Lecture 4
Governance

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Most of our previous analysis is independent of the firm's goals

- Up until now, firm objectives have not been our main concern:
  1. Limit order markets are trading mechanisms, having little to do with the motivations of those using it.
  2. Arbitrage opportunities, or more generally APT, are attractive to anyone serving their own interests.
  3. The bidding rules we derived for auctions take the underlying valuations as given by any arbitrary tastes.
  4. Our portfolio analysis is for small investors who cannot affect the probability distribution of financial returns.
- What are the objectives of publicly traded firms?

How firms reward their top employees

Identifying shareholder objectives

- One way of discerning the objectives of publicly traded firms is investigate the pay structure of top managers.
- The CEO manages the day-to-day activities of his firm.
- Managerial compensation comes in the form of:
  1. Cash and bonus
  2. Stock and option grants
  3. Abnormal return on stocks and options held by the manager
  4. Pension and retirement benefits
  5. Compensation for termination
- My work with alumnus Dr. Margiotta and Prof Gayle shows that CEO compensation is very sensitive to the firms' financial abnormal return (that is net of return on market portfolio), because of the amount of the firm's (granted but not yet vested) securities he holds.

TABLE 4—CROSS-SECTIONAL INFORMATION ON COMPONENTS OF COMPENSATION
(*In thousands of US$ (2000); standard deviations in parentheses*)

Variable	Rank	Old	New restricted	New all
Salary and bonus	All	219	838	667
		(114)	(1,066)	(905)
	CEO	261	1,037	1,127
		(115)	(1,365)	(1,282)
	Non-CEO	179	640	552
		(97)	(576)	(738)
Value of options granted	All	79	2,401	903
		(338)	(13,225)	(3,753)
	CEO	111	3,402	1,782
		(439)	(18,172)	(7,169)
	Non-CEO	51	1,401	681
		(198)	(4,237)	(2,106)
Value of restricted stock granted	All	11	187	152
		(95)	(1,633)	(936)
	CEO	8	242	298
		(72)	(2,021)	(1,464)
	Non-CEO	13	133	115
		(112)	(1,118)	(743)
Change in wealth from options held	All	5	785	281
		(134)	(14,636)	(8,710)
	CEO	7	1,667	1,474
		(167)	(17,078)	(13,567)
	Non-CEO	3	−76	−18
		(94)	(11,706)	(6,939)
Change in wealth from stock held	All	−3	−40	125
		(439)	(5,681)	(4,350)
	CEO	0.434	−14	264
		(479)	(6,712)	(6,791)
	Non-CEO	−7	−64	90
		(398)	(4,496)	(3,473)

How firms reward their lower ranked employees

Identifying shareholder objectives

- Below the very top ranks, compensation does not depend as much on the firm's abnormal returns.
- My current research with Profs Gayle and Golan suggests that, on the lower rungs, the prospect of promotion is a very important motivator, which substitutes for performance pay.
- Our results suggest that removing pay incentives at the top level might have a negative cascading effect throughout the organization.
- TARP companies are providing some small sample evidence in a taxpayer-funded public policy experiment.

Concentrated ownership and firm returns

Identifying shareholder objectives

- Another way of discerning shareholder goals is to estimate abnormal returns as a function of ownership concentration by individuals.
- There is some evidence that this function has an inverted U shape.
- High levels of ownership concentration might lead to a tightly controlled board that can more easily monitor management.
- At very high levels of concentration, a large shareholder (coalition) might use the company for his own consumption purposes.
- For example did the Bankroft family, or does Rupert Murdoch, use the Dow Jones Company to peddle the WSJ editorial policies, reducing its expected dividend stream?

Investor Activism

Ownership and firm value

- Mutual funds are a potentially powerful mechanism for marshalling the resources of like minded investors to take over and control enterprises and pursuing goals that do not maximize expected wealth.
- Although the firms they control lose value, the controlling owners may accomplish other real objectives instead, such as environmental goals.
- In such cases dissenting minority shareholders suffer at the hands of the board (having failed to anticipate these changes by selling their shares first).

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Portfolio 21 Annual Report
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Are non wealth maximizing firms takeover targets?

Identifying shareholder objectives

- Firms not maximizing their expected wealth have correspondingly lower equity values.
- They represent a profit opportunity to private investors and/or their management.
- If the board is not organized to prevent a buyout, their positions are at risk.
- Potential buyers often partially fund their purchases with the help of creditors, raising the debt/equity ratio.
- When their intentions are made public, this raises the equity value of outstanding shares, increasing the acquisition costs.
- This helps explain why limit sell orders are not stacked on the ask price.

Diluting ownership and control

Ownership and firm value

- Strong boards supported by concentrated ownership and/or voting rights can fend off takeovers if they choose.
- Three other major functions of the board are to:
  1. set CEO compensation in the interests of those represented on the board.
  2. assist in the promotion and succession process of executive management.
  3. oversee fiduciary obligations of the firm.
- When large shareholders reduce their stake in the firm, the board becomes more fragmented, and does not perform its functions as well.
- This causes the equity value of the firm falls.
- This helps to explain why limit buy orders are not stacked at the bid price.

Alternative organizational forms

Matching the goals of owners to the type of firm

- Privately held firms do not run the risk of takeover, so are a more attractive vehicle for pursuing non wealth maximizing objectives.
- Sole proprietorships, partnerships, nonprofit organizations, and limited liability private companies are the main alternatives to working for a publicly listed firm or a government agency.
- Most business firms are not publicly listed, and most employees are not employed in a publicly listed firm.
- With the exception of limited liability private companies, there is no presumption that wealth maximization is paramount.
- For example the owner of a sole proprietorship is personally liable for his firm, and thus more likely to maximize expected utility rather than expected wealth.
- This helps to explain why only those concerns that are driven by wealth maximization tend to become incorporated.

Employer Firms, Establishments, Employment, and Annual Payroll Small Firm Size Classes, 2006

Employment size of firm	Firms	Establishments	Employment	Annual Payroll ($1,000)
Total	6,022,127	7,601,160	119,917,165	4,792,429,911
0*	794,622	796,218	-	42,278,863
1-4	2,875,406	2,880,935	5,959,585	187,451,177
5-9	1,060,787	1,073,496	6,973,537	214,137,111
10-14	428,399	444,615	5,011,995	160,553,028
15-19	218,417	233,909	3,664,403	121,640,050
20-24	135,142	150,584	2,948,977	98,669,944
25-29	90,182	104,010	2,421,084	82,297,946
30-34	65,322	78,830	2,081,209	71,052,815
35-39	48,158	60,707	1,776,169	62,312,576
40-44	38,019	49,887	1,593,034	56,338,411
45-49	29,641	40,625	1,390,311	49,763,757
50-74	87,461	134,133	5,269,759	189,023,587
75-99	41,940	78,979	3,596,332	132,458,117
100-149	40,325	97,341	4,876,978	179,563,625
150-199	18,992	63,227	3,266,060	123,141,302
200-299	18,058	85,804	4,366,806	164,713,408
300-399	8,328	55,791	2,865,423	110,211,852
400-499	4,857	43,556	2,162,078	83,185,528
500-749	6,024	68,071	3,654,660	145,405,025
750-999	2,950	44,312	2,543,023	102,146,596
1,000-1,499	2,962	60,928	3,605,836	152,725,489
1,500-2,499	2,374	76,065	4,537,676	195,499,433
2,500-4,999	1,877	113,479	6,479,030	304,377,206
5,000-9,999	931	121,673	6,490,547	302,709,162
10,000+	953	643,985	32,382,653	1,460,773,903
<20	5,377,631	5,429,173	21,609,520	726,060,229
<50	5,784,095	5,913,816	33,820,304	1,146,495,678
<100	5,913,496	6,126,928	42,686,395	1,467,977,382
<500	6,004,056	6,472,647	60,223,740	2,128,793,097

* Employment is measured in March, thus some firms (start-ups after March, closures before March, and seasonal firms) will have zero employment and some annual payroll. Excludes farms.

Source: U.S. Small Business Administration, Office of Advocacy, based on data provided by the U.S. Census Bureau, Statistics of U.S. Businesses.

The board of directors

- As consumers and savers, members on the board of directors also make portfolio choices, but as owners, they also care about:
    1. The goals of their firms, for example wealth maximization, or something they might regard as more socially responsible.
    2. How well positioned is the firm to achieve their goals.
    3. Whether goals of board coincide with those of management
- How can members harness the knowledge and energy of managers to further shareholder interests?

Moral hazard

- These issues are complicated by the fact that board members know less than managers about the firm.
- Moral hazard arises when unobserved choices or actions of one player affect, but do not fully determine, the payoff received by the other party to the trade.
- Since the player's choice is not observed, a contract cannot direct him to make a particular choice.
- However linking the player's payments to events that are related to the consequences of his action, can align his incentives to the less informed party, even though the consequences are only partly attributable to, or caused by, the action itself.

Other examples of moral hazard

- Moral hazard is a much pervasive phenomenon than its applications in management:
  1. Lawyers representing clients might be more likely to win if they are paid according to their success record, and also whether they win the case in question or not.
  2. The extent of warranties against product defects is often limited by the uses the product is put, and how much care is taken.
  3. Insurance against accidents discourages care, so premiums not only reflect past accidents but also moving violations.

Long term contracts

- Sometimes information about the unobserved action can emerge at some later point in time.
- Options and shares granted to managers are not vested with them until 3 to 5 years later, because some of what they do is not recognized until then.
- Similarly construction companies can sometimes be sued for structural defects that are found after the project is completed.
- In this case we might expect large construction companies with deep pockets and collateral to have an advantage over small companies that can more nimbly evade punishment, and domestic managers with roots at home to be preferred to foreigners.

Settle up as soon as possible

- But unless you specialize in lending, credit entries are essentially nonperforming financial assets.
- Debtors have incentive to evade their liability (through bankruptcy, flight or death), and such assets typically have a low or negative, pro-cyclical rate of return.
- (See the recent WSJ article on dropping slow paying clients in a recession.)
- Similarly discretionary claw-back provisions in executive compensation create credibility problems for the board and their managers.
- Therefore non-banking institutions typically shun long term credit positions with others, unless new information about past performance is slow in coming.

Characterizing the optimal contract

- In setting contracts for their top managers , the executive compensation committees must respect the private information and outside options available to its manager, modeled here by the:
  1. participation constraint, to induce the manager to sign on with the company
  2. incentive compatibility constraint, to induce the manager to maximize the expected value of the firm.
- The board extracts the maximal rent from the relationship subject to these constraints.

A moral hazard problem

- To illustrate the nature of optimal contracting under moral hazard, we consider a wealth maximizing group of shareholders who contract with a risk averse CEO to manage their firm.
- The CEO has 3 choices He can:
  1. work for another firm (j = 0).
  2. accept employment with the shareholders' firm, but pursue his own interests rather than theirs (j = 1).
  3. accept employment with the shareholders' firm, and pursue their interests (j = 2).

Manager's preferences

- Suppose the manager gets a utility of

$$w^{1/2}$$

from following the directions of his employer and a utility of

$$\alpha w^{1/2}$$

from adopting a preferred managerial lifestyle to his job. If

$$\alpha > 1$$

the manager benefits from say ignoring shareholder interests and doing his own thing.

Signals about managerial effort

- Suppose shareholders observe a signal about whether the manager is diligently working for them or not.
- Denote the signal by the variable s, and suppose it only takes two values. Either s=1 or s=2.
- When the manager works diligently, the probability that $s = 1$ is p_1, and the probability $s = 2$ is $p_2 = 1 - p_1$.
- When the manager shirks, the probability that $s = 1$ is q_1 and the probability that $s = 2$ is $p_2 = 1 - q_1$.
- We suppose that $s = 1$ is more likely if the manager shirks, and $s = 2$ is more likely if the manager works diligently. Thus $p_1 < q_1$ and $p_2 > q_2$.

Shareholders objectives

- We assume the objective of shareholders is minimize the expected payments to the manager subject to the constraints that he:
  1. Chooses to work for them (called the participation constraint)
  2. Decides to work diligently rather than shirk (called the incentive compatibility constraint)
- When s = 1 they pay the manager w_1 and when s = 2 they pay him w_2.
- Thus shareholders minimize:

$$p_1 w_1 + p_2 w_2$$

subject to his participation and incentive compatibility.

Participation

- Let $\left(\hat{w}_1, \hat{w}_2\right)$ denote the compensation in each state.
- Suppose the manager could take a position with another firm paying w_0.
- It is straightforward to demonstrate that at the optimal contract the participation constraint is satisfied with equality.
- Then the participation constraint may be expressed as:

$$p_1 w_1^{1/2} + p_2 w_2^{1/2} = w_0^{1/2}$$

Is the signal redundant?

- Notice there is no conflict of interest between shareholders and the manager if $\alpha \leq 1$
- Consider the unconstrained optimum (w_1^*, w_2^*).
- The solution to this problem can be found by minimizing Lagrangian

$$p_1 w_1 + p_2 w_2 - \lambda\left(p_1 w_1^{1/2} + p_2 w_2^{1/2} - w_0^{1/2}\right)$$

where λ is the Lagrange multiplier.

- The first order conditions are

$$2p_1 = \lambda p_1 w_1^{-1/2} \qquad 2p_2 = \lambda p_2 w_2^{-1/2}$$

- This implies full insurance

$$w_1^* = w_2^* = w_0$$

Incentive compatibility

- When the incentive compatibility constraint is binding we can express it as

$$q_1 \alpha w_1^{1/2} + q_2 \alpha w_2^{1/2} = w_0^{1/2}$$

- Noting that:

$$q_1 \alpha \hat{w}_1^{1/2} + q_2 \alpha \hat{w}_2^{1/2} - p_1 \hat{w}_1^{1/2} - p_2 \hat{w}_2^{1/2}$$

$$= p_1 \left(\alpha \hat{w}_1^{1/2} - \hat{w}_1^{1/2} \right) + p_2 \left(\alpha \hat{w}_2^{1/2} - \hat{w}_2^{1/2} \right) + (q_1 - p_1) \alpha \left(\hat{w}_1^{1/2} - \hat{w}_2^{1/2} \right)$$

  incentive compatibility requires the expression to be negative. Hence $\hat{w}_1 < \hat{w}_2$.

- Thus we interpret $\hat{w}_1$ as the base pay and $\hat{w}_2 - \hat{w}_1$ as the bonus.

When is shirking inevitable?

- If $p_2 < \alpha q_2$ then:

$$p_1 w_1^{1/2} + p_2 w_2^{1/2} < q_1 \alpha w_1^{1/2} + q_2 \alpha w_2^{1/2}$$

for all (w_1, w_2) and we cannot meet the incentive compatibility constraint. The signal is too poor.

- In this case incentives cannot be used to motivate the manager. He will shirk regardless of the contract.
- The optimal contract is then found by minimizing compensation subject to the participation constraint.
- The solution is to set $\alpha \hat{w}^{1/2} = w_0^{1/2}$ or $\hat{w} = \alpha^{-2} w_0$.

Optimal compensation

- The only other case is that .

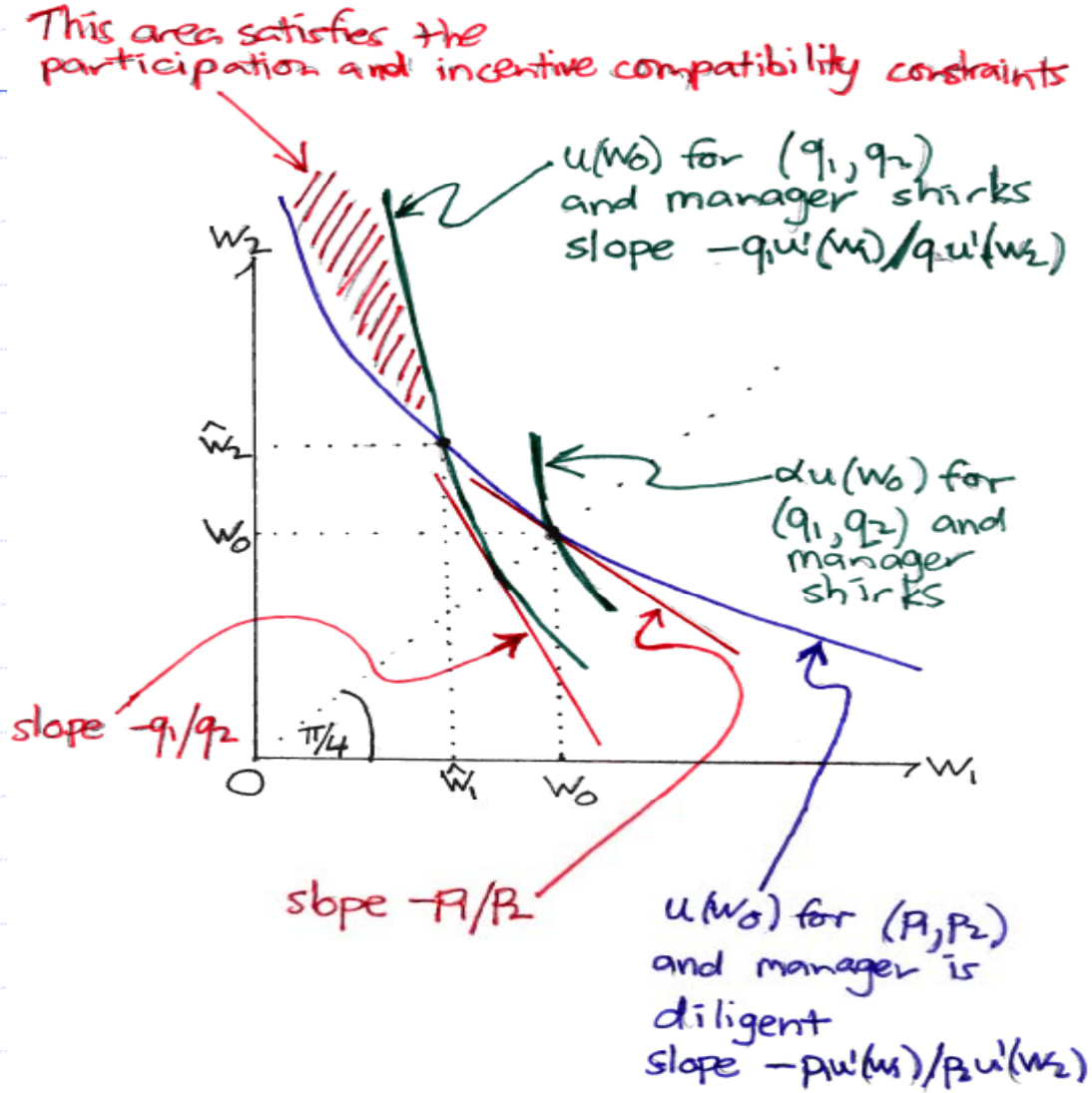
$$1 < \alpha < \frac{p_2}{q_2}$$

- In this case both the participation and incentive compatibility constraints are met with equality.
- We can find the optimal contract by solving the two equations in the two unknowns $\left(\hat{w}_1, \hat{w}_2\right)$ to obtain:

$$\hat{w}_1 = \left(\frac{q_2 - p_2/\alpha}{p_1 q_2 - q_1 p_2}\right)^2 w_0$$

$$\hat{w}_2 = \left(\frac{q_1 - p_1/\alpha}{p_2 q_1 - p_2' p_1}\right)^2 w_0$$

Illustrating the optimal contract



A verbal recapitulation

- Private information and outside options available to agents working for principals are captured through the incentive compatibility and participation constraints.
- These constraints help determine the shape of the contract but limit its value. The more attractive the outside alternative to the agent, the harder it is to monitor the agent's activities, then the lower the value of the contract to the principal.
- However ignoring these constraints is even more costly to the principal, because the agent may reject the contract, or not pursue the firm's interests.

TABLE 7—GROSS LOSSES TO FIRMS FROM SHIRKING IN MILLIONS OF US$ (2000)
(*Standard deviations in parentheses*)

Parameter		Industry	Old	New
τ_1	Per year	Aerospace	13.751	180.212
			(29.522)	(261.294)
	Present value		81.065	1,261.484
			(177.132)	(1,829.058)
	Per year	Chemicals	33.392	160.038
			(73.537)	(240.970)
	Present value		200.352	1,120.266
			(441.222)	(1,686.79)
	Per year	Electronics	16.650	230.566
			(49.182)	(600.607)
	Present value		99.907	1,613.962
			(894.492)	(4,204.249)

Contracting with specialists

- Often managers know less than their own workers about the value employees contribute to and take from the firm.
- More generally, medical doctors and specialists diagnose the illnesses for patients, strategic consultants evaluate firm performance for shareholders, and building contractors tell property owners what needs to be done.
- This leads us to investigate how principals (like shareholders and managers) should design contracts for agents (such as managers and workers) when their information about the next level down the hierarchy is incomplete.
- We consider a game between venture capitalists and entrepreneurs.

Venture capital

- There are two types of discoveries, minor and major, denoted by j = 1, 2. The probability it is minor (j = 1) is p, and the probability it is major one (j = 2) is 1 - p.
- It costs $c_j x$ to develop a commercial product with appeal of x, where $c_1 > c_2$, which in turn produces a present value of log(1+x) to the firm.
- A budget of b_i is allocated to the entrepreneur to develop the product up to a consumer appeal level of x_i when he announces a discovery of type i = 1,2.

Funding

- The policy of the venture capitalists on funding is summarized by (b_1,x_1) and (b_2, x_2).
- The entrepreneur announces whether he has made a major discovery (i=2), a minor (i=1) one, or none at all (i=0).
- If i = 0, then VC and the entrepreneur net 0.
- Otherwise the VC nets: $\log(1+x_i) - b_i$

  and the entrepreneur nets: $b_i - c_j x_i$

  where c_j is the true discovery.

Full information solution

- In this case the VC directly sees the discovery, and sets the budget just high enough to motivate optimal development. Thus :

$$b_j = r + c_j x_j$$

- Substituting for b_j into the VC objective function, he chooses x_j to maximize

$$\log(1+x_j) - b_j = \log(1+x_j) - r - c_j x_j$$

- Taking the first order condition and solving we obtain

$$x_j = 1/c_j - 1$$

- Funding is undertaken only when $c_j < 1$ and profits, as defined below, are positive

$$-\log(c_i) - r - 1 + c_j$$

Participation and incentive compatibility when there is incomplete information

- Suppose the VC does not directly observe the discovery, but relies exclusively on the entrepreneur's word .
- The entrepreneur will truthfully report the outcome of his activities if the following two constraints are met:

1. The participation constraint requires for each j:

$$b_j - c_j x_j \geq r$$

2. The incentive compatibility constraint requires:

$$b_2 - c_2 x_2 \geq b_1 - c_2 x_1$$

and vice versa. Note that both inequalities cannot be satisfied by strict equality since $c_1 < c_2$.

Solving for the budgets

- The participation constraint binds for the minor discovery (j = 1), but not for major ones. That is:

$$b_1 - c_1 x_1 = r$$

$$b_2 - c_2 x_2 \geq b_1 - c_2 x_1 > b_1 - c_1 x_1 = r$$

- Substituting for b_1 in the incentive compatibility constraint yields :

$$b_2 \geq b_1 + c_2 x_2 - c_2 x_1 = r + c_1(x_1 - x_2) - c_2 x_1$$

- Minimizing b_2 we conclude the incentive compatibility constraint binds with strict equality for major discoveries (j = 2), but not for minor ones.

Optimal product development

- Having derived the optimal budget as a function of product development, we choose x_1 and x_2 to maximize:

$$p[\log(1+x_1) - b_1] + (1 - p)\,[\log(1+x_2) - b_2]$$

$$= p[\log(1+x_1) - r - c_1x_1]$$

$$+ (1 - p)\,[\log(1+x_2) - r - c_2x_2 + c_2x_1 - c_1x_1]$$

$$= p[\log(1+x_1) - cx_1] + (1 - p)\,[\log(1+x_2) - c_2x_2] - r$$

- In the third line, c is called the virtual cost of x_1 and is defined by the equation:

$$c = c_1 + (c_1 - c_2)\,(1 - p)/p$$

Solution to the full disclosure policy

- Mathematically this is almost the same problem as the full information case.
- Taking the first order condition and solving, we obtain:

$$x_1 = 1/c - 1$$

$$x_2 = 1/c_2 - 1$$

- Substituting for x_1 and x_2 into the profit equation derived on the previous slide, we obtain:

$$p[\log(1+x_1) - cx_1] + (1-p)[\log(1+x_2) - c_2x_2] - r$$

$$= p[c - \log(c)] + (1-p)[c_2 - \log(c_2)] - r - 1$$

Two other policies

- An alternative to full disclosure is to treat every discovery as minor (and let the entrepreneur consume the surplus when he makes a major discovery).
- If all discoveries are treated as minor, VC profits are:

$$c_1 - \log(c_1) - r - 1$$

- The last option is to reward only major discoveries.
- If only major discoveries are reported, then profits are:

$$(1 - p)[c_2 - 1 - \log(c_2)] - r$$

Numerical Parameterization

- Suppose the probability of a minor discovery is $p = 0.5$.
- Let the marginal cost of developing a minor discovery be $c_1 = 0.5$, and the marginal cost of developing a major discovery be $c_2 = 0.25$
- This implies the virtual cost of a minor discovery is

$$c = c_1 + (c_1 - c_2)(1 - p)/p$$

$$= 0.5 + (0.5 - 0.25)$$

$$= 0.75$$

- Since the standard budget r enters as a cost in all three schemes, for comparative purposes we set $r = 0$.

Comparing the policy options on information disclosure

- Summarizing, the profits from a full disclosure policy are:

  $p[c - \log(c)] + (1 - p)[c_2 - \log(c_2)] - r - 1$

  $= 0.5[0.75 - \log(0.75)] + 0.5[0.25 - \log(0.25)] - 1$

  $= 0.336988$

- If all discoveries are treated as minor, the profits are:

  $c_1 - \log(c_1) - r - 1 = 0.5 - \log(0.5) - 1 = 0.193147$

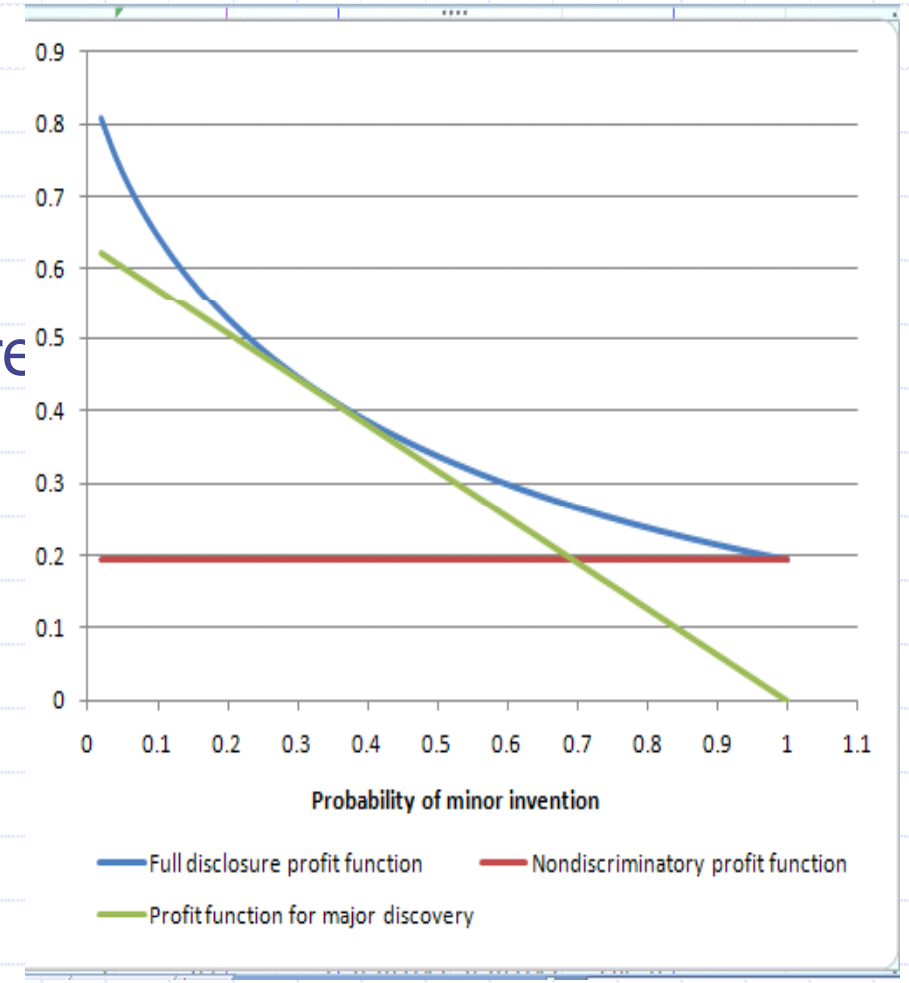
- If only major discoveries are reported, then profits are:

  $(1 - p)[c_2 - 1 - \log(c_2)] - r$

  $= 0.5[0.25 - 1 - \log(0.25)] = 0.318147$

How profits depend on the probability of a minor invention

- If the probability of a major invention is very high, then a full disclosure policy is optimal.
- If the probability is very low, a nondiscriminatory policy is more profitable.
- Otherwise only major inventions are rewarded.



Information is valuable

- Optimal contracting provides an opportunity for the contractor to extract rents from his business partners, employees, customers and clients.
- Private information and outside options available to each party are explicitly modeled through the truth telling, incentive compatibility and participation constraints.
- Extracting maximal rent may require relatively complicated contracts, which if written incorrectly, carry the prospect of loss.