2

The Property Rights Approach

ALL the theories discussed in Chapter 1 suffer from the drawback that they do not explain what changes when two firms merge. I now describe a theory—the property rights approach—that tries to address this question head-on.[1] I divide the chapter into three parts. Section 1 provides a verbal description of the property rights approach. Section 2 develops a formal model under a very stylized set of assumptions. Finally, Section 3 discusses what light the theory can throw on actual organizational arrangements.

1. A general description

Consider two firms, A and B, and imagine that firm A acquires firm B. Ask the following question: what exactly does firm A get for its money? At least in a legal sense, the answer seems straightforward: firm A acquires, i.e. becomes the owner of, firm B's assets. Included in this category are firm B's machines, inventories, buildings, land, patents, client lists, copyrights, etc.—that is, all of firm B's physical or nonhuman assets. Excluded are the human assets of those people working for firm B; given the absence of slavery, the human capital of these workers belongs to them both before and after the acquisition.

Why does ownership of physical or nonhuman assets matter? The answer is that ownership is a source of power when contracts are incomplete. To understand this, note that an incomplete contract will have gaps, missing provisions, or ambiguities, and so situations will occur in which some aspects of the uses of nonhuman assets are not specified. For example, a contract between General Motors and Fisher Body might leave open certain aspects of maintenance policy for Fisher machines, or might not specify

[1] The following is based on Grossman and Hart (1986) and Hart and Moore (1990). The account in the first part of the chapter is drawn from Hart (1989).

the speed of Fisher's production line or the number of shifts per day, or whether GM's production process can be modified to accept Fisher's input more easily.[2]

Given that a contract will not specify all aspects of asset usage in every contingency, who has the right to decide about missing usages? According to the property rights approach, it is the owner of the asset in question who has this right. That is, the owner of an asset has *residual control rights* over that asset: the right to decide all usages of the asset in any way not inconsistent with a prior contract, custom, or law.[3] In fact, possession of residual control rights is taken virtually to be the definition of ownership. This is in contrast to the more standard definition of ownership, whereby an owner possesses the residual income from an asset rather than its residual control rights.[4]

Note that this view of ownership seems to accord with common sense. For example, suppose I rent you my car for six months and during this period you have an urge to install a CD player. It would generally be agreed that, if the contract is silent, you would have to ask my permission to do this; that is, the residual right to change the interior of the car would be mine as owner rather than yours as renter. Furthermore, even if the contract did make provisions for a CD player, there would be many other

[2] In contrast, a comprehensive contract would include a detailed list of the way every asset should be used in every eventuality. For example, the contract might say: machine 1 should be used in the following way (button 1 of machine 1 should be in the 'on' position, button 2 of machine 1 should be in the 'off' position, dial 3 of machine 1 should be in the 45° position, . . .); machine 2 should be used in the following way (button 1 of machine 2 should be in the 'off' position, button 2 of machine 2 should be in the 'on' position, dial 3 of machine 2 should be in the 60° position, . . .); etc. An incomplete contract will not—cannot—contain this much detail.

[3] In the case of a large company such as General Motors, the owner(s) may delegate the residual control rights to management or a board of directors. This chapter ignores the delegation issue and treats firms as if they were owner-managed; however, see Ch. 3, §3, and Chs. 6–8.

[4] For a discussion of the relationship between residual income and residual control rights, see Ch. 3, §4. The idea that an owner has residual control rights seems consistent with the standard view of ownership adopted by lawyers:

> But what are the rights of ownership? They are substantially the same as those incident to possession. Within the limits prescribed by policy, the owner is allowed to exercise his natural powers over the subject-matter uninterfered with, and is more or less protected in excluding other people from such interference. The owner is allowed to exclude all, and is accountable to no one. (Oliver Wendell Holmes, *The Common Law 193*, (1963 edn.))

events and actions which would not be covered and with respect to which you would have to ask my permission.[5]

So, in the General Motors–Fisher Body example, if the two companies are separate, GM has the right to decide whether to modify its production process, while Fisher can make the decisions about the speed of its own production line, number of shifts per day, or maintenance of its machines. (This is under the assumption that the contract is silent about these issues.) On the other hand, if GM acquires Fisher, then GM can make all the above decisions. Finally, if Fisher acquires GM, then all the decisions are in the hands of Fisher.

To see the economic implications of different ownership arrangements, it is useful to focus on the third cost of contractual incompleteness described in Chapter 1, the distortion in relationship-specific investments.[6] Suppose GM and Fisher have an initial contract that requires Fisher to supply GM with a certain number of car bodies every day. Imagine that demand for GM's cars now rises and GM requires additional car bodies. Suppose also that the initial contract is silent about this possibility, perhaps because of the difficulty of anticipating the circumstances of the demand increase. If Fisher is a separate company, GM must secure Fisher's permission to increase supply. That is, the status quo point in any contract renegotiation is where Fisher does *not* provide the extra bodies. GM does not have the right to go into Fisher's factory and set the production line to supply the extra bodies; Fisher, as owner, has this residual right of control. This is to be contrasted with the situation where Fisher is a subdivision or subsidiary of GM, so that GM owns Fisher's factory. In this

[5] Of course, as renter of my car, you will have *some* residual control rights. For example, it would generally be understood that you can decide where to drive the car or whom to take as a passenger, if the contract is silent about these matters. (However, you would probably have to ask my permission to take the car on safari.) What is important for the analysis that follows is not that the owner has all the residual control rights, but that the owner has some of the most economically significant ones. The fact that renters have some residual rights is consistent with this view. It is also important to note that, to the extent that a rental agreement has a fixed term, the owner of the asset has all the residual control rights concerning actions and events after the agreement ends (and before it begins). So in the car example I can decide where the car is driven and who is a passenger after the six months are up.

[6] Note, however, that a similar analysis could be carried out with respect to the other costs of contractual incompleteness. I will have more to say about this in Ch. 4, §3.

case, if Fisher management refuses to supply the extra bodies, GM has the option to dismiss management and hire someone else to supervise the factory and supply extra bodies. (GM could even run Fisher itself on a temporary basis.) The status quo point in the contract renegotiation is therefore quite different.

To put it very simply, if Fisher is a separate firm, Fisher management can threaten to make both Fisher assets and its own labour unavailable for the uncontracted-for supply increase. In contrast, if Fisher belongs to GM, Fisher management can only threaten to make its own labour unavailable. The latter threat will generally be weaker than the former.[7]

Although the status quo point in the contract renegotiation may depend on whether GM and Fisher are one firm rather than two, it does not follow that the outcomes after renegotiation will differ. In fact, if the benefit to GM of the extra car bodies exceeds the cost to Fisher of supplying them, one would expect the parties to agree that the bodies should be supplied, regardless of the status quo point.[8] However, the divisions of surplus in the two cases will be very different. If GM and Fisher are separate, GM may have to pay Fisher a large sum to persuade it to supply the extra bodies. In contrast, if GM owns Fisher's plant, it may be able to enforce the extra supply at much lower cost since, in this case, Fisher management has much reduced bargaining and threat power.

Anticipating the way surplus is divided, GM will typically be more prepared to invest in machinery that is specifically geared to Fisher bodies if it owns Fisher than if Fisher is independent, since the threat of expropriation is reduced; for example, as noted, GM can always run the Fisher factory itself if Fisher management tries to extract too much surplus. The incentives for Fisher, however, are quite the opposite. Fisher management will generally be more willing to come up with cost-saving or quality-enhancing innovations if Fisher is an independent firm, because Fisher management is more likely to see a return on its activities. If Fisher Body is independent, it can extract some of the surplus from an innovation by incorporating the innovation in bodies it

[7] If current Fisher management is indispensable for the operation of Fisher assets, there is, of course, no difference between the two threats. It is rare, however, that management is completely irreplaceable.

[8] This is an application of the Coase theorem; see Coase (1960).

supplies to another car manufacturer. In contrast, if GM owns Fisher, Fisher management faces partial (or even total) expropriation of the value of an innovation to the extent that GM can deny Fisher management access to the assets necessary to incorporate the innovation (or can even hire a new management team to implement the innovation if the innovation is asset-specific rather than management-specific).[9]

In summary, the benefit of integration is that the acquiring firm's incentive to make relationship-specific investments increases since, given that it has more residual control rights, it will receive a greater fraction of the *ex post* surplus created by such investments. On the other hand, the cost of integration is that the acquired firm's incentive to make relationship-specific investments decreases since, given that it has fewer residual control rights, it will receive a smaller fraction of the incremental *ex post* surplus created by its own investments.[10]

I now present a model that formalizes the above ideas. Before I do so, it is worth noting that so far the discussion of control changes has been restricted to the impact on top management. Workers' incentives will also be affected by changes in ownership, however. I postpone a discussion of worker incentives to Chapter 3. In that chapter I also cover a number of other aspects of the integration decision.

[9] One way to protect Fisher managers from expropriation is to provide them with a golden handshake (or parachute). However, while a golden handshake will provide financial security, it may not encourage Fisher management to make relationship-specific investments, since the value of the handshake is unlikely to depend on such investments.

[10] Under some conditions, expropriation problems can be avoided regardless of the structure of ownership. One possibility is for the parties to write an *ex ante* profit-sharing agreement. However, a profit-sharing agreement may be insufficient to encourage *ex ante* investments for two reasons. First, profits may not be verifiable; e.g. one party could inflate costs and claim that profits are low. Second, an *ex ante* agreement that Fisher, a division of General Motors, can receive a share of the profit from an innovation may not mean much if GM—as owner of the Fisher assets—can threaten not to implement the innovation unless Fisher agrees to give up some of its profit share. A second way the parties might overcome expropriation problems is to share investment expenditures. For example, if GM and Fisher are independent, Fisher could compensate GM for its later hold-up power by contributing toward GM's initial Fisher-specific investment. Note, however, that this strategy will work only to the extent that either GM can contractually agree to make the investment (which may be difficult if the investment is hard to describe or verify) or Fisher can make part of the investment on GM's behalf. Otherwise, GM could use an up-front payment from Fisher to make a *non*-relationship-specific investment.

2. *A formal model of the costs and benefits of integration*

In order to develop a formal model, I now abstract from many of the real-world aspects of an economic relationship involving entities such as General Motors and Fisher Body. I focus on a highly stylized situation in which there are just two assets, a1 and a2, and two managers operating them, M1 and M2. Suppose that M2, in combination with a2, supplies a single unit of input—called a widget—to M1. M1, in combination with a1, then uses this widget to produce output that is sold on the output market (see Figure 2.1).

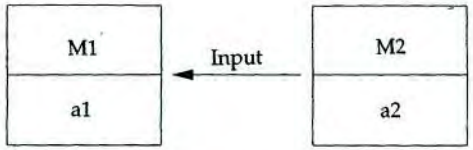

FIG. 2.1

The economic relationship lasts for two dates. *Ex ante* relationship-specific investments are made at date 0, and the widget is supplied at date 1. Assume the assets are already in place at date 0, so that the investments are in making these assets more productive. The parties have symmetric information throughout. Also, there is no uncertainty about the parties' costs or benefits. However, there *is* uncertainty about the type of widget M1 requires. This uncertainty is resolved at date 1; that is, at this time it becomes clear what the relevant widget type is.

The *ex ante* uncertainty about widget type makes an effective long-term contract impossible; the point is that specifying the widget price in advance means nothing, given that the widget type cannot be described.[11] Thus, the parties negotiate about the widget type and price at date 1 from scratch.[12] I shall suppose—and this assumption will be discussed further in Chapter 4—that

[11] For further discussion of the no-long-term contract assumption, see Ch. 4, §1.

[12] At date 1 there is no difficulty in writing an enforceable contract about price since the widget type is known and can be described.

the parties have rational expectations about the recontracting process when they make their investments at date 0. In particular, even though the parties cannot write a comprehensive contract, they can make correct calculations about the expected return from any action.

Assume that the parties are risk-neutral and have large (unlimited) amounts of initial wealth, so that each party can purchase any asset it is efficient for her to own. For simplicity, take the interest rate to be zero.

I suppose that it is too costly for the parties to specify particular uses of assets a1 and a2 in a date 0 contract. Thus, whoever owns asset a1 or a2 has not just residual rights of control, but all control rights over the asset. In other words, the owner can use the asset in any way she wants.[13]

For almost all of this section, I will focus on three 'leading' ownership structures:

Non-integration:	M1 owns a1 and M2 owns a2.
Type 1 integration:	M1 owns a1 and a2.
Type 2 integration:	M2 owns a1 and a2.

Other possible ownership structures will be discussed briefly at the end of this section and in Chapter 4.

Investments and payoffs

Denote M1's relationship-specific investment at date 0 by i, where i, a non-negative number, represents the level and cost of the investment. This investment might stand for an expenditure in developing the market for M1's final product. I assume that i will affect M1's revenue both if M1 trades with M2 and if he does not. If trade occurs, M1's revenue is denoted by $R(i)$ and his *ex post* payoff is $R(i) - p$, where p is the agreed widget price. (The investment cost i must be subtracted from this *ex post* payoff to obtain M1's *ex ante* payoff.) If trade does not occur, M1 buys a widget from an outside supplier, that is, a 'non-specific' widget from the spot market at price $\bar{p}$, say. (Alternatively, if M1 has access to a2, he can hire someone to make a widget for him.) This non-specific widget may lead to lower-quality output. Denote M1's revenue in

[13] See again Ch. 4 for further discussion.

this case by $r(i;A)$ and his *ex post* payoff by $r(i;A) - \bar{p}$. Here the lower-case r indicates the absence of M2's human capital and the argument A refers to the set of assets M1 has access to in the event that trade does not occur (i.e. A represents the assets M1 owns). (In contrast, if trade does occur, M1 has access to all the assets in the relationship.) So, under non-integration, $A = \{a1\}$; under type 1 integration $A = \{a1,a2\}$; and under type 2 integration $A = \emptyset$. (If M1 has access to a2, he may be able to modify the non-specific widget, which is one reason why r may depend on a2.)

In the same way, denote M2's relationship-specific investment at date 0 by e, where e, a non-negative number, represents the level and cost of the investment. This investment might stand for an expenditure of money or time in making M2's operations more efficient. I assume that e will affect M2's production costs both if M2 trades with M1 and if she does not. If trade occurs, M2's production costs are denoted by $C(e)$ and her *ex post* payoff is $p - C(e)$. (The investment cost e must be subtracted from this *ex post* payoff to obtain M2's *ex ante* payoff.) If trade does not occur, M2 will sell her widget on the competitive spot market for $\bar{p}$, but will have to make some adjustments to turn it into a general-purpose widget. (Alternatively, if M2 has access to a1, she can hire someone to transform her widget directly into final output.) In this case M2's production costs are denoted by $c(e;B)$, so that M2's *ex post* payoff is $\bar{p} - c(e;B)$. Here the lower-case c indicates the absence of M1's human capital and the argument B refers to the set of assets M2 has access to in the event that trade does not occur. So, under non-integration, $B = \{a2\}$; under type 1 integration $B = \emptyset$; and under type 2 integration $B = \{a1,a2\}$.

The total *ex post* surplus if trade occurs is $R(i) - p + p - C(e) = R(i) - C(e)$, and the total surplus if trade does not occur is $r(i;A) - \bar{p} + \bar{p} - c(e;B) = r(i;A) - c(e;B)$. I will assume that there are always *ex post* gains from trade:

$$R(i) - C(e) > r(i;A) - c(e;B) \geq 0 \text{ for all } i \text{ and } e, \text{ and for all } A,B, \text{ where } A \cap B = \emptyset \text{ and } A \cup B = \{a1,a2\}. \tag{2.1}$$

Condition (2.1) captures the idea that the investments i and e are relationship-specific: they pay off more if trade occurs than if it does not. However, I assume that relationship-specificity also applies in a marginal sense; that is, the marginal return from each

investment is greater the more assets in the relationship, human and otherwise, to which the person making the investment has access. In other words, M1's marginal investment return is highest if he has access to both M2's human capital and the assets a1 and a2. If he does not have access to M2's human capital, it is higher if he has access to a1 and a2 than if he has access only to a1, and so on; similarly for M2. Taking into account that C' and c' are negative (an increase in e reduces costs), I write these conditions as:

$$R'(i) > r'(i;a1,a2) \geq r'(i;a1) \geq r'(i;\emptyset) \text{ for all } 0 < i < \infty, \tag{2.2}$$

$$|C'(e)| > |c'(e;a1,a2)| \geq |c'(e;a2)| \geq |c'(e;\emptyset)| \text{ for all } 0 < e < \infty. \tag{2.3}$$

Here $|x|$ denotes the absolute value of x, and $r'(i;A) \equiv \partial r(i;A)/\partial i$, $c'(e;B) \equiv \partial c(e;B)/\partial e$. I also assume $R' > 0$, $R'' < 0$, $C' < 0$, $C'' > 0$, $r' \geq 0$, $r'' \leq 0$, $c' \leq 0$, $c'' \geq 0$ (i.e., R is strictly concave, C is strictly convex, r is concave, c is convex).[14]

Note that the strict inequalities in (2.2) and (2.3) mean that i is at least partly specific to M2's human capital and e is at least partly specific to M1's human capital. However, the weak inequalities in (2.2) and (2.3) mean that i may or may not be specific to the nonhuman assets a1 and a2. If $r'(i;a1,a2) = r'(i;a1) > r'(i;\emptyset)$, for example, then i is specific to asset a1 but not to asset a2 (in a marginal sense); similarly for e.

Finally, it is supposed that R,r,C,c, and i and e are observable to both parties, but are not verifiable (to outsiders). Thus, they cannot be part of an enforceable contract.[15]

[14] In addition, I make the technical assumptions $R'(0) > 2$, $R'(\infty) < 1$, $C'(0) < -2$, $C'(\infty) > -1$. Note that I suppose r to be (weakly) concave and c to be (weakly) convex to allow for the cases where r and c are constants; i.e., the investments i and e do not affect r and c.

[15] The contract, 'I will pay you £1 million if you make the investment i' is not enforceable, since no outsider knows whether it has been fulfilled. Similarly, the parties' revenues and costs cannot be made part of a profit- or cost-sharing agreement. Since the idea that a variable can be observable but not verifiable plays a key role in this book, it is worth giving some examples. One concerns the book itself. The quality of the book is observable, in the sense that anybody can read it. (Of course, some are in a better position to evaluate it than others.) However, it would have been difficult for Oxford University Press and me to have written a contract making my royalties a function of quality, since if a dispute arose it would be hard for either of us to prove that the book did or did not meet some pre-specified

It is worth pointing out that the above formulation implicitly supposes that the investments i and e are investments in human capital rather than in physical capital. To see this, note that under type 1 integration M1's *ex post* payoff in the absence of trade with M2 is $r(i;a1,a2) - \bar{p}$, which is independent of e. If M2's investment were an investment in physical capital, i.e. if it were embodied in asset a2, then one would expect e to affect M1's payoff, given that M1 controls a2. Similarly, M2's type 2 integration payoff in the absence of trade with M1, $\bar{p} - c(e;a1,a2)$, is independent of i, which would not be the case if i were an investment in physical capital embodied in a1.[16]

Ex post division of surplus

Consider what happens at date 1 given particular investment decisions i and e. Take the asset ownership structure as fixed for the moment and suppress i, e, and the sets of assets A and B that M1 and M2 control. So denote M1's revenue and M2's costs by R and C if trade occurs and by r and c if trade does not occur.

According to (2.1), there are *ex post* gains from trade, given by $[(R - C) - (r - c)]$. Moreover, these will not be achieved under the initial contract since the initial contract does not specify the type of widget to be supplied. However, since the parties have symmetric information, it is reasonable to expect them to realize the gains through negotiation. I shall assume that bargaining is such that the *ex post* gains from trade, $[(R - C) - (r - c)]$, are divided

standard. (For this reason my royalties are made to depend on some (more or less) verifiable consequences of quality, e.g. sales.) In other words, quality is not verifiable. A second example is a university tenure decision. In an ideal world the conditions for being granted tenure would be specified in advance in minute detail (quantity and quality of publications, teaching performance, prominence in the profession, etc.). In practice this is impossible to do, and so the criteria are left fairly vague. At the same time, many aspects of a candidate's performance are observable (certainly the publication record is). The difficulty is to prove that someone's work does or does not meet the appropriate standard to justify tenure. In other words, whether the standard is met is not verifiable. For a further discussion of observability and verifiability, see Ch. 4.

[16] The case of investments in physical capital is discussed in §6 of Ch. 3. Note also that it is supposed that type 1 integration does not allow M1 to make M2's investment e on her behalf and type 2 integration does not allow M2 to make M1's investment i on his behalf. That is, M1 always makes the investment i and M2 always makes the investment e, regardless of organizational form. For a further discussion of this, see Ch. 3, §6.

50 : 50, as in the Nash bargaining solution. Then M1 and M2's *ex post* payoffs equal

$$\pi_1 = R - p = r - \bar{p} + \tfrac{1}{2}[(R - C) - (r - c)] \tag{2.4}$$
$$= -\bar{p} + \tfrac{1}{2}R + \tfrac{1}{2}r - \tfrac{1}{2}C + \tfrac{1}{2}c,$$

$$\pi_2 = p - C = \bar{p} - c + \tfrac{1}{2}[(R - C) - (r - c)] \tag{2.5}$$
$$= \bar{p} - \tfrac{1}{2}C - \tfrac{1}{2}c + \tfrac{1}{2}R - \tfrac{1}{2}r,$$

and the widget price is given by

$$p = \bar{p} + \tfrac{1}{2}(R - r) - \tfrac{1}{2}(c - C). \tag{2.6}$$

Notice that M1's payoff function puts equal weight on the variables R and r. The reason is that, if R rises by 1, *ceteris paribus*, then the widget price rises by ½ because of Nash bargaining (half the gains go to M2). Hence M1's profits increase by ½. On the other hand, if r rises by 1, *ceteris paribus*, then the widget price falls by ½ (again by Nash bargaining). Hence M1's profit again increases by ½. Similar considerations explain why M2's payoff function puts equal weight on the variables C and c.[17]

The first-best choice of investments. Negotiation at date 1 always leads to an efficient *ex post* outcome under any ownership structure. However, as will be seen, the choice of investments may not be efficient. In a first-best world, where the parties could coordinate their actions, they would have a joint interest in maximizing the date 0 (net) present value of their trading relationship:

$$R(i) - i - C(e) - e. \tag{2.7}$$

The reason is that, given any investments (i,e) that do not maximize (2.7), the parties can always do better by choosing (i,e) to maximize (2.7) and redistributing the increased surplus through lump-sum transfers at date 0. (Recall the assumption that M1 and M2 are both wealthy.) Denote the unique solution to the first-best problem by (i^*,e^*). The first-order conditions for maximizing (2.7) are

[17] Note that the bargaining process is assumed to be independent of ownership structure. M1 and M2 still divide the gains from negotiation 50 : 50 even when M2 is an employee of M1 or M1 is an employee of M2. This may seem a strong assumption. In fact, I would argue that it is a weak assumption. It would be *too* easy to obtain a theory of the costs and benefits of integration if it were supposed that the bargaining process changes under integration.

(2.8) $$R'(i^*) = 1,$$

(2.9) $$| C'(e^*) | = 1.$$

The second-best choice of investments. Now consider the second-best incomplete contracting world, where the parties choose their investments non-cooperatively at date 0. Suppose that the ownership structure is such that M1 owns the set of assets A and M2 owns the set of assets B. Then from (2.4) and (2.5) M1's and M2's payoffs, net of investment costs, are given by

(2.10) $$\pi_1 - i = -\bar{p} + \tfrac{1}{2}R(i) + \tfrac{1}{2}r(i;A) - \tfrac{1}{2}C(e) + \tfrac{1}{2}c(e;B) - i,$$

(2.11) $$\pi_2 - e = \bar{p} - \tfrac{1}{2}C(e) - \tfrac{1}{2}c(e;B) + \tfrac{1}{2}R(i) - \tfrac{1}{2}r(i;A) - e.$$

Differentiating (2.10) with respect to i and (2.11) with respect to e yields the following necessary and sufficient conditions for a (Nash) equilibrium:

(2.12) $$\tfrac{1}{2}R'(i) + \tfrac{1}{2}r'(i;A) = 1,$$

(2.13) $$\tfrac{1}{2}|C'(e)| + \tfrac{1}{2}|c'(e;B)| = 1.$$

For future reference, it is useful to write out (2.12) and (2.13) for the three 'leading' ownership structures.

Non-integration. The equilibrium is characterized by

(2.14) $$\tfrac{1}{2}R'(i_0) + \tfrac{1}{2}r'(i_0;\text{a1}) = 1,$$

(2.15) $$\tfrac{1}{2}|C'(e_0)| + \tfrac{1}{2}|c'(e_0;\text{a2})| = 1.$$

(Here the subscript 0 stands for no integration.)

Type 1 Integration. The equilibrium is characterized by

(2.16) $$\tfrac{1}{2}R'(i_1) + \tfrac{1}{2}r'(i_1;\text{a1,a2}) = 1,$$

(2.17) $$\tfrac{1}{2}|C'(e_1)| + \tfrac{1}{2}|c'(e_1;\varnothing)| = 1.$$

(Here the subscript 1 stands for type 1 integration.)

Type 2 Integration. The equilibrium is characterized by

(2.18) $$\tfrac{1}{2}R'(i_2) + \tfrac{1}{2}r'(i_2;\varnothing) = 1,$$

(2.19) $$\tfrac{1}{2}|C'(e_2)| + \tfrac{1}{2}|c'(e_2;\text{a1,a2})| = 1.$$

(Here the subscript 2 stands for type 2 integration.)

Under assumptions (2.2) and (2.3), (2.12) and (2.13) yield the following result about all second-best outcomes.

PROPOSITION 1. Under any ownership structure, there is underinvestment in relationship-specific investments. That is, the investment choices in (2.12) and (2.13) satisfy $i < i^*$, $e < e^*$.

Proof. Suppose i,e satisfy (2.12) and (2.13). Then, by (2.2) and (2.3),

$$R'(i) > \tfrac{1}{2}R'(i) + \tfrac{1}{2}r'(i;A) = 1$$
$$|C'(e)| > \tfrac{1}{2}|C'(e)| + \tfrac{1}{2}|c'(e;B)| = 1.$$

The result follows since $R'' < 0$, $C'' > 0$. □

The intuition for the underinvestment result is as follows. If M1 invests a little more, this increases the gains from trade by $R'(i)$. However, M1's payoff increases only by $\tfrac{1}{2}R'(i) + \tfrac{1}{2}r'(i;A) < R'(i)$; the remaining gains go to M2. Being self-interested, M1 does not take M2's payoffs into account and hence invests too little. A similar argument applies to M2.[18]

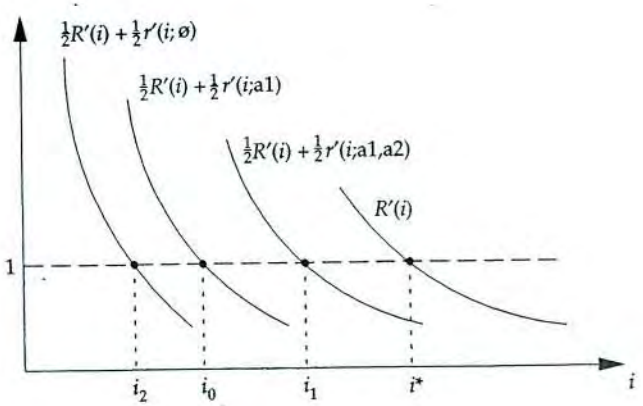

FIG. 2.2

[18] Not all models of ownership yield underinvestment. For example, in Grossman and Hart (1986), overinvestment is possible as well as underinvestment. This is because (2.2) and (2.3) do not hold in the Grossman–Hart model.

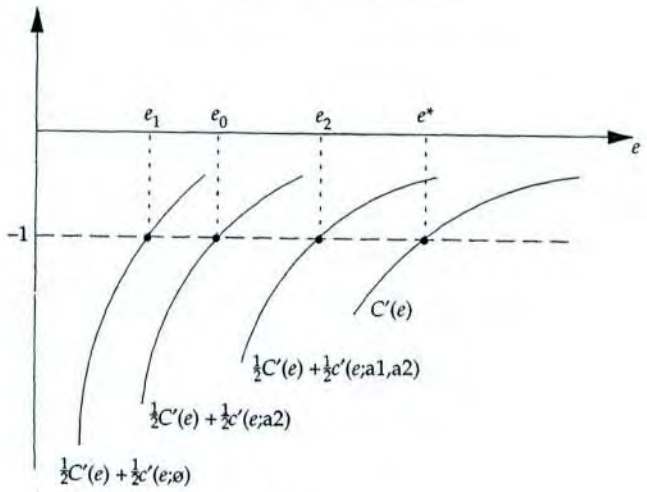

FIG. 2.3

The first-best outcome, and the second-best outcomes under non-integration and type 1 and type 2 integration, are illustrated in Figures 2.2 and 2.3.[19] It is clear from these figures what the effects of integration are. Relative to non-integration, type 1 integration raises M1's investment, but lowers M2's. Relative to non-integration, type 2 integration raises M2's investment, but lowers M1's. That is,

$$i^* > i_1 \geq i_0 \geq i_2, \tag{2.20}$$

$$e^* > e_2 \geq e_0 \geq e_1. \tag{2.21}$$

For future reference, note that efficient *ex post* bargaining implies that the total surplus from the relationship under any ownership structure is given by

$$S \equiv R(i) - i - C(e) - e, \tag{2.22}$$

where i and e satisfy (2.12) and (2.13).[20]

[19] Proposition 1 has been derived under the assumptions that the *ex post* surplus when M1 and M2 trade, given by $T(i,e) \equiv R(i) - C(e)$, is separable in i and e; i.e. $(\partial^2/\partial i\,\partial e)\,T(i,e) = 0$. Proposition 1 can be shown to generalize to the case $(\partial^2/\partial i\,\partial e)\,T(i,e) \geq 0$ (i.e., i and e are complements); see Hart and Moore (1990).

[20] In this model, ownership structure matters because it affects the no-trade payoffs r and c (more particularly, the marginal payoffs r' and c'). Not all bargaining solutions have the property that the equilibrium outcome depends on the no-trade payoffs. For example, in a bargaining game with outside options, the equilibrium division of surplus is independent of the no-trade payoffs (that is, the outside options) within a certain range (see, e.g., Osborne and Rubinstein 1990). However, what is important for the analysis of ownership is that the no-trade payoffs sometimes matter, not that they always matter. With a reasonable amount of *ex ante* uncertainty about investment returns, the no-trade payoffs will affect the equilibrium division of surplus with positive probability even in a bargaining game with outside options. Thus, the main ideas of the analysis of ownership will continue to be relevant.

Ex ante division of surplus

Little has been said so far about how the surplus S is divided under a particular ownership structure. Equations (2.10) and (2.11) correspond to the *ex post* division, but, given that lump-sum transfers are possible at date 0, the *ex ante* division may be different. I shall suppose that M1 has many potential trading partners at date 0, but M1 is unique. Then M2 will receive her reservation payoff at date 0, V say, and M1 will get all the gains from the relationship, $S - V$.[21] Nothing depends on this assumption about relative bargaining power, however. In fact, as will be seen, the size of V plays no role in the analysis of optimal ownership structure (as long as $(S - V)$ exceeds M1's date 0 reservation payoff; I assume this in what follows).

The choice of ownership structure

The last step is to determine which ownership structure is best. This is straightforward. Simply compute the total surplus from the various arrangements. (The division of surplus is unimportant since this can always be adjusted using lump-sum transfers at date 0.) In other words, compare the following:

$$\begin{aligned} S_0 &= R(i_0) - i_0 - C(e_0) - e_0, \\ S_1 &= R(i_1) - i_1 - C(e_1) - e_1, \\ S_2 &= R(i_2) - i_2 - C(e_2) - e_2. \end{aligned} \tag{2.23}$$

[21] More generally, the *ex ante* division of surplus will be determined by the degree of competition in the market for alternative 'M1s' and 'M2s' at date 0, that is, by how many potential trading partners M1 has and how many potential trading partners M2 has. Note that relative bargaining power at date 0 may be very different from relative bargaining power at date 1 since relationship-specific investments have not yet been made at date 0. Williamson (1985) has referred to this as 'the fundamental transformation'.

The theory predicts that the ownership structure that yields the highest value of S will be chosen in equilibrium. For example, if at the starting point of their relationship M1 owns a1 and M2 owns a2, and $S_1 > \text{Max}(S_0,S_2)$, then M1 will buy a2 from M2 at some price that will make them both better off. (In fact, given the assumptions about relative bargaining power, the price will be such that M2's final payoff is V.)

Analysis of the optimal ownership structure

I now consider in greater detail what forces favour one ownership structure over another. Before I start, it is worth making a simple observation. As is clear from (2.12)–(2.13), any change in ownership structure that increases $r'(i;\bullet)$ (resp., increases $|c'(e;\bullet)|$) without decreasing $|c'(e;\bullet)|$ (resp., decreasing $r'(i;\bullet)$), or more generally that increases i or e without decreasing the other, is good. The reason is that, since both parties (always) underinvest (see Proposition 1), such a change moves the parties closer to the first-best and so total surplus given by $R(i) - i - C(e) - e$ rises.

It is useful to introduce some definitions.

DEFINITION 1. M1's investment decision will be said to be *inelastic* in the range $\frac{1}{2} \leq \rho \leq 1$ if the solution to $\text{Max}_i\, \rho\, R(i) - i$ is independent of ρ in this range. Similarly, M2's investment decision will be said to be *inelastic* in the range $\frac{1}{2} \leq \sigma \leq 1$ if the solution to $\text{Min}_e\, \sigma\, C(e) + e$ is independent of σ in this range.[22]

DEFINITION 2. M1's investment will be said to become *relatively unproductive* if $R(i)$ is replaced by $\theta R(i) + (1 - \theta)i$, and $r(i;A)$ is replaced by $\theta r(i;A) + (1 - \theta)i$ for all A = a1, (a1,a2) or $\varnothing$, where $\theta > 0$ is small. M2's investment will be said to become *relatively unproductive* if $C(e)$ is replaced by $\theta C(e) - (1 - \theta)e$, and $c(e;B)$ is replaced by $\theta c(e;B) - (1 - \theta)e$ for all B = a2, (a1,a2) or $\varnothing$, where $\theta > 0$ is small.

DEFINITION 3. Assets a1 and a2 are *independent* if $r'(i;\text{a1,a2}) \equiv r'(i;\text{a1})$ and $c'(e;\text{a1,a2}) \equiv c'(e;\text{a2})$.

[22] For M1's investment decision to be inelastic, it must be the case that, for some $\hat{\imath}$, $R'(i) > 2$ for $0 < i < \hat{\imath}$, $R'(i) < 1$ for $i > \hat{\imath}$; and for M2's investment decision to be inelastic, it must be the case that, for some $\hat{e}$, $|C'(e)| > 2$ for $0 < e < \hat{e}$ and $|C'(e)| < 1$ for $e > \hat{e}$. In Definition 1, therefore, the assumption that R'' and C'' exist everywhere is relaxed.

DEFINITION 4. Assets a1 and a2 are *strictly complementary* if either $r'(i;\text{a1}) \equiv r'(i;\varnothing)$ or $c'(e;\text{a2}) \equiv c'(e;\varnothing)$.

DEFINITION 5. M1's human capital (resp., M2's human capital) is *essential* if $c'(e;\text{a1,a2}) \equiv c'(e;\varnothing)$ (resp., $r'(i;\text{a1,a2}) \equiv r'(i;\varnothing)$).

These definitions are intuitive. The first one guarantees that M1 (resp., M2) will choose the same level of i, $\hat{\imath}$ say, (resp., the same level of e, $\hat{e}$ say) in any one of the ownership structures with 50 : 50 bargaining.

In the second definition, the net social return from M1's (resp., M2's) investment, $R(i) - i$, becomes $\theta(R(i) - i)$ (resp., $C(e) + e$ becomes $\theta(C(e) + e)$), which is small when θ is small. In other words M1's (resp., M2's) investment becomes unimportant relative to M2's (resp., M1's).

The third definition says that a1 and a2 are independent if access to a2 will not increase M1's marginal return from investment given that he already has access to a1; and if access to a1 will not increase M2's marginal return from investment given that she already has access to a2.

The fourth definition says that a1 and a2 are strictly complementary either if access to a1 alone has no effect on M1's marginal return from investment (M1 needs a2 as well), or if access to a2 alone has no effect on M2's marginal return from investment (M2 needs a1 as well).

Finally, the fifth definition says that one party's human capital is essential if the other party's marginal return from investment is not enhanced by the presence of the assets a1 and a2 in the absence of the first party's human capital.

Proposition 2 makes use of the above definitions.

PROPOSITION 2. (A) If M2's investment decision (resp., M1's investment decision) is inelastic, then type 1 integration (resp., type 2 integration) is optimal.

(B) Suppose M2's investment (resp. M1's investment) becomes relatively unproductive, and $r'(i;\text{a1,a2}) > r'(i;\text{a1})$ for all i (resp. $|c'(e;\text{a1,a2})| > |c'(e;\text{a2})|$ for all e). Then, for θ small enough, type 1 integration (resp., type 2 integration) is optimal.

(C) If assets a1 and a2 are independent, then non-integration is optimal.

(D) If assets a1 and a2 are strictly complementary, then some form of integration is optimal.

(E) If M1's (resp., M2's) human capital is essential, then type 1 (resp., type 2) integration is optimal.

(F) If both M1's human capital and M2's human capital are essential, then all ownership structures are equally good.

Proof. (A) Suppose M2's investment decision is inelastic. Then (2.3) and (2.13) imply that M2 sets $e = \hat{e}$ under all ownership structures. Thus, it is best to give all the control rights to M1. Conversely, if M1's investment decision is inelastic, it is best to give all the control rights to M2.

(B) Suppose that M2's investment is relatively unproductive. Then M2's first-order condition under any ownership structure becomes (see (2.13)):

$$\tfrac{1}{2}\theta\,|\,C'(e)\,|\,+\tfrac{1}{2}\,(1-\theta)+\tfrac{1}{2}\theta\,|\,c'\,(e;B)\,|\,+\tfrac{1}{2}(1-\theta)=1,$$

which simplifies to

$$\tfrac{1}{2}\,|\,C'(e)\,|\,+\tfrac{1}{2}\,|\,c'(e;B)\,|\,=1.$$

In other words, M2's investment decision is independent of θ. However, net surplus, given by

$$\begin{aligned} S &= R(i)-i-\theta\,C(e)+(1-\theta)\,e-e \\ &= R(i)-i-\theta\,(C(e)+e) \\ &\to R(i)-i \text{ as } \theta\to 0. \end{aligned}$$

Thus, for θ small, what matters is M1's investment decision. Hence it is optimal to give all the control rights to M1. The same argument shows that M2 should have all the control rights if M1's investment is relatively unproductive.

(C) Note that, by the definition of independence, the solutions to (2.14) and (2.16) are the same; that is, $i_1 = i_0$. Since $e_1 \le e_0$, non-integration dominates type 1 integration. Also, the solutions to (2.15) and (2.19) are the same; that is, $e_2 = e_0$. Since $i_2 \le i_0$, non-integration dominates type 2 integration.

(D) Suppose first that $r'(i;\text{a1}) \equiv r'(i;\varnothing)$. Then the solutions to (2.14) and(2.18) are the same; that is, $i_0 = i_2$. Since $e_0 \le e_2$, type 2 integration dominates non-integration. The same argument shows that, if $c'(e;\text{a2}) \equiv c'(e;\varnothing)$, type 1 integration dominates non-integration.

(E) Note that, if M1's human capital is essential, then the solutions to (2.15), (2.17), and (2.19) are all the same; that is, $e_0 = e_1 = e_2$. Since $i_1 \ge i_0 \ge i_2$, type 1 integration is optimal. The same argument shows that, if M2's human capital is essential, type 2 integration is optimal.

(F) This follows from the fact that, if M1 and M2's human capital are both essential, the solutions to (2.14), (2.16), and (2.18) are all the same and so are the solutions to (2.15), (2.17), and (2.19); that is, $i_0 = i_1 = i_2$ and $e_0 = e_1 = e_2$. Thus, organizational form is irrelevant. □

Most of Proposition 2 is very intuitive. Part (A) says that there is no point giving ownership rights to a party whose investment decision is not responsive to incentives. Part (B) says that there is no point giving ownership rights to a party whose investment is unimportant. Parts (C)–(F) are a little more striking, and it is worth saying a bit more about them.

To understand (C), start with non-integration and consider transferring control of a2 from M2 to M1. This has no effect on M1's marginal return from investment in the event that the parties fail to reach agreement since a1 is no more useful with a2 than without; but transferring control to M1 may have a significantly negative effect on M2's marginal investment return, since without a2 M2 may be able to achieve very little. Thus, the effect of the control transfer is to keep i constant but reduce e, which reduces total surplus. A similar logic applies if we transfer control of a1 from M1 to M2: e stays constant, but i may fall significantly. Thus, when the assets are independent, both forms of integration are dominated by non-integration.

Consider next (D). Start with non-integration. If a1 and a2 are strictly complementary, then transferring control of a2 from M2 to M1 weakly increases M1's marginal return from investment (his return from investment absent an agreement with M2 rises), but it has no effect on M2's marginal return. The reason is that a2 is useless without a1 and so giving up a2 does not change M2's return absent an agreement with M1. Thus, moving from non-integration to integration yields benefits but no costs. A similar logic applies as one moves from non-integration to type 2 integration; hence type 2 integration also is superior to non-integration. Thus, when the assets are strictly complementary, some form of integration is better than non-integration, but without further information (about, say, the importance of M1's invest-

ment relative to M2's) it is not possible to rank type 1 integration against type 2 integration.

To understand (E), note that, if M1's human capital is essential, then transferring assets from M2 to M1 has no effect on M2's investment incentives, since M2's no-trade payoff does not depend on the assets she has in the absence of M1's human capital (at the margin). Thus, there is no cost of the control transfer. However, there may be a benefit, since if M1 has all the assets this is likely to increase his incentive to invest.

Note that (B) and (E) together can be summarized as saying that a party with an important investment or important human capital should have ownership rights.

Finally, (F) says that, if both M1 and M2 have essential human capital, then ownership structure does not matter since neither party's investment will pay off in the absence of agreement with the other.

Two observations are worth making. First, the argument showing that complementary assets should be owned together also shows that joint ownership of an asset is suboptimal. Suppose a1 is owned by both M1 and M2. What this means is that if negotiations break down neither M1 nor M2 has access to a1 independently (since any asset usage must be agreed by both). However, such an arrangement is equivalent to dividing a1 in two and assigning one half to M1 and the other half to M2. Since it is clear that the two halves are strictly complementary, an argument similar to that in the proof of Proposition 2(D) tells us that such an outcome is dominated by one in which all of a1 is assigned to either M1 or M2. (This is true whoever is the owner of a2.)[23]

A caveat is important here. I have supposed that the investments i and e are embodied in M1 and M2's human capital, in the sense that M1 does not obtain the benefit of e unless he reaches agreement with M2, and M2 does not obtain the benefit of i unless she reaches agreement with M1. As will be seen in Chapter 3, if investments are embodied in physical assets rather than human assets, it is no longer clear that strictly complementary assets

[23] This argument assumes that an asset cannot be used by two people independently. However, for some assets joint usage is possible. For example, a patent can be developed and marketed by two separate firms. In such a case, joint ownership may be optimal. See Aghion and Tirole (1994) and Tao and Wu (1994).

should be owned by the same person (or that assets should not be jointly owned).[24]

Second, it should be noted that there is another ownership arrangement that has not been considered: 'reverse' non-integration, in which M1 owns a2 and M2 owns a1. It is easy to rule this arrangement out, however. Since a1 is the primary asset M1 works with and a2 is the primary asset M2 works with, one would expect M1 to be more productive with a1 than with a2 and M2 to be more productive with a2 than with a1. In other words, one would expect $r'(i;a2)$—the marginal return on M1's investment if he has access only to a2—to be less than $r'(i;a1)$, and $|c'(e;a1)|$—the marginal return on M2's investment if she has access only to a1—to be less than $|c'(e;a2)|$. It follows immediately from this that non-integration dominates this fourth ownership arrangement.[25]

3. *Simple things the theory can tell us about the world*

To conclude this chapter, I would like to consider whether the theory's predictions match up with the actual organizational arrangements observed. Unfortunately, there has to date been no formal testing of the property rights approach, and so in what follows I do not attempt to go beyond what is impressionistic.

One very simple implication of the theory is that, *ceteris paribus*, a party is more likely to own an asset if he or she has an important investment decision (where the investment decision might represent figuring out how to make the asset more productive or looking after the asset). As an example of this, consider the fact

[24] It is also not clear that Proposition 2(D) generalizes to the case where contracts are partially, but not totally, incomplete, i.e. where long-term contracts have some role to play. The reason is that Proposition 2(D) depends on the idea that allocating a2 to M2, say, in the absence of a1 does not increase M2's marginal return if bargaining breaks down (since a2 is useless without a1), but does lower M1's marginal return. However, if a long-term contract is in place, then disagreement corresponds to sticking to the original contract. In this case, a2 may have value to M2 under the original contract, even if M2 does not own a1, and there may therefore be some gain from allocating a2 to M2.

[25] I have also ignored stochastic ownership structures, i.e. arrangements in which, say, M1 owns a2 with probability σ and M2 owns a2 with probability $(1-\sigma)$. These are discussed further in Ch. 4.

that it is usually thought efficient for someone to own the house they live in or the car they drive (as long as they can afford to; wealth constraints are not part of the present story, but see Chapter 5).[26] Presumably the reason is that the person with most influence on the house's or car's value is the user; giving anybody else ownership or control rights in the asset would dilute the incentives of the user, with no compensating gains since this other person has no effect on asset value. So in the above model it would be like making M2 the owner of a1 and a2 when $C' = 0$.[27]

Another stylized fact consistent with this implication of the theory is that lower-level employees in an organization usually do not have significant ownership or control rights in the organization. Arguably the reason is that lower-level employees carry out (relatively) routine tasks.[28] Motivating such employees by giving them ownership rights may not therefore achieve very much in terms of increased productivity. (It is as if R' or $|C'|$ is small in the above model.) It makes more sense to allocate the scarce ownership rights so as to motivate key higher-ups, whose actions (usually) have a greater effect on company value (Proposition 2(B)) or whose human capital is very important (Proposition 2(E)).[29]

A second implication of the theory is that highly complementary assets should be under common ownership. There are many instances of this in practice (some trivial): a window of a house and the house itself are usually owned together; so are a lock and a key, the engine of a truck and its chassis; a list of clients' names and the list of their addresses.[30] There are also less obvious and more significant examples. Joskow (1985) has investigated the ownership arrangements governing electricity generating plants

[26] I am also ignoring taxes. Tax considerations can sometimes cause parties to lease an asset, say, rather than own it.

[27] An investment in a house or a car might correspond more closely to a physical capital investment than to a human capital investment. However, the same logic applies. On this, see also Ch. 3, §6.

[28] Wealth constraints could also be a factor here.

[29] In large companies, ownership and control rights are often in the hands of outside shareholders rather than key employees. It might be thought that this contradicts the theory presented here since outside shareholders do not take important actions or have essential human capital. However, shareholders make a financial investment in the company and need some protection against this investment being expropriated; ownership and control rights can be seen as providing this protection. Financial investment is discussed further in Chs. 5–8.

[30] For a discussion of examples like these, see Klein *et al.* (1978).

that site next to coal mines. Such assets are highly complementary, and not surprisingly he finds a high incidence of common ownership in the form of vertical integration. Stuckey (1983) has investigated the case of aluminium refineries that site next to bauxite mines. In this situation, the degree of complementarity is arguably even greater, since, not only are the two entities located next to each other, but also the refinery installs equipment that is specific to the particular bauxite mine. Stuckey finds that vertical integration occurs in essentially every case.

Related to the idea that complementary assets should be owned together is the idea that increasing returns to scale should lead to the formation of large firms. Under increasing returns to scale, one large asset is more productive than two assets of half the size. In a first-best world one large asset would be chosen, although, as was argued in Chapter 1, it is not clear that one can interpret this outcome as corresponding to a firm. In a second-best world the choice of the large asset is less clear, since moving from two assets to one may have undesirable incentive consequences. (M2 may invest less if she loses ownership rights.) However, if the technological returns to scale are strong enough—a limiting case is where the smaller assets are completely unproductive—then the large asset outcome will be second-best optimal. Since, according to Proposition 2(D), it makes no sense to allocate ownership of different parts of a single asset to different people, one can interpret this outcome as corresponding to a single, large firm.

Just as the theory predicts that complementarities—otherwise known as synergies—make integration more likely, so it predicts the opposite: independent assets should be separately owned. This advice is not always heeded by companies considering acquisitions—consider for example the conglomerate merger wave of the 1960s in the USA and the UK—but, at least in the 1990s, it seems to command considerable support. And, of course, there are so many instances of independent assets under separate ownership that this might be said to be the leading case empirically.

An interesting application of the idea that independent assets should be separately owned is the case of a standard competitive spot market where there are many buyers trading with many sellers. It is usually thought that non-integration is an efficient arrangement in such a market. The theory supports this. Consider

a typical non-integrated buyer M1 and a typical non-integrated seller M2. For example, M1 might be Oxford University and M2 might be Apple Computers, which, say, supplies Oxford with computers. If Oxford and Apple fail to reach agreement about the price and quality of computers, each can fairly easily switch to another partner. In other words, $R'(i) \simeq r'(i;a1)$ and $C'(e) \simeq c'(e;a2)$, and so non-integration yields approximately the first-best. In contrast, if Oxford University bought Apple, Oxford could extract some of the returns from innovative activity by Apple management (and possibly Apple workers) and so Apple would underinvest in such activity. ($|c'(e;\varnothing)|$ may be much less than $|C'(e)|$.) Thus, in the case of Oxford University and Apple—and more generally in the case of competitive buyers and sellers—integration yields considerable costs but almost no benefits.

The conclusions about strictly complementary and independent assets can throw light on a well-known idea due to Stigler (1951). Stigler argues that an industry in an early stage of development will be characterized by integration, since the industry will be too small to support specialized supply services, which are subject to increasing returns to scale. Hence firms will make their own inputs. As the industry expands, however, specialist suppliers will eventually be able to set up, and, since they are more efficient, non-integration will become optimal. The analysis is consistent with this. When the industry contains a small number of firms (possibly just one), complementarities between the purchaser(s) of input and supplier(s) of input are great, since there are few alternative trading partners. Proposition 2(D) then implies that integration is optimal. However, when the market is large enough to support many purchasers and suppliers, complementarities between any single purchaser and supplier become smaller, and Proposition 2(C) implies that non-integration is then optimal.[31]

The cases of strictly complementary assets (one buyer and one seller, who have no alternative trading partners) and independent assets (many buyers and sellers, each of whom can switch to an alternative trading partner at date 1) are both quite special. Another interesting situation is where a single seller supplies

[31] This argument implicitly assumes that as the industry expands the number of producers grows (i.e. that a few purchasers do not dominate the market). This is discussed further at the end of the section.

many buyers with input. To the extent that each buyer is worried about the possibility of hold-up, it may want to acquire ownership rights in the seller. Since it is impossible for every buyer to own 100 per cent of the seller, the best arrangement may be to give each buyer a share of the seller, with attached voting rights (and to adopt some sort of majority voting rule). An example of this in practice is an oil pipeline that is collectively owned by the oil refineries that use it (see Klein *et al.* 1978). Other examples may be various kinds of partnerships, including law firms (the partners of the law firm may all use a common input consisting of administrative services plus the law firm's name); or consumer, worker, and producer co-operatives (see Hansmann 1996). For more details on the theory behind this case, see Hart and Moore (1990).[32]

The simple model of this chapter may also help us to understand changes in organizational structure over time. A number of commentators have argued that a trend toward de-integration has occurred in the 1980s and 1990s.[33] This trend is often traced to the fact that the large factories of the past are being replaced by smaller-scale, more flexible technologies, causing a reduction in lock-in effects; and to the fact that, because of advances in information technology, agents who were previously engaged in routine tasks need to be motivated to make wise decisions on the basis of the increasing amount of information at their disposal.[34]

The model in Section 2 can explain why the above factors could be responsible for a trend toward de-integration. The increased flexibility in technology means that assets are becoming less complementary. (An asset can more easily be modified to be suitable

[32] It is worth noting that a partnership or co-operative is different from joint ownership (which, I argued above, is suboptimal). Under two-party joint ownership, both parties have a veto, which means that each party can hold up the other. In contrast, under a partnership or co-operative, decisions are (typically) made by majority rule, which means that no fixed subset of the parties has a veto. For more on the theory of co-operatives, see Hart and Moore (1994*b*).

[33] See e.g. *Business Week* (22 October 1993, Special Issue, 'Enterprise: How Entrepreneurs are Reshaping the Economy and What Big Companies can Learn'); *The Economist* (5 March 1994, 'Management Focus', 79); *Wall Street Journal* (19 December 1994, 'Manufacturers Use Supplies to Help Them Develop New Products', 1). The de-integration trend often goes under the name of 'contracting out' or 'out-sourcing'.

[34] For an interesting discussion of the impact of information technology on the size of firms, see Brynjolfsson (1994).

for a new trading partner.) The importance of individual initiative means that M1's and M2's investment decisions are both significant. According to Proposition 2(B) and (C), both forces suggest that non-integration is more likely to be optimal than before (on this, see also Brynjolfsson 1994).

It might be thought that another explanation for de-integration is that advances in information technology have reduced the costs of writing contracts. However, the theory developed here does *not* predict that non-integration is more likely the lower are contracting costs. I argued in Chapter 1 that in a zero-transaction-cost world organizational form does not matter, i.e. that non-integration and integration are equally efficient. On the other hand, this chapter has considered the case where transaction costs are so large that long-term contracts cannot be written at all. It has been shown that under these conditions non-integration and integration can both be optimal depending on the circumstances. It follows that a simple monotonic relationship between transaction costs and integration does not exist.[35]

Finally, it is worth returning to the traditional U-shaped average cost diagram in Figure 1.1. I argued that it is hard for neoclassical theory to justify this figure. The property rights approach may have an easier time. At small scales of production, a firm uses assets that are highly complementary (two machines located next to each other or several rooms of a building), or assets that exhibit increasing returns to scale, and Proposition 2(D) tells us that hold-up problems would be increased if these assets were not under common ownership. In other words, initially the average cost of carrying out activities within the firm is declining. However, when the firm extends beyond a certain point, synergies between assets may fall. In particular, the manager and assets at the centre will become less important with regard to operations at the periphery, in the sense that investments at the periphery are unlikely to be specific either to the manager or to the assets at the centre. (In a large firm, the centre and the periphery may for many purposes operate almost independently.) In addition, investments at the centre are unlikely to be enhanced very much by the existence of the periphery.

[35] Also, it is not clear empirically that contracting costs *have* fallen as a result of advances in information technology; see Brynjolfsson (1994) and the references therein.

According to Proposition 2(C), the average cost of carrying out activities within the firm starts to rise.

In a rough sense, then, the theory developed in this chapter is consistent with the story about firm size found in every standard microeconomics textbook.[36]

[36] Throughout this chaper, I have ignored the effect of imperfect competition. That is, I have supposed that any contract M1 and M2 enter into, including a change in ownership, has a negligible impact on any other parties, including consumers. This assumption is clearly very restrictive, but I have made it because I wanted to focus on the 'efficiency' reason for firms and for integration. In practice, of course, not all integration decisions are made for efficiency reasons. Firms integrate horizontally to raise prices to consumers. Firms integrate vertically to foreclose on rival purchasers and suppliers. There is a huge industrial organization literature on mergers, although very little of it has taken an incomplete contracting approach. (For a discussion of the literature, see Tirole (1988); two papers that do take an incomplete contracting approach are Bolton and Whinston (1993) and Hart and Tirole (1990).) The theory developed in this book should be a useful ingredient in future work in this area.