Corporate Investment Policy: Asset Valuation and the Cost of Capital with Frictionless Markets and withTaxes

Gilles Chemla

Imperial College London

TANAKA BUSINESS SCHOOL

Plan

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1. Introduction

→How do firms allocate capital?

→How can we assess uncertain future cash flows (hereafter CF)?

1. Introduction: Why start with Frictionless Markets?

Benchmark: No transaction cost, no tax.
No agency cost
No asymmetric information between insiders and outsiders.

Then a lot of issues can be left out:

- Investors and the firm can make the same transactions in financial markets
- Investment and financing decisions are independent (Fisher separation)
- Financing decisions (more generally financial transactions) do not affect firm value.

2. The objective of the firm and the net-present-value rule

- When firms act on behalf of expected utility maximizing investors, the objective of the firm, and hence the unique optimal investment criterion, are to maximize the Net Present Value, hereafter NPV.

- NPV is the sum of expected cash flows, each discounted at an appropriate rate that can be interpreted as the expected return on the next best « comparable » project.

- A fundamental pb of the capital allocation process is then the valuation of the different capital projects.

- What is the correct theoretical asset pricing model?

3. Valuation by discounting 1

- The simplest approach to valuing future CF is to apply a single discount rate, ρ *, which is appropriate for the risk of the CF.

$$V_t = \sum_{s=t+1}^{T} \frac{y_{t,s}}{(1+\rho^*)^{(s-t)}}$$

where $y_{t,s}$ = expected value at time t of CF to be received at time s.

with discount rate $\rho^* = R_{t,s} + \lambda$,

where $R_{t,s}$ = the spot interest rate at time t for a loan of (s-t) periods

λ = a constant risk premium

4. Estimating equity discount rates in practice

The most common approaches to estimating costs of equity capital :

- « The traditional method or the DCF method »: Forecast the CF that investors could reasonably expect to receive from a share of common stock. Find the discount rate that equates the value of the stream of expected CF to the stock price.

- « The CAPM method »: This method is the most popular . In Graham and Harvey's (2001) survey, out of 392 CFO of large corporations, 73% of the respondents always use the CAPM !

- The Multi-factor asset pricing models: Either the Intertemporal Capital Asset Pricing Model (Merton, 1973) or the Arbitrage Pricing Theory (Ross, 1976).

4.1.1. Estimating equity discount rates with asset-pricing models

- Problems (Fama and French (1997)):

→ The imprecise estimates of risk loadings.

Estimates of CAPM and 3-factor risk loadings would only be precise if the loadings were constant.

→ The uncertainty of the magnitude about risk premiums.

- Two main approaches for the estimation of the equity risk premium :

« A historical approach »: the premium often assumed to be constant over time

« A forward-looking approach »: relies on forecasts of future dividends from the stocks that make up the market portfolio.

4.1.2. Estimating equity discount rates with the DCF method

- Typically from dividend discount model.

$$P_t = \sum_{s=1}^{\infty} \frac{E_t[\, d_{t+s}\,]}{(1+k)^s}$$

P_t : The share price at time t

d_t : The dividend per share payable at time t

k : The cost of equity capital

Note: Using this equation to estimate the cost of equity capital, requires some model for forming dividend expectations.

4.1.2. Estimating equity discount rates with the DCF method: *Gordon and Gordon (1997)*

- Example of a model for forming dividends expectations :

  - Use analyst estimates of future earnings to make forecasts of future accounting rates of return
  - Assumption of a dividend payout

→ Forecasts of earnings and dividends !

$$P_0 = \sum_{T=1}^{N} \frac{d_0 (1+g)^T}{(1+k)^T} + \frac{e_1 (1+g)^N}{k(1+k)^N}$$

d_0 = the current dividend	N = number of years
e_1 = next year earnings per share	k = cost of equity
g = rate of growth of e_1	P_0 = the current share price

4.1.3. Estimation of the cost of capital : Asset-pricing models ? DCF method ?

No consensus !

The relative merits of the 2 approaches
is to make reasonable dividend forecasts for individual firms
and this will differ from firm to firm.

4.2. From firm cost of equity to firm cost of capital

- To this point: project financed entirely by equity!
- MM (1958). Value of unlevered firm equals value of levered firm
- Firm cost of capital independent of capital structure and it is a weighted average of cost of debt and of cost of equity.
- Equity cost of capital simply determined: $r_E = r_A + {}^{D}/_{E} * (r_A - r_D)$

r_E increases with ${}^{D}/_{E}$. This is because equity becomes riskier.
This is consistent with the CAPM, as we get:

$$\beta_E = \beta_A + {}^{D}/_{E} * (\beta_A - \beta_D)$$

Note: The increase in r_E compensates exactly the additional risk associated with a higher D/E ratio.

5.The real options approach

- Takes into account the optional value of investment decisions.
- Example: Timing option: the option to postpone an investment project until more information become available.

$$p = XD\ (Q)$$

- 2 cases:
  - The CF depend only on the actions of one decision maker and uncontrollable moves by nature.
  - The CF depend also on the decisions of other actors such as the firm's competitors (perfect or imperfect competition).

5.Real Options andThe certainty equivalent approach

- The option value of an investment is often estimated by using the certainty equivalent approach.
- ‘Certainty equivalent‘: Payoff that would make an agent indifferent between a given gamble and that payoff for sure.
- For a risk averse agent, the certainty equivalent is less than the expected value of the gamble.

➔ “Certainty equivalent” or “martingale” pricing.

1. Calculate the CF certainty equivalent,
2. Discount it back at the riskless interest rate.

6. Corporate Investment with Taxes

1. Objectives:

- How do frictions such as taxes affect corporate investment?
- Apply the weighted cost of capital (WACC) and the adjusted present value (APV) methods.
- Understand the pros and cons of these methods and discuss on how to improve on them.

6.1. The WACC Method.

- **Because of taxes, financing decisions now matter.**

- **Method:** Discount cash flows at a unique discount rate that can (satisfactorily?) take frictions into account; and hence also the costs and benefits of financing decisions.

- **The WACC as a rate of return.** Suppose that a firm with existing assets and capital structure invests in a new project.

  The project is expected to produce the same expected yearly income in perpetuity.

  The firm maintains its debt ratio.

6.1. The WACC Method 2

If the project is worthwhile, the income from a dollar invested must:

- cover after-tax interest $E[r_D](1-T_c)D/(D+E)$, and
- provide an acceptable return to equityholders $E[r_E]E/(D+E)$.
- Hence, the project return must exceed:

$$WACC = \frac{D}{D+E} E[r_D](1-Tc) + \frac{E}{D+E} E[r_E]$$

6.1. The WACC method 3

- **When the project is in the same risk class as the firm & when capital structure is unchanged**, we may write the weighted average formula:

$$NPV = -(\text{Initial Investment}) + \sum_{t=1}^{T} \frac{(\text{After.tax.cash.flow})_t.\text{under.100\%.equity.financing}}{(1+\text{WACC})^t}$$

- **Note:** this can be used if if the project keeps the same business risk and capital structure as the firm.

6.2. The Adjusted Present Value (APV) method.

- The **APV method** evaluates a projects taking into account separately the costs and benefits associated with the capital structure.

APV	=	NPV if 100% equity financed
	+	NPV of tax benefits of debt
	+	NPV of floating costs of debt
	+	NPV of financial distress costs
	+	…

Note: To use this method, one needs to determine, in particular, the required rate of return on an all-equity financed firm.

6.2. APV & the rate of return on an unlevered firm, r_{OA}.

This is the rate of return on **operating assets**.

Corresponding β_{OA} is a measure of the business risk

Problem: Hard to find 100% equity-financed comparison firms. This rate of return has to be estimated from the info on existing levered firms.

Hence, estimates, but methods are not great…

Example of an estimate of r_{OA}

- Suppose that the same firm as in the previous section invests in a new project and expects to produce the same yearly income in perpetuity.

- What would be the expected return on the assets *if the firm were all-equity financed*?

$$E[r_{OA}] = \frac{D}{D + E - T_c D} E[r_D](1 - T_c) + \frac{E}{D + E - T_c D} E[r_E]$$

Hence, the return on equity would be:

$$E[r_E] = E[r_{OA}] + \frac{D}{E}(1 - T_c)[\, E[r_{OA}] - E[r_D]]$$

Corresponding Betas

- Operating risk:

$$\beta_{OA} = \frac{D}{D + E - T_c D}\beta_D(1 - T_c) + \frac{E}{D + E - T_c D}\beta_E$$

- Equity beta

$$\beta_E = \beta_{OA} + \frac{D}{E}(1 - T_c)[\beta_{OA} - \beta_D]$$

When debt is riskless, $\beta_E = [1+(1-T_c)D/E]\,\beta_{OA}$.

6.3. APV vs WACC method

Firms use the WACC method more often.

They then have to discount only one set of cash flows and they believe that the appropriate rate of return is easier to estimate.

Academics prefer the APV method because

a. It calculates separately the value created by the project and the value created by the financing.

b. Unlike the WACC, the APV can be used when debt levels or tax rates change over time.

c. APV can take into account various types of frictions more easily

Problems with WACC and APV

- The WACC and r_{OA} are difficult to estimate rigorously when considering more frictions...

  …and when the environment changes

- Both methods are very « static »: Frictions create a distinction between internal capital and external capital.

  The value of $1 of internal capital invested may differ from $1.

  Same for $1 issued at a cost.

  Same for the value of $1 of profit.

Corporate Dynamics with Taxes

- Need a model of investment dynamics (real options) with market frictions
- Existing models are not sufficiently tractable to overcome WACC and APV methods.
- Ready for the challenge?

Readings

- Grinblatt and Titman, Financial Policy and Corporate Strategy, Chapter 13
- Brennan, “Corporate Investment Policy”, in the Handbook of Economics and Finance, 2003, Constantinides, G., M. Harris and R. Stulz (eds)