1+g)}{1+g}\right]Po=\left[\frac{k-g}{1+g}\right]Po=do \tag{9f}$$

$$Po(k-g)=do(1+g)=d1 \tag{9g}$$

$$\therefore \text{ Po}=\frac{\text{d1}}{\text{k}-\text{g}}$$

See J L Farrell, "The dividend discount model: A primer", *Financial Analysts Journal* (Nov/Dec 1985) pp.16-25.

Farrell suggests that the variable of most interest to investors is generally the stock's discount rate k. The price of the stock is readily found, and such variables as the current dividend and the growth rate can be estimated (with varying degrees of difficulty).

$$\text{k}=\frac{\text{D}}{\text{P}}+\text{g}$$

The stock's discount rate is a function of 2 variables - the dividend yield and the growth rate g, estimating the dividend and the growth rate of dividend g.

Estimating the dividend and the growth rate of the dividend may be facilitated if we redefine these variables.

Defining E as year-ahead earnings and 1-b as a payout ratio, we can think of dividends as a function of a payout rate and an earnings level such that:

$D = (1-b)E$

by further defining b as a retention rate and r as a return on equity, or a measure of profitability, we can think of the growth rate of the dividend as a function of the retention rate and return on equity such that:

$g = br$

With these alternative definitions, the equation for determining the discount rate becomes

$$k = \frac{(1-b)E}{p} + br \qquad (10)$$

Note that the inputs for equation (10) and estimates for the following variables - the level of earnings E, the retention rate b, (alternatively the payout rate (1-b) and the basic level of profitability r.)

An illustration

Suppose we want to estimate the discount rate, or expected re turn, of the market as a whole. The simplified model can be applied across all stocks as shown below:

Table 1 - Expected Return on S+P 500

Year	Earnings (E)	Payout Ratio (1-b) %	Return on Investment (r)	Dividends (D)	Retention rate (b)	Growth (br)
1980	14.82	42	17.8	6.16	58	10.3
1981	15.36	43	17.0	6.63	57	9.7
1982	12.65	54	12.9	6.87	46	5.9
1983	14.04	55	14.0	7.04	45	6.7
1984	16.73	45	16.3	7.53	55	9.0

Expected return E(R) = $\frac{(1-b)E}{P} + br$

= 4.5 + 9.0 = 13.5%

Inflation rate = 6.5

Expected real return = 7.0

Realised return 1926-1984 = 9.3

Inflation = 3.0

Realised real return = 6.5

In the table, the return on investment for US stock 1980-84 averaged 15.6%. The payout rate averaged about45%. The 1984 retention rate and return on investment imply a sustainable growth rate of 9%. At the end of 1984, the dividend yield on the S+P 500 was 4.5%. This indicates an overall expected return or discount rate for the S+P 500 of 13.3%. The realised real rate 1926-1984 was 9.3% but if we take the inflation rate of 6.5 for the expected return of 17.5, we are left with a real return of 7.0%, not so far from the historical average.

Appraising individual stock

The simplified form of the dividend discount model is also appropriate for firms we might characterise as being of a stable, more mature variety, i.e., utilities, food retailers, beer producers, bank and life insurance, household products, etc. - earnings patterns, retentions, rates, etc. are fairly stable. The formula needs to be modified for high growth - highly cyclical companies.

Interest rate risk

For perpetuities such as preferred stocks, where dividend payments are fixed, the formula for calculating duration d is

$$d = \frac{1}{k}$$

where k = the required return.

Calculating the duration for common stock is similar, except we need to allow for dividend growth.

The duration of common stock is

$$d = \frac{1}{k - g}$$

$$\text{duration} = \frac{1}{\text{dividend yield}}$$

This indicates that the companies with the low dividend yields have longer durations than stocks with high dividend yields and are relatively more sensitive to discount rate changes.

Table 2 - Relative duration -stocks versus bonds

Bonds	12/31/84
Coupon	$11.70
Maturity	20 years
Interest rate	11.7%
Duration	8 years
Stocks	
Dividend	$7.53
Growth rate	9.0
Discount rate	13.5
Duration	22 years

Purchasing power risk

Stocks probably have less inflation risk than bonds because the cash flows-dividends are flexible.

$$P = \frac{D(1+I)}{k(1+I) - g(1+I)}$$

Note all three variables have been augmented by the rate of inflation (1+I).

The company may or may not be able to offset the rate of inflation on its growth rate.

Reference: Chapters 1 to 5, G. Foster, *Financial Statement Analysis*, Prentice-Hall 1986, plus handouts.

This course is concerned with Security Analysis.

To price securities in financial markets, investors need financial information - investment focus.

There are various parties who demand financial statement information.

Such information facilitates decision-making, assists the monitoring of management, helps in the interpretation and application of contracts based on this information.

A. Shareholders, investors, and security analysts
B. Managers - stewardship focus
C. Employees
D. Lenders and other suppliers
E. Customers
F. Government/Regulatory Agencies
G. Other parties

Conflicts amongst diverse parties

Factors affecting demand for financial statement information

A. Potential of the information to reduce uncertainty.
B. Availability of competing information sources. FSI - more directly related to variables of interest - more reliable, lower cost, more timely. Other source - production, market share, etc.

See Foster Table (1.1)

Differential Disclosure: Possible Examples

I) Major lenders receiving information that is more detailed and more frequently updated than that provided to shareholders.

II) Bond rating agencies being provided with more detailed information about product profit margins than is publicly disclosed.

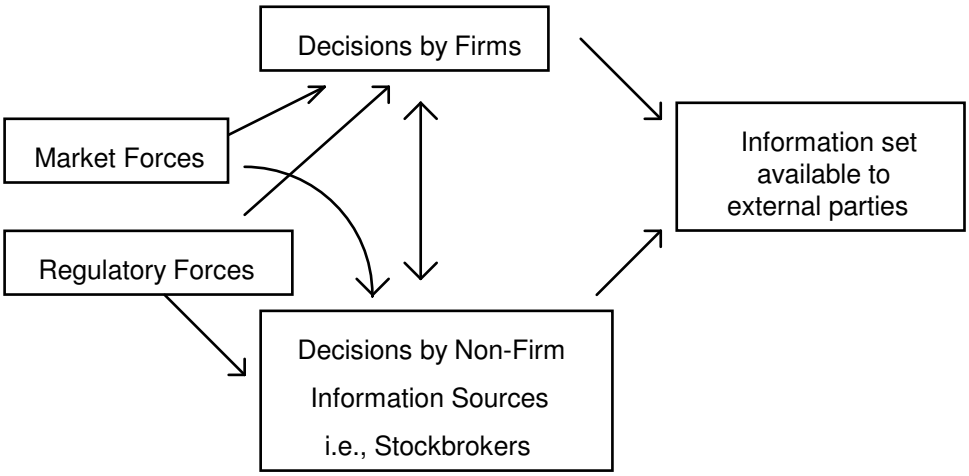
III) Venture capitalists receiving more details about new product developments.

Public disclosure could lead to a competitive disadvantage.

The use of independent auditors helps to verify information disclosed.

In ventures with a high degree of uncertainty, the reputation of the management is a critical factor.

The regulatory forces and the supply of financial statement information.



A. Influence of the Government and Judiciary
B. Government regulatory bodies - ASC
C. Private sector regulatory bodies - Australian Accounting Standards, Australian Stock Exchange.
D. Private lobbying groups - Trade Unions, environmental groups, etc.

Voluntary disclosure - Lemons problem - reputation

Market forces and the supply of financial statement information.

1. Capital market forces - instrument offered (debt equity, etc.)
2. Terms of the instrument
3. Expected distribution of returns

Labor market forces - agency costs - control of management actions, monitoring funding costs, etc.

Corporate control market forces.

Costs associated with disclosure

1. Collection and processing costs

2. Litigation costs
3. Political costs
4. Competitive disadvantage costs
5. Constraints on managerial behaviour

Financial Statement Analysis: Introductory Techniques

Cross-sectional techniques

1. Common-size statements - firms are different sizes, express components of the balance sheet as percentages.

2. Financial ratio analysis
   1. cash position, $\frac{\text{cash \& marketable securities}}{\text{current liabilities}}$.
   2. liquidity = $\frac{CA}{CL}$

3. Working capital $\frac{\text{working capital}}{\text{sales}}$

4. Capital structure = $\frac{TL}{TA}$

5. Debt service cover = $\frac{\text{op. income}}{\text{Annual int. payments}}$

6. Profitability = $\frac{\text{Net Income}}{TA(AV)}$

7. Turnover = $\frac{\text{Sales}}{TA(AV)}$

Time series techniques

1. Trend statements - use a year as a base. Look at trends in earnings, sales net income etc.

2. Financial Ratio Analysis - trends in financial ratios.

3. Variability measures - variability in financial ratios = $\frac{\text{max value} - \text{minimum value}}{\text{mean financial ratio}}$

Combining financial statement and non-financial statement information.

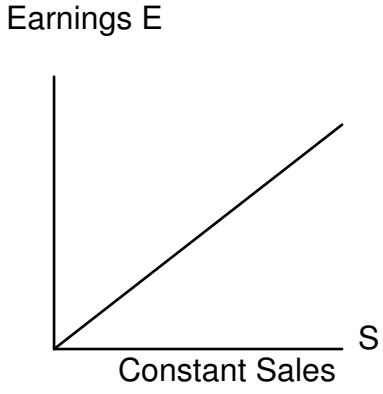
1. Product market information - market share - consumption date - income levels.

2. Capital market information - market capitalisation and yields, P/E ratios, dividend yields.
   - Problems with financial statement information off balance sheet finance - definition, (conventions, deferred taxes - debt or equity).

Financial Statement Numbers: some empirical issues

- Use of ratios - control for size differences - make the data better satisfy ordinary statistical assumptions, i.e., for regression analysis, probe a theory, exploit an empirical regularity.

1. Assumptions of ratio analysis - constant proportionality
   mean financial ratios



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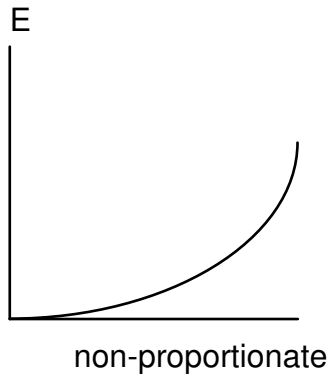

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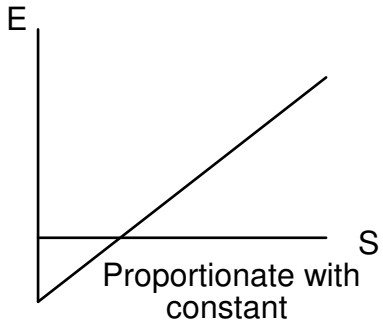

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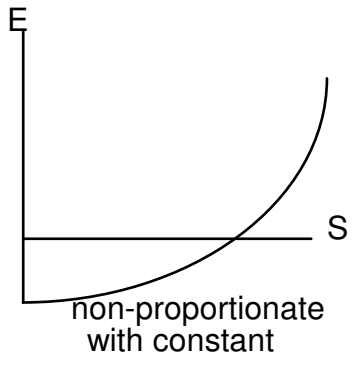

(iv)

Computation issues in calculating ratios- negative denominators, outliers, accurate classification - accounting method (off balance sheet, Economic structural changes).

The distribution of financial statement numbers - can normality be assumed! Aspects of distribution, central tendency, dispersion, skewness, kurtosis.

Correlations and co movements between financial statement numbers - have to be careful of collinearity between ratios if we are using them in regression analysis.

R Ball & G Foster, "Corporate Financial Reporting: A methodological Review of Empirical Research", Journal of Accounting Research (1982)

Methodology is an inquiry into method.

For the purpose of the review, they classify the corporate financial reporting literature into four topic areas:

(a) Corporate disclosure
(b) Accounting method choice
(c) Time series analysis
(d) Financial distress analysis

Financial statements comprise a major part of the data base in the empirical research.

A principal difference between accounting research and research in other areas such as economics is that accounting research requires a mapping into the 'institutional' domain in which accounting information is produced used.

Genesis of empirical research ideas

(1) importance of the topic to external parties such as the accounting profession, corporate management, or the investment and credit community.
(2) importance of the topic or research method to a research community.
(3) availability of theoretical structure to guide the research.
(4) availability of databases.
(5) availability of econometric or statistical techniques to analyse the data.

Many competing views of the world

(i) Accounting model view - conservatism - matching, etc.

(ii) Economic reality/truth view - "economic" or "true" earnings.

(iii) Fair presentation/comparability - inter-firm or inter-period comparability is important.

(iv) Economic consequences to firm's stockholders' views.

(v) Economic consequences to management view.

(vi) Regulatory compliance view.

The above are neither mutually exclusive or exhaustive.

Quasi-experimental nature of the research

Very difficult to manipulate experimental variables

High degree of uncertainty

Internal validity

Selection - pattern of implied assumptions about exogenous versus endogenous variables - patterns of selecting control variables.

Ambiguity abaout direction of causal inference.

Construct validity

Are we measuring what we intend to? Problems of proxies, i.e., size and political cost.

Statistical conclusion validity

How robust are the findings?

External validity

How general are the results?

Trade-off between different types of validity.

Tests against competing hypotheses.

An empirical researcher in corporate financial reporting faces considerable uncertainty in many important aspects of research. One source of this arises from gaps in knowledge levels in the basic disciplines of the behavioural sciences, economics, mathematics, and statistics. The economics literature has made limited progress in modelling the multi-principal, multi-agent settings that characterise publicly held corporations.

Difficulties in modelling the institutional environment.

Special care must be given to methodological issues.