Oliver Hart May 15, 2003

Karl Borch Lecture

FIRMS VERSUS CONTRACTS

- Firms are important in economic activity
- In December 2001, 24 companies in the U.S. with market value of equity greater than $100 billion
- Walmart, the largest U.S. employer, has 1.24 million employees [2002 figure]
- In 1991-2, the employee-weighted average number of employees per enterprise was 2,525 in the U. K., 2,244 in Italy, 1,197 in France, and 951 in Germany (Kumar, Rajan, Zingales (2001))
- Degree of vertical integration in Europe in 1990s measured by average ratio of value added to sales in an enterprise was .397 in France and .337 in Germany (Kumar et al.)
- 2/3 of the growth in industries over the 1980s came from growth in size of existing firms (sample of 43 countries; Rajan-Zingales (1998))
- Of course, markets important too. Markets and firms coexist, boundaries keep changing. Worldwide value of M and A > $1.6 trillion in 1997 (Holmstrom-Roberts (1998))
- Challenge for economists: what determines mix?

- In spite of importance of firms, very little formal analysis

- Consider the three main paradigms:

(A) Competitive Markets (Arrow-Debreu GE model)

(B) Imperfect Competition (Game Theory)

(C) Informational Economics (Adverse Selection/ Mechanism Design/Principal-Agent Theory)

- In first two of these, firm is a profit-maximizing black box

- In third, black box is opened a little. For example, in principal-agent theory study optimal contract between owner and manager. But one firm or two independent contractors? Firm boundaries not determined.

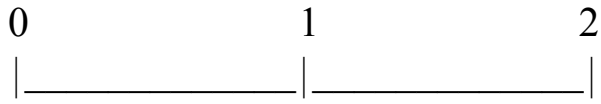
- Fourth paradigm turns out to be more useful for studying firm boundaries (and perhaps internal organization too). It's based on transaction costs/incomplete contracts.

- Coase (1937) . . . Williamson (1975, 1979, 1985), Klein, Crawford and Alchian (1978) . . . Property Rights Theory (Grossman and Hart (1986), Hart and Moore (1990), and Hart (1995))

- PRT provides a formal model, and I will focus on this for the first part of the talk. In the second part (shorter) I will discuss some recent attempts to move beyond PRT.

- PRT (like TCE) takes view that firm boundaries matter in situations where parties have long-term relationships [lock-in] and, because future is uncertain, cannot write complete long-term contracts. PRT identifies firm with assets it owns and takes view that asset ownership matters because owner has residual control rights.

- Very simple version of PRT model [abstract]
- Two manager/agents M1, M2 and one asset A



Parties meet, contract and determine ownership of A	M1 invests i_1 M2 invests i_2	Cooperate ? (e.g. trade)

Extreme uncertainty about future at date 0 ⇒ no LT contract

Uncertainty resolved at date 2 ⇒ perfect ST contract

Symmetric information throughout

Owner of A can walk away with asset

i_1, i_2 nonverifiable investments in human capital

Zero interest rate

Rational expectations

Ex-post payoffs: Under cooperation, $R_1(i_1) + R_2(i_2)$

Under no cooperation, M1 gets $r_1(i_1)$ if M1 owns A

0 otherwise

Under no cooperation, M2 gets 0 if M1 owns A

$r_2(i_2)$ otherwise

Gains to cooperation: Assume 50:50 split (Nash bargaining)

[Investments in human capital]

M1 ownership

M1's payoff = $r_1(i_1) + \frac{1}{2}[R_1(i_1) + R_2(i_2) - r_1(i_1)] - i_1$

M2's payoff = $0 + \frac{1}{2}[R_1(i_1) + R_2(i_2) - r_1(i_1)] - i_2$

FOC: $\frac{1}{2} R_1'(i_1) + \frac{1}{2} r_1'(i_1) = 1$

$\frac{1}{2} R_2'(i_2) = 1$

M2 ownership

M1's payoff = $0 + \frac{1}{2}[R_1(i_1) + R_2(i_2) - r_2(i_2)] - i_1$

M2's payoff = $r_2(i_2) + \frac{1}{2}[R_1(i_1) + R_2(i_2) - r_2(i_2)] - i_2$

FOC: $\frac{1}{2} R_1'(i_1) = 1$

$\frac{1}{2} R_2'(i_2) + \frac{1}{2} r_2'(i_2) = 1$

First-best

Max $R_1(i_1) + R_2(i_2) - i_1 - i_2$

FOC: $R_1'(i_1) = 1, \; R_2'(i_2) = 1$

Assume $R_1' > r_1' > 0, R_2' > r_2' > 0$

Conclusion: (1) Underinvestment in second-best [hold-up]

(2) Trade off: i_1 higher under M1 ownership, i_2 higher under M2 ownership.

(3) Allocate A to party whose investment is more important (trying to maximize $R_1(i_1) + R_2(i_2) - i_1 - i_2$)

Joint ownership

M1's payoff = 0 + ½ [$R_1(i_1) + R_2(i_2)$] - i_1

M2's payoff = 0 + ½ [$R_1(i_1) + R_2(i_2)$] - i_2

FOC: ½ $R_1'(i_1) = 1$

½ $R_2'(i_2) = 1$

M1 ownership

½ $R_1'(i_1)$ + ½ $r_1'(i_1) = 1$

½ $R_2'(i_2) = 1$

M2 ownership

½ $R_1'(i_1) = 1$

½ $R_2'(i_2)$ + ½ $r_2'(i_2) = 1$

Joint ownership dominated (Why?)

- Applying Model to the World:

1) Suppose M1 comes with an asset (take as given). Then rudimentary theory of firm boundaries. Should M2/A be a separate firm or should M1 own A (M2 works for M1)? Natural to interpret as a vertical relationship.
Cost of integration: M2 less entrepreneurial

2) <u>Joint Ventures/Alliances</u>
Can interpret M1 and M2 as companies investing in a joint venture. For example, M1 might be a pharmaceutical company and M2 a biotechnology company, with A representing the assets produced by their collaboration (new drug patents). Of course, we have a result that says joint ownership suboptimal! But:

(A) i_1, i_2 may enhance value of A (physical capital investments)

(B) Suppose A has several uses. Ownership can be shared, i.e., M1 can be allocated some uses/decision rights and M2 others.

3) Corporate Finance

Can interpret i_1, say, as a financial investment (investment in physical capital).

Model can explain why outside investors/financiers are normally allocated votes (equity) or contingent votes (debt): allocating income rights is not enough.

See Aghion-Bolton (1992).

4) Evidence

- Woodruff (2002) showing that Mexican footwear retailers more likely to be independently owned when innovation important.
- Berger et al. (2003) showing that large banks less good at lending based on subjective or "soft" information.
- Chen et al. (2003) showing that large actively managed mutual funds perform less well than small ones.
- Baker-Hubbard (2002) showing that shippers more likely to own trucks used to transport their shipments when new technology makes it easier to monitor driver behavior.
- Elfenbein-Lerner (2003) showing that, in internet portal alliances, party who invests more owns more
- Kaplan-Stromberg (2002) showing that allocation of control, votes, board seats is important ingredient of venture capital deals.

- PRT provides an analytical framework for understanding ownership and control, but it also has significant limitations.

- Main limitations: in basic PRT model, individuals invest (in human capital) and own; everything sorted out by bargaining (can introduce multiple agents); little sense of firm as an organizational entity.

- Model has little to say about horizontal integration.

- Recently a branch of the literature has developed that may move us in the direction of understanding large companies (and their internal organization).

- New ingredient: some actions/decisions are not even ex post contractible. These noncontractible decisions are taken by the boss [as opposed to PRT . . .].

Simple Example Based on Hart-Holmstrom (2002)

- 2 units in same or related product markets
- Each unit has one manager/worker
- Unit can coordinate by making their products compatible (operating system and software). Represent this by a unit choosing "Yes" rather than "No." Assume this is a noncontractible decision. Boss makes decision.

$$\left[\begin{array}{l}\text{boss} = \text{owner} \\ \qquad\quad \text{or CEO}\end{array}\right]$$

- It takes two to coordinate, i.e., each unit must choose Yes for coordination to occur (either unit can veto coordination by choosing No).
- Suppose boss of unit diverts unit profit ($\Rightarrow$ fortunes of boss tied to performance of unit).
- Let coordination yield changes in profits $\Delta v_{A,}\ \Delta v_B$ in units A, B respectively.
- Assume unit manager obtains private benefits (job satisfaction or quasi-rents stemming from activity-specific skills). Coordination yields changes in private benefits $\Delta w_{A,}\ \Delta w_B$. Nontransferable.

- Under first-best:

  $C \Leftrightarrow \Delta v_A + \Delta w_A + \Delta v_B + \Delta w_B > 0$

- Under nonintegration (each manager is boss of her unit):

  $C \Leftrightarrow \Delta v_A + \Delta w_A > 0, \Delta v_B + \Delta w_B > 0$ [Too little C]

- Under integration (with an outside boss):

  $C \Leftrightarrow \Delta v_A + \Delta v_B > 0$ [Too much C if $\Delta w_A + \Delta w_B < 0$]

[• No ex post bargaining]

- Basic trade-off

- NI good if

  $\text{Sign}\,(\Delta v_A + \Delta w_A) = \text{Sign}\,(\Delta v_B + \Delta w_B)$

  $= \text{Sign}\,(\Delta v_A + \Delta w_A + \Delta v_B + \Delta w_B)$

- NI bad if $\Delta v_A + \Delta v_B + \Delta w_A + \Delta w_B > > 0$ and $\Delta v_A + \Delta w_A < 0$ or $\Delta v_B + \Delta w_B < 0$

- I good if $\Delta w_A + \Delta w_B$ small.

- I bad if $\Delta w_A + \Delta w_B << 0$.

- Model can throw light on efficiency reasons for horizontal integration of large firms (Cisco-StrataCom, Cemex - , ITT -)

- Through private benefit effect, model can explain why integration decisions can affect workers generally, not just top management.

- Model might be extended to analyze delegation inside firm

Summary

- A large amount of economic activity takes place within firms rather than in the marketplace

- In spite of this, economists' understanding of firms is quite primitive relative to their understanding of markets

- I have described some attempts to understand the determinants of firm boundaries, ownership and control.

- I have discussed two approaches that throw light on firm boundaries. In one ownership is a bargaining chip. In the other an owner (boss) takes decisions.

- I have argued that the second approach may help us to go inside the firm.

- Much remains to be done! [Enforcing authority . . .]