

Accounting Information, Agency Cost and Cost of Capital

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A two-part final exam question

- 1 cash flow: $\tilde{F}_j \equiv a + \gamma_j \tilde{\eta} + \phi_j \tilde{\xi}_j$
- 2 same systematic risk: $\gamma_1 = \gamma_2$
- 3 different idiosyncratic risk: $\phi_1 > \phi_2$

Q1: which has a higher cost of capital?

- a $\Delta_1 = \Delta_2$ correct without moral hazard
b $\Delta_1 > \Delta_2$ correct with moral hazard

Q2: which has a higher implied cost of capital?

- a $\Delta_1 = \Delta_2$ correct regardless of moral hazard
b $\Delta_1 > \Delta_2$

Main force: risk sharing distortion affects CoC.

Bonding results in concentration of restricted shares s_j .

$$\begin{aligned}\Delta_j &= (1 - s_j) * \text{Cost of Capital Implied in Traded Stocks} + s_j * \text{Cost of Capital Implied in Restricted Stocks} \\ &= \text{Invisible} \\ &= \underbrace{\text{Firm j's CAPM Beta} \times \text{Risk Premium of the Market Portfolio}}_{\text{CAPM Cost of Capital}} + \text{Risk Premium of Idiosyncratic Risk}\end{aligned}$$

Intuition for the wedge

- 1 Restricted stocks are issued to the manager as bonding.
- 2 Concentrated idiosyncratic risk is useful for incentives but costly to the firm.
- 3 Systematic risk is filtered out for incentives and optimally shared in the market.
- 4 Implied CoC from traded shares v.s. the true financing cost to the firm.

- 1 Idio info reduces use of restricted shares and CoC.
- 2 Implied CoC systematically bias downward the true CoC.
- 3 Economy level idio info quality can increase CoC.

The model

A general equilibrium model with three sub-problems

- Moral hazard and optimal compensation contract within each firm
- Personal portfolio management of both managers and investors
- Investors' project selection decisions for each firm

The timeline

- 1 Each investor is endowed with a project, hires a manager with a compensation package, sells the project, and invests
- 2 Each manager receives a contract, chooses an effort, and invests
- 3 Projects pay off and all consume.

- cash flow: $\tilde{F}_j \equiv a_j - \frac{c}{2} a_j^2 + \gamma_j \tilde{\eta} + \phi_j \tilde{\xi}_j$
- accounting signal: $\tilde{Y}_j = a_j + \alpha_j \tilde{\epsilon}_j$
- contract: $\tilde{w}_j \equiv v_j + b_j \tilde{Y}_j + s_j \tilde{G}_j$
- utility: $CE^i = E[\tilde{W}^i] - \frac{1}{2r_i} \text{Var}[\tilde{W}^i], i \in \{I, A\}$.

Problem 1: moral hazard

The manager chooses an effort.

$$\begin{aligned}
 \tilde{w}_j &= \underbrace{v_j}_{\text{Base Salary}} + \underbrace{b_j \tilde{Y}_j}_{\text{Earnings-based Bonus}} + \underbrace{s_j(\tilde{F}_j - b_j \tilde{Y}_j)}_{\text{Restricted Stocks}} - \underbrace{\frac{c}{2} a_j^2}_{\text{Effort Cost}} + \underbrace{z_j \left(\int_{i \in \Omega} (1 - s_i)(\tilde{F}_i - b_i \tilde{Y}_i) di - p \right)}_{\text{Market Portfolio}} \\
 &= (b_j + (1 - b_j)s_j)a_j - \frac{c}{2} a_j^2 + v_j + (E[\tilde{M}] - p) \\
 &= \text{Invisible} \\
 &+ \underbrace{b_j(1 - s_j)\alpha_j \tilde{\varepsilon}_j}_{\text{Idiosyncratic Measurement error}} + \underbrace{s_j \phi_j \tilde{\zeta}_j}_{\text{Idiosyncratic Cash Flow Risk}} + \underbrace{(s_j \gamma_j + z_j (\text{Avg}[\gamma] - \text{Avg}[rs]))}_{\text{Systematic Cash Flow Risk}} \tilde{\eta}
 \end{aligned}$$

Solution to Moral Hazard

- Incentive Compatible:

$$\underbrace{b_j + s_j(1 - b_j)}_{\text{Marginal Benefit of Effort}} - \underbrace{a_j c}_{\text{Marginal Cost of Effort}} = 0$$

- Individual Rationality:

$$v_j = w_0 + \underbrace{\frac{c}{2} a_j^2 - (s_j + (1 - s_j) b_j) a_j}_{\text{Reimbursement for Direct Cost}} + \underbrace{\frac{\text{Avg}[\gamma]}{\rho_E + \rho_A} s_j \gamma_j}_{\text{Compensation for Systematic Risk}} + \underbrace{\frac{s_j^2 \phi_j^2 + (1 - s_j)^2 b_j^2 \alpha_j^2}{2 \rho_A}}_{\text{Compensation for Idiosyncratic Risk}}$$

- Manager's portfolio decision

Problem 2: Portfolio Management

- Each investor holds a market portfolio.

$$x_j = \frac{\text{Avg}[\gamma]}{\text{Avg}[\gamma] - \text{Avg}[\gamma_S]} \frac{\rho_I}{\rho_I + \rho_A}$$

- Manager holds a market portfolio plus restricted shares.
 - The systematic risk in her compensation is hedged away.
 - The idiosyncratic risk in her compensation is not.

$$z_j = \frac{\text{Avg}[\gamma]}{\text{Avg}[\gamma] - \text{Avg}[\gamma_S]} \frac{\rho_A}{\rho_I + \rho_A} - \frac{\text{Avg}[\gamma]}{\text{Avg}[\gamma] - \text{Avg}[\gamma_S]} \frac{\gamma_j S_j}{\text{Avg}[\gamma]}$$

- Price of traded shares pays only for **systematic** risk.

$$p_j = (1 - b_j) a_j - \frac{\text{Avg}[\gamma]}{\rho_I + \rho_A} \gamma_j$$

Problem 3: optimal contract and financing decisions

The NPV rule for financing: $(1 - s_j)p_j - v_j - k_0$

The optimal compensation contract decision:

$$\begin{aligned} L(b_j, s_j, \mu) = & a_j - \frac{c}{2}a_j^2 - \frac{\text{Avg}[\gamma]}{\rho_I + \rho_A}\gamma_j - \frac{(b_j(1 - s_j))^2\alpha_j^2 + s_j^2\phi_j^2}{2\rho_A} \\ & + \textit{invisible} \\ & + 2\mu(b_j + (1 - b_j)s_j - a_jc) \end{aligned}$$

The main results

Main Result 1: Risk Premium of Idiosyncratic Risk

- First best without moral hazard: $\mu = 0$ or $b_j = s_j = 0$.
- Second best with moral hazard: $\mu > 0$ or $b_j > 0, s_j > 0$.
- Implication for cost of capital:

$$\Delta_j = \frac{\text{Avg}^2[\gamma]}{\rho_I + \rho_A} \frac{\gamma_j}{\text{Avg}[\gamma]} + \frac{1}{2} \frac{1}{\rho_A \left(\frac{1}{\phi_j^2} + \frac{1}{\alpha_j^2} \right) + c}$$

- Risk premium of the idiosyncratic risk is the shadow price of moral hazard constraint.

$$A_j \equiv \mu = \frac{1}{2} \frac{1}{\rho_A \left(\frac{1}{\phi_j^2} + \frac{1}{\alpha_j^2} \right) + c}$$

Generalizability of Result 1

- Moral hazard is one example of frictions that leads to concentration of idiosyncratic risk. Other examples:
- Adverse selection: Leland and Pyle (1977)
- Blockholding and institutional holding
- Debt financing

Implication 1: Biased Proxy of Cost of Capital

$$\begin{aligned}
 \Delta_j &= (1 - s_j) * \text{Cost of Capital Implied in Traded Stocks} + s_j * \text{Cost of Capital Implied in Restricted Stocks} \\
 &= \text{Invisible} \\
 &= \underbrace{\text{Firm j's CAPM Beta} \times \text{Risk Premium of the Market Portfolio}}_{\text{CAPM Cost of Capital}} + \text{Risk Premium of Idiosyncratic Risk} \\
 &= \frac{\gamma_j}{\text{Avg}[\gamma]} \frac{\text{Avg}^2[\gamma]}{\rho_I + \rho_A} + \frac{1}{2} \frac{1}{\rho_A \left(\frac{1}{\phi_j^2} + \frac{1}{\alpha_j^2} \right) + c}
 \end{aligned}$$

Implication 1: the bias

$$\Delta_j = \frac{\text{Avg}^2[\gamma]}{\rho_I + \rho_A} \frac{\gamma_j}{\text{Avg}[\gamma]} + \frac{1}{2} \frac{1}{\rho_A \left(\frac{1}{\phi_j^2} + \frac{1}{\alpha_j^2} \right) + c}$$

- 1 True CoC is the weighted average.
- 2 Empirical CoC is inferred from traded shares.
- 3 Bias = $A_j = \frac{1}{2} \frac{1}{\rho_A \left(\frac{1}{\phi_j^2} + \frac{1}{\alpha_j^2} \right) + c}$
- 4 All the effects of idiosyncratic risk on CoC are filtered out by the biased proxy of CoC.

Implication 1: how large is the bias?

- 1 Managerial ownership is one proxy. $A_j = \frac{\phi_j^2}{2\rho_A} S_j$
- 2 Holderness, Kroszner and Sheehan (1999 JF):
21.1%, 12.4%, (12.2%, 4.6%)
- 3 Fahlenbrach and Stulz (2009 JFE): 22.3%, 14.8%
- 4 Other solutions that lead to concentration of idiosyncratic risk: Leland and Pyle (1977), blockholders, debt financing

Implication 1: remedies

- Look for the true CoC: Investment decisions

$$I_j \propto d - \Delta_j = \frac{1}{2c} - k_0 - w_0 - \frac{\text{Avg}[\gamma]}{\rho_I + \rho_A} \gamma_j - \frac{1}{2} \frac{1}{\rho_A \left(\frac{1}{\phi_j^2} + \frac{1}{\alpha_j^2} \right) + c}$$

- Determinants of the bias:

$$A_j = \frac{1}{2} \frac{1}{\rho_A \left(\frac{1}{\phi_j^2} + \frac{1}{\alpha_j^2} \right) + c}$$

The general equilibrium effects

$$\alpha_j \equiv \lambda_j \alpha + \delta_j$$

- firm level quality: δ_j
- economy level quality: α

Main Result 2: General Equilibrium Effects of Accounting Quality

As accounting quality changes in the economy level,

- CoC is determined by the market portfolio

$$\Delta_j = \frac{\text{Avg}^2[\gamma]}{\rho_I + \rho_A} \frac{\gamma_j}{\text{Avg}[\gamma]} + \frac{1}{2} \frac{1}{\rho_A \left(\frac{1}{\phi_j^2} + \left(\frac{1}{\lambda_j \alpha + \delta_j} \right)^2 \right) + c}$$

- Market portfolio is determined by CoC.

$$\text{Avg}[\gamma] = \int_{\Delta_i < d} \gamma_i di$$

- CoC could increase or decrease and firms differ.

Proposition

As the quality of accounting information at the economy-level improves (α becomes smaller), for an individual firm:

- 1 *the quality of its accounting information improves;*
- 2 *the risk premium for its idiosyncratic risk decreases ($\frac{\partial A_j}{\partial \alpha} > 0$);*
- 3 *the risk premium for its systematic risk (weakly) increases ($\frac{\gamma_j}{r_I + r_A} \frac{\partial \Gamma}{\partial \alpha} < 0$); and*
- 4 *the risk premium it pays to finance its project could either increase or decrease, depending on its sensitivity to the economy-level factor α and its relative exposure to systematic and idiosyncratic risk. That is, $\frac{\partial \Delta_j}{\partial \alpha} > 0$ if and only if $-\frac{\gamma_j}{r_I + r_A} \frac{\partial \Gamma}{\partial \alpha} < \frac{\lambda_j}{2} \frac{\partial A_j}{\partial \alpha}$.*

An Example of the General Equilibrium Effect

- 1 Type 1: $\lambda_1 = 0$ and $\gamma_1 > 0$
- 2 Type 2: $\lambda_2 = 0$ and $\gamma_2 = 3\gamma_1$
- 3 Type 3: $\lambda_3 > 0$ is large and $\gamma_3 = 2\gamma_1$

$$\text{Assumption: } 4 \frac{\gamma_1^2}{\rho_I + \rho_A} < d < \frac{9}{2} \frac{\gamma_1^2}{\rho_I + \rho_A}$$

- If $\alpha=0$, $\text{Avg}[\gamma] = \frac{\gamma_1 + 2\gamma_1}{2}$, **None of Type 2** is financed:

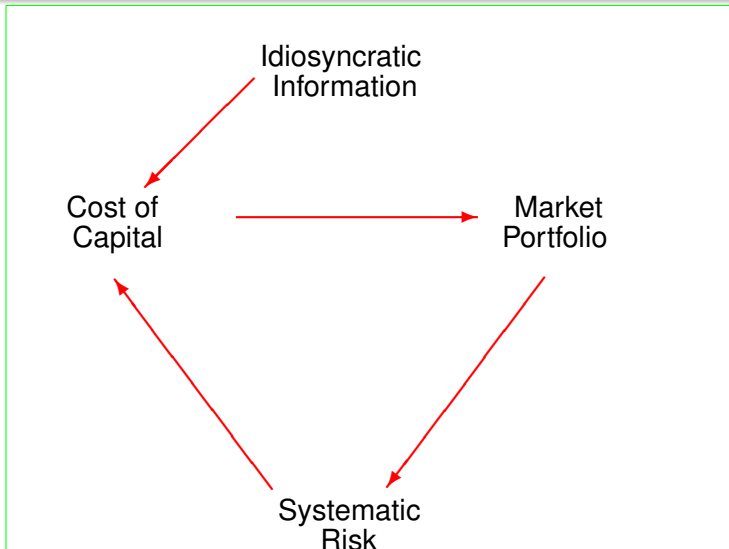
$$\Delta_2 = \frac{\frac{3}{2}\gamma_1}{\rho_I + \rho_A} * (3\gamma_1) > d;$$

- If $\alpha = 1$, $\text{Avg}[\gamma] = \gamma_1$, **Some of Type 2** are financed:

$$\Delta_2 = \frac{\gamma_1}{\rho_I + \rho_A} * (3\gamma_1) < d;$$

The first and second best cases do not subsume each other.

General Equilibrium Effect of Idiosyncratic Accounting Information



Implication 2: Accounting Quality is a Factor!

$$\Delta_j = \underbrace{\frac{\gamma_j}{\text{Avg}[\gamma]} \times \frac{\text{Avg}^2[\gamma]}{\rho_I + \rho_A}}_{\text{CAPM Cost of Capital}} + \underbrace{A_j}_{\text{Risk Premium of Idiosyncratic Risk}}$$

Firm j's CAPM Beta
Risk Premium of the Market Portfolio
Risk Premium of Idiosyncratic Risk

$$A_j = \frac{1}{2} \frac{1}{\rho_A \left(\frac{1}{\phi_j^2} + \frac{1}{\alpha_j^2} \right) + c}$$

Implication 3: Testing Effects of Accounting Standards and Disclosure Regulation

Higher accounting quality for all does not lead to lower CoC for all!

The GE effect, or the externality through market portfolio, has distributional consequences.

As accounting quality in the economy-level increases,

- risk premium of the idiosyncratic risk decreases
- risk premium of the market portfolio and beta could either increase or decrease
- overall effect on CoC is not clear

- Idiosyncratic accounting information reduces CoC.
- Implied CoC biases downward the true CoC.
- Economy-wide accounting quality change has complicated general equilibrium effect.