Large Shareholders, Monitoring, and Ownership Dynamics: Toward Pure Managerial Firms?

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- My latest lesson from Michel: The 2011 Cirano paper by Boyer, Lasserre and Moreaux

Introduction: objective

- Dynamic model of divestment by a large shareholder of a firm where her interest and that of the manager are not perfectly congruent.
- Large shareholder: she monitors the manager
- Manager: he undertakes effort that benefits the firm and himself.
- He may make decisions that yield greater benefit to him than to shareholders.
- Small shareholders free-ride on the monitoring effort of large shareholder.
- Large shareholder cannot charge the firm for her effort (non-verifiable).

tendency for dispersed ownership (3)

- Emprical observations: there is a tendency for more dispersed ownership in US, UK, etc. (Berles and Means, 1932; Laporta et al., 1999; Urosevic, 2001; Franks et al.,2004) Also, recently in Brazil (1997-2002): Gorga (2009).
- Some explanations:
- Roe (1994) and LaPorta et al. (1999): dispersion of ownership in US due to specific US laws and policies that discourage onwership concentration.
- Gomes (J of Finance, 2000): by selling her shares, the owner-manager can diversify idiosyncratic risks with investors.
- DeMarzo and Urošević (JPE, 2006): large shareholder's tradeoff between risk diversification and her incentives and ability to improve the firm's performance (which increases with her fraction of ownership of her firm).

background (4)

- But risk aversion is not necessary.
- Burkart, Gromb, and Panunzi (BGP) (QJE, 1997) assume risk neutrality and show motives for divestment: conflict between a large shareholder and the manager.
- However, BGP (QJE, 1997) restricted attention to a static setting.
- Our dynamic analysis has added some interesting features about the equilibrium divestment strategies.

two main factors

- We explain the tendency toward dispersed ownership by modelling 2 main factors, while assuming risk neutrality.
- First, trade-off between the gains from monitoring by a large shareholder and the gains from managerial initiatives.
- Second, incentives for large shareholder to divest when her marginal valuation of ownership is below the small investors' valuation.
- The first feature was formulated by BGP in a static context
- The second feature is built on the literature on the Coase conjecture (Ronald Coase, 1972): durable goods monopolist has no monopoly power.

Coase Conjecture (6)

- Suppose a monopolist producing a durable good at constant marginal cost cannot commit.
- Then the combination of (i) his ability to sell repeatedly and (ii) rational expectations by potential buyers would result in:
- only one possible equilibrium outcome: he can only charge the price that would prevail under perfect competition,
- and the market demand is satisfied instantaneously.

Our main results (7)

- Large shareholder corresponds to the Coasian monopolist
- Coase's conjecture holds (immediate and complete divestment: lumpy sale) if divergence of interests between the large shareholder and the manager is mild
- If this divergence is very strong, Coase's conjecture fails: large shareholder will divest only gradually, with share price falling slowly over time, converging only in the long run to competitive price.
- An intermediate case: at first, large shareholder makes a massive sale of shares. This is followed by a slow process of divestment of the remaining shares.

Intuition (8)

- Divestment because small shareholders perceive that their dividend stream per share is worth more than the large shareholder's marginal returns on a share (as she has to incur the monitoring cost).
- This wedge in marginal valuations implies that equilibrium must involve share trading.
- When the divergence of interests between manager and large shareholder is **mild,** her total instantaneous payoff (net of monitoring cost) is a strictly **concave** and increasing function of her fraction of ownership.
- Therefore the revenue she would obtain from selling shares at market price strictly dominates the net revenue obtained from maintaining her initial stock.
- Then it is optimal to sell all shares in one go

Intuition (9)

- In the reverse case (strong divergence of interests) : her total instantaneous payoff is a strictly **convex** and increasing function of her fraction of ownership.
- Then equilibrium share price equals the large shareholder's capitalised marginal instantaneous payoff, which increases in her shareholding.
- Selling shares too quickly would cause a drastic fall in share price.
- In the intermediate case (weak congruence of interests, and a large stake) the large shareholder's payoff function is S shaped: it is convex (concave) when her fraction of ownership is small (large).
- Then optimal strategy is to make an initial lumpy sale, followed by gradual sale.

Related Literature (Gomes: risk aversion and adverse selection)

- Gomes (2000): large shareholder is also the manager.
- owner-manager may be of one type or another.
- Although the owner-manager knows her type, investors know only the probability distribution of types.

Related literature (Gomes: risk aversion and adverse selection)

- Each period, owner-manager chooses her new fraction of equity ownership and her effort level.
- Investors update their belief about the owner-manager's type, and they price shares in the market accordingly.
- Owner-manager's equilibrium strategy: divest her shares gradually (in contrast to the perfect information benchmark, where the owner-manager would sell all her shares in the first period).
- This gradualism is necessary for the entrepreneur to develop a reputation for treating minority shareholders well.

Related literature (DeMarzo and Urosevic: risk aversion and moral hazard)

- DeMarzo and Urošević (2006): replace adverse selection with moral hazard.
- Large shareholder: has control benefits
- Assume constant absolute risk aversion (CARA)
- If moral hazard is weak, large shareholder trades immediately to the competitive price-taking allocation.
- With strong moral hazard, she will adjust her stake downwards gradually.
- Tradeoff between risk diversification and her incentives and ability to improve the firm's performance.

Related literature (Edelstein: risk aversion, moral hazard, with multiple insiders)

- Edelstein (2007): generalize DeMarzo and Urošević (2006): many insiders
- Aggregate stake of the insiders decreases gradually over time
- Long run equilibrium aggregate stake of the insiders are greater for firms with a larger number of insiders.

The model (14)

- Our model is a dynamic extension of BGP (QJE, 1997)
- Manager: M (owns no shares). Large shareholder, S (monitors manager). Ownership fraction is α.
- All other shareholders are atomistic. Have rational expectations.
- Effort of manager is e $(0 \leq e \leq 1)$. Effort of S is E $(0 \leq E \leq 1)$.
- All agents are risk neutral.

Assumptions (15)

- In each period, firm must choose one project.
- Projects come in 4 types, $i \in \{0, 1, 2, 3\}$
- Type i project yields a pair of benefits $\left(\Pi^i, b^i\right)$
- Π^i is verifiable, and accrues to shareholders.
- b^i is non-verifiable and accrues to M.

Project payoffs

- Type 0: $\Pi^0 = 0$ and $b^0 = 0$ (regardless of state of nature)
- Type 1: $\Pi^1 = -k\Pi$ and $b^1 = -kb$ (regardless of state of nature)
- where $k > 0$ and large number, Π and b are given positive numbers (known). So want to avoid Type 1 project.
- Type 2 and Type 3: payoffs depend on state of nature (A or Not A). State A occurs with probability $\lambda \in (0, 1)$
- State of nature occurs before the firm chooses its project. Information about which state has occured **may** be available if manager tries to find out.

Matrix of payoffs (17)

$$\begin{bmatrix} \text{Type 2} & \text{Type 3} & \text{Probability} \\ (\Pi, b) & (\Pi, b) & \lambda \\ (\Pi, 0) & (0, b) & 1-\lambda \end{bmatrix}$$

λ is a measure of the extent of congruence of interests.
If $\lambda = 1$ (i.e. state A always occurs for sure) then the congruence is perfect
If $\lambda = 0$, M would prefer type 3 and S would prefer 2: their interests would be diametrically opposed.
Assume $0 < \lambda < 1$.

Unknown identity of projects (18)

- Each period t, the firm is presented with 4 projects, one of each type.
- Everyone knows which of these is a type 0 project.
- The other 3 projects are presented as named projects $\{\gamma, \mu, \theta\}$
- There is a one-to-one mapping ϕ_t from $\{\gamma, \mu, \theta\}$ to $\{1, 2, 3\}$.
- This mapping is not revealed to M unless he spends effort $e > 0$.

Chance of identifying projects

- If M uses effort level e where $0 \leq e \leq 1$, then with probability e he will know the mapping ϕ_t and the state of nature.
- Ex post, M is either completely informed, or completely uninformed
- S does not observe e.
- S uses effort level E where $0 \leq E \leq 1$ to try to find out what M knows.
- If M is completely uninformed, S will know that M is completely uninformed.
- If M is completely uninformed, S will know this too, but she may or may not know what M knows.

Chance of identifying projects

- If M is completely informed, S will capture M's information with probability E (and will not capture it, with prob. $1 - E$).
- Assume simultaneous moves by M and S.

Ex post choice (21)

- Case 1: both M and S remain uninformed. They will agree to choose Type 0 project.
- Case 2: only M is informed. Then S knows M will ensure the payoff b for himself. This gives S payoff $\alpha\Pi$ with probability λ and 0 with prob $1-\lambda$
- Case 3: both are informed. S will exercise her control rights and require M to choose Type 2.

Expected aggregate dividends for a given pair of effort levels

- Denote by $D(e, E)$ the expected aggregate dividends for the shareholders. Then

$$D(e, E) \equiv (1 - e) \times 0 + e \times [E\Pi + (1 - E)\lambda\Pi]$$

- Then for a fixed E, an increase in the manager's effort e raises the expected dividends
- For a fixed $e > 0$, an increase in the shareholder's monitoring effort raises the expected dividends:

Nash equilibrium effort levels (23)

- M's effort cost is $(1/2)e^2$
- M chooses $e \in [0,1]$ to maximize

$$-\frac{1}{2}e^2 + [(1-e)\times 0] + e \times \{E\,[\lambda b + (1-\lambda)\times 0] + (1-E)b\}$$

- This gives M's downward sloping best-reply function

$$e = \min\{1, b\,[1-(1-\lambda)E]\}$$

- This implies that S's monitoring effort E will reduce M's incentives to exercise effort.

Nash equilibrium effort levels (24)

- S's effort cost is $(1/2)E^2$
- S chooses $E \in [0, 1]$ to maximize her expected payoff,

$$\alpha D(e, E) - \frac{1}{2}E^2$$

- This gives S's upward sloping best-reply function

$$E = \min\{1, \alpha\Pi(1-\lambda)e\}$$

- To ensure an interior Nash equilibrium, the following assumption is made: $\lambda < 1$, $0 < b < 1$ and

$$0 < b\Pi < \frac{1}{\lambda(1-\lambda)}.$$

- This defines Region F (see Figure 1, below the curve f).

Nash equilibrium effort levels (25)

- Nash equilibrium

$$E(\alpha) = \frac{\alpha\Pi b(1-\lambda)}{1+\alpha\Pi b(1-\lambda)^2} < 1 \text{ and } e(\alpha) = \frac{b}{1+\alpha\Pi b(1-\lambda)^2} < 1$$

- Then $E'(\alpha) > 0$ and $e'(\alpha) < 0$. Higher α implies lower equilibrium effort of manager.
- Define $\Omega = \Pi b$. It is an indicator of the "stake" of the game. $E(\alpha)$ increases in Ω. And $e(\alpha)$ decreases in Ω for a given b.
- Define equity value as expected aggregate dividends:

$$W(\alpha) = D(e(\alpha), E(\alpha)) = e(\alpha)\Pi\left[\lambda + (1-\lambda)E(\alpha)\right]$$

- Equity value is increasing in α in Region Q, and is hump-shaped in α in Region $F-Q$. (See Figure 1) $W(\alpha)$ is maximized at $a_2^* = \min\left\{1, \Omega^{-1}(1-\lambda_2)^{-1}\right\}$

Equity Value versus Net Equity Value

- Large shareholder's net income is her dividend income minus her effort costs:

$$R(\alpha) = \alpha W(\alpha) - \frac{1}{2}\left[E(\alpha)\right]^2, \; R'(\alpha) > 0 \text{ for all } \alpha \in [0,1]$$

- Net equity value is

$$V(\alpha) = R(\alpha) + (1-\alpha)W(\alpha)$$

- Net equity value is maximized at

$$\alpha_1^* = \frac{1}{\frac{1}{1-\lambda} + \Omega(1-\lambda^2)} < 1$$

- **Fact 1**: marginal value of a share to a large shareholder is smaller than value of a share to an atomistic shareholder: $R'(\alpha)/n < W(\alpha)/n$. (equality iff $\alpha = 0$)

Shape of large shareholder's net income function (27)

- Lemma 1: The function $R(\alpha)$ is strictly convex in Region X, strictly concave in Region T, and S-shaped in Region A (See Figure 1).
- (on the upper boundary of region X i.e. lower boundary of Region T, $R''(\alpha) > 0$ if $\alpha < 1$ and $R''(1) = 0$)
- (if $\lambda = 1/2$, then $R''(0) = 0$.)

A dynamic version, with commitment (28)

- at each t, S gets $R(\alpha(t)) \equiv \alpha W(\alpha(t)) - \frac{1}{2}[E(\alpha(t))]^2$
- S contemplates reducing her ownership of shares at the rate $-\dot{\alpha}(t)n$ at time t. (We allow $\dot{\alpha}(t)$ to be of either sign.) (n is contant)
- Let $p(t)$ be the market price of a share at time t.
- Investors have rational expectations: share price at t is value of discounted stream of expected dividends:

$$p(t) = \int_t^\infty \exp(-r(\tau - t))\frac{W(\alpha(\tau))}{n}d\tau.$$

- Then $\dot{p}(t) = rp(t) - \frac{W(\alpha(\tau))}{n}$.
- Usual non-arbitrage condition in a competitive asset market: the return to holding an asset (i.e. the sum of capital gains and dividends) is just equal to the opportunity cost, $rp(t)$.

A dynamic version, with commitment

- The payoff to the large shareholder is then

$$J^c(\alpha_0) = \int_0^\infty \exp(-rt)\left[R(\alpha(t)) - \dot{\alpha}(t)np(t)\right] dt$$

- What is her optimal divesting strategy?
- Depends on whether S can commit to a time path of sale of her shares.
- let $\phi(t) \equiv \exp(-rt)np(t) = \int_t^\infty \exp(-r\tau)W(\alpha(\tau))d\tau$
- Objective of S becomes (after integration by parts):

$$\max_{0\leq\alpha(t)\leq 1} \int_0^\infty \exp(-rt)\left[R(\alpha(t)) + (\alpha_0 - \alpha(t))\, W(\alpha(t))\right] dt$$

A dynamic version, with commitment

- solution: choose same value for $\alpha(t)$ for all $t \in (0, \infty)$.
- An immediate jump in the state variable (an impulse control) to some optimal *committed level* $\alpha(0^+) = \alpha^c$
- and after this initial jump, $\alpha(t)$ will be kept constant at α^c for ever

Optimal asset sales under commitment (31)

- **Proposition 1 (Optimal asset sale strategy under commitment).** *If the large shareholder can make a binding commitment on her time path of share holding, her optimal policy is to reduce her shareholding immediately from her initial holding α_0 to a committed level α^c where*

$$\alpha^c = \frac{\alpha_0(1-\lambda)}{1+\alpha_0(1-\lambda)^2\Pi b(1+\lambda)} \equiv \chi(\alpha_0) < \alpha_0$$

and afterward she retains her remaining shares for ever.

Time inconsistency

- The large shareholder is willing to commit not to sell more shares thereafter because she wants to elicit a higher initial share price.
- The solution displays time-inconsistency.
- The commitment strategy of holding $\alpha(t) = \chi(\alpha_0)$ for all $t \in (0, \infty)$ implies that at any time $t_1 > 0$, if S would be released from her original commitment, she would again want to sell immediately some more shares (because at t_1 the relevant initial holding would be α_{t_1}).
- Share price would fall below the initial price, $W(\alpha^c)/(rn)$. Capital losses to the previous buyers of shares.
- Solutions that display time-inconsistency are generally regarded as unacceptable (Coase, 1972). Must look for time-consistent solutions.

Markov-perfect Equilibrium

- Seek solutions with time-consistent property, and robust to perturbation. Insisting on a stronger property than time-consistency: Markov perfect equilibrium MPE
- In a MPE, S uses a Markovian strategy ω and the market has a Markovian price function, or expectation rule, ρ such that
- (i) given ρ, Markovian strategy ω maximizes S's payoffs, for all possible starting (date, state) pairs (t, α_t),
- (ii) given ω, Markovian price function ρ is consistent with rational expectations.

Markovian price expectation

- atomistic agents have Markovian price expectation function $p(t) = \rho(\alpha(t))$, where ρ is a function of the state variable α.
- The price expectations function must be rational: share price must equal capitalized value of future dividend stream:

$$\rho(\alpha(t)) = \frac{1}{n}\int_t^{\infty} \exp(-r(\tau - t))W(\alpha(\tau))d\tau,$$

- where $\{\alpha(.)\}_t^{\infty}$ is time path of α induced by strategy ω of S, from time t.

Markovian strategy of large shareholder

- A strategy ω of S is a specification of
- (i) a collection of disjoint intervals $I_1, I_2, ..., I_m$ where $I_i \equiv [a_i, b_i] \subset [0, 1]$,
- (ii) a lumpy sale function $L_i(.)$ that specifies a downward jump in the state variable, such that $\alpha - 1 \leq L_i(\alpha) \leq \alpha$, (if $L_i(\alpha)$ is negative, it signifies a lumpy purchase of shares), and
- (iii) a gradual sale function $g(.)$ defined for all $\alpha \notin I_i$, such that

$$\dot{\alpha}(t) = -g(\alpha(t)) \text{ for } \alpha \notin I_i$$

- The payoff to the large shareholder, given (t, α_t), is

$$\int_t^\infty \exp(-r(\tau - t)) \left[R(\alpha(\tau)) - \dot{\alpha}(\tau) np(\tau)\right] d\tau$$

MPE in Region X (convex function R)

- In region X, S's net income function $R(\alpha)$ is strictly convex for all $\alpha \in (0,1)$.
- Furthermore, since $W(0) = R'(0)$, it follows that $R(\alpha) > \alpha W(0)$ for all $\alpha > 0$.
- This means that, starting with α_0, if S were to sell all her α_0 instantaneously, her share would be sold at the price $p = \frac{1}{nr} W(0)$
- and her payoff (revenue from sales) would be $\frac{\alpha_0}{r} W(0)$, which is strictly smaller than $\frac{1}{r} R(\alpha_0)$.
- This suggests that selling her shares gradually would be better than selling them off in one go.

Proposition 2 (MPE in region X)

- **Proposition 2**: *In region X (where S's net returns function $R(\alpha)$ is convex) her equilibrium strategy is to sell her shares gradually, such that $\alpha(t) \to 0$ asymptotically as $t \to \infty$, and the atomistic investors' equilibrium price function is*

$$\rho(\alpha) = \frac{1}{nr}\left[\frac{\Omega\left(\lambda + \alpha\Omega(1-\lambda)^2(1+\lambda)\right)}{\left(1+\alpha\Omega(1-\lambda)^2\right)^3}\right] = \frac{1}{nr}R'(\alpha)$$

The equilibrium price is increasing in α.

- *Optimal rate of sale at time t is $-\dot{\alpha}(t)$, where*

$$\frac{-\dot{\alpha}(t)}{\alpha(t)} = \frac{\left(\lambda + \alpha\Omega(1-\lambda)^2(1+\lambda)\right)\Omega^2(1-\lambda)^2}{\left(1+\alpha\Omega(1-\lambda)^2\right)^3 N\rho'(\alpha)} > 0$$

- *Share price falls monotonically, converging asymptotically to* $\rho(0) = \frac{1}{rn}W(0) = \frac{1}{rn}R'(0)$.

Comment and Figure 2

- Interestingly, the fraction of shares held by S never vanishes in finite time.
- Starting from any initial fraction α_0, the time it takes to reduce her holding to a given fraction $\underline{\alpha} > 0$ is increasing in λ and decreasing in r.
- Suppose for instance that she initially holds $\alpha = 1$, $\Omega = 0.2$ and $r = 0.05$.
- If $\lambda = 0.1$, the time it takes for α to falls to 0.1 is 29 years.
- If $\lambda = 0.2$, the corresponding time is 10.5 years.
- Figure 2 plots the time paths under these parameter values..

MPE in region T (concave R)

- In region T, function $R(\alpha)$ is strictly concave for all $\alpha \in (0,1)$.
- Furthermore, since $W(0) = R'(0)$, it follows that $R(\alpha) < \alpha W(0)$ for all $\alpha > 0$.
- This means that, starting with α_0, if S were to sell all her α_0 instantaneously, her share would be sold at the price $p = \frac{1}{nr} W(0)$,
- and her payoff (revenue from sales) would be $\frac{1}{nr} W(0)(n\alpha_0)$, which is strictly greater than $\frac{1}{r} R(\alpha_0)$, which is her payoff if she does not offer to sell her shares.
- This suggests that selling her shares gradually would be worse than selling them all off in one go. (Proposition 3 in text)

MPE in region A (function R is S-shaped)

- **Proposition 4:** *When the vector of parameter (λ, Ω) is in region A, then if $\alpha > \widetilde{\alpha}$ the large shareholder will divest immediately in a lumpy fashion the fraction of her stock in excess of $\widetilde{\alpha}$. Afterwards, she gradually divests the remaining shares. The atomistic investors hold the following price expectation rule*

$$\rho(\alpha) = \begin{cases} \frac{1}{nr} R'(\widetilde{\alpha}) & \text{if } \alpha \in [\widetilde{\alpha}, 1] \\ \frac{1}{nr} R'(\alpha) & \text{if } \alpha \in [0, \widetilde{\alpha}] \end{cases} .$$

- *The value function of the large shareholder is*

$$J(\alpha) = \begin{cases} \frac{1}{r} R(\widetilde{\alpha}) + (\alpha - \widetilde{\alpha}) \frac{U'(\widetilde{\alpha})}{r} & \text{if } \alpha \in [\widetilde{\alpha}, 1] \\ \frac{1}{r} R(\alpha) & \text{if } \alpha \in \alpha \in [0, \widetilde{\alpha}] \end{cases} .$$

Conclusion (41)

- S divests her shares of because, in the absence of share trading, there would exist a wedge between her marginal returns on holding these assets and atomistic investors' valuation of a share.
- This wedge arises because the atomistic investors free ride on her monitoring effort which is aimed at reducing the manager's opportunistic behavior (such as choosing projects that are more advantageous to him than to the shareholders).
- As she divests, the manager increases his effort, but in general this is to the detriment of the firm's profit stream. (We show that $W'(\alpha) > 0$ for $\alpha < \alpha_2^*$).
- This evolution toward a pure managerial firm, in which the owners do not monitor the manager, can be gradual or immediate, depending on the degree of incongruence.

Conclusion (42)

- One may wonder whether this tendency for disperse ownership would disappear if the owners can propose incentive contracts to the manager.
- Burkart, Gromb and Panaunzi (1997) have already answered this question by showing that, depending on parameter values, there nevertheless remains in that case some scope for monitoring and a negative relationship between the manager's effort and the large shareholder's stake in the firm.
- Another question is why the large shareholder does not manage the firm herself instead of hiring a manager, for then she would have no incentive to divest her shares
- A possible answer is that she may lack managerial skills, or she may not have time.