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**Understanding Ownership:
Residual Rights of Control and
Appropriable Control Rights**

by

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Abstract

We discuss the notion of ownership in economics, taking our point of departure in the Grossman-Hart-Moore property rights approach. We criticize the exclusive identification of ownership with residual rights to control in this approach, and argue that economic organization may be rendered determinate under complete contracting (contrary to the GHM approach). Crucially, we argue that under complete contracting, some control rights may be appropriable because of measurement and enforcement costs. This holds the key to a theory of ownership that is not dependent on the notion of residual rights to control, but rather relies on appropriable control rights. However, the two perspectives may be complementary rather than rival.

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Introduction

What is the meaning of ownership in economics and why does it matter for economic organization? These issues were brought to economists' attention by Ronald Coase's (1960) pioneering paper, and gave rise to what was once called "the property rights approach" (e.g., Alchian 1965; Demsetz 1967; Alchian and Demsetz 1972; Barzel 1982, 1987, 1994, 1997). However, modern (formal) economists increasingly tend to think of ownership and its implication from a different perspective, namely from that of the Grossman-Hart-Moore approach (henceforth, the "GHM approach") (Grossman and Hart 1986; Hart and Moore 1990; Hart 1991, 1995). Sometimes this hugely successful approach is also called "the property rights approach", but it is not identical to its non-formal predecessor.

Strong claims are made in the GHM approach about the category of ownership. More specifically, ownership is defined as *residual* control rights to assets, that is, the right to determine the uses of assets under circumstances that are not specified in a contract. Because it is assumed that ownership is perfectly enforceable by courts (while contracts are not), ownership over assets provides "status quo points" (or "threat points") for the parties' bargaining over the surplus from contracting, which influence their investment incentives. In contrast, ownership cannot be associated with the notion of rights to residual income, as in the older property rights literature.

In this paper we shall discuss the GHM approach from a critical perspective informed by the "older" property rights economics. The novel contribution of the paper is to contest a number of basic claims made about ownership in the GHM approach and to suggest an alternative.¹ This does not mean that we think that of the notion of ownership as control rights as nonsensical. Rather, the point is that much of the literature has not gone sufficiently far in thinking about control. In particular, it has neglected a particular category of control rights, namely what we call "*appropriable control rights*". As a general matter, this concept refers to reallocation of rights by means of appropriation by one or more of the parties to a contract. Thus, shirking (Alchian and Demsetz 1972) is one example of an agent appropriating control rights, but the concept has a much broader coverage. Generally, appropriation of control rights will take place when there are costs of detecting

¹ In his review of Hart (1995), Demsetz (1998) also criticizes Hart's use of the concept of ownership. Though related, his perspective is, however, different from ours.

appropriation, of taking precautionary measures against appropriation, and of verifying that appropriation has taken place to a third party. Appropriable control rights *directly* influence behavior because they determine the residual income from the use of assets. This is in contrast to the residual rights of control, stressed in the GHM approach, where the link between residual rights of control and residual income is only indirectly established through the effect on bargaining power.

Furthermore, in contrast to residual rights of control, appropriable control rights exist under complete (or comprehensive) contracting. For example, under complete contracting, there may be variability that necessitates measurement activities. The presence of measurement costs means that some control rights will effectively be appropriable. Economizing with measurement costs may be sufficient to render ownership – in the sense of concentration of appropriable control rights – determinate. For example, dissipation may be minimized if appropriable control rights are concentrated in the hands of one agent, along with residual rights to income. Per implication economic organization may be determinate even under complete contracting. However, the aim is not to reject the GHM approach; the two concepts of control rights are not substitutes, but rather complements. Thus, the notion of appropriable control rights may be combined with the GHM emphasis on residual rights of control. This helps remedying some deficiencies in the GHM approach, such as its inability to account for, for example, quasi-vertical integration, rental contracts, and the employment relation.

We begin by presenting the GHM approach in broad outline (“*The GHM Approach to Ownership and Economic Organization*”), and then turn to a broad critical discussion of the approach. Our basic critique is that there is a fundamental *asymmetry* in the GHM approach: Whereas residual rights of control are fully enforceable in courts, contracts are not (“*Legal Ownership, Economic Rights, and the Asymmetry in the GHM Approach*”). This asymmetry arise because property rights are not properly considered as multi-dimensional, which limites the explanatory potential of the GHM approach. We argue that considering appropriable control right eliminates this asymmetry by stressing the inability to fully enforce all property rights and thereby making explicit the many ways in which residual income arises. Moreover, we point out that this notion of ownership is consistent with complete contracting and that economic organization (e.g., the firm-market choice) may therefore be rendered determinate under complete contracting (“*Ownership and*

Complete Contracts”). Finally, we examine the implication for the GHM approach of incorporating appropriable control rights, and point out that this makes it possible to derive conclusions that run counter to those of this approach (“*Implications for the Grossman-Hart-Moore Approach*”).

The Grossman-Hart-Moore Approach to Ownership

Following the pioneering paper by Sanford Grossman and Oliver Hart (1986), “The Costs and Benefits of Ownership”, the GHM approach has become virtually dominant in the modern economics of organization. In addition to the issues traditionally considered in the theory of the firm – such as the boundaries of the firm – the GHM approach has been applied to, for example, corporate finance (Hart 1995), corporate governance, the organization of production in public versus private firms, and the boundaries of knowledge-intensive firms (Brynjolfsson 1994). Moreover, the approach is continuously being refined (notably Rabin 1993; Farrell and Gibbons 1995; Noeldeke and Schmidt 1995; Hart and Moore 1998; Rajan and Zingales 1998), and extended, for example, combined with ideas from principal-agent theory (Holmström and Milgrom 1991, 1994).

The GHM approach makes a number of strong claims about ownership and its implications for economic organization. We briefly review these here.

First, it is argued that ownership should be associated with the notion of residual rights to control rather than with the notion of residual rights to income (as in, e.g., Jensen and Meckling 1976). In support of this, the noted American legal scholar and judge, Oliver Wendell Holmes is quoted (in Hart 1995: 30n):

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.

In effect, the concept of ownership in the GHM framework is made virtually identical to that of lawyers, although no compelling explicit reason is given for why economists should

necessarily adopt the juristic conception of ownership.² The implicit reason arguably is that only this conception of ownership will allow one to discriminate between alternative types of economic organization, such as integration or non-integration.

Second, granting that ownership means residual rights to control, this notion per definition only makes sense under incomplete contracting, since residual rights of control are defined as the rights to determine the uses of assets under circumstances that are not covered by contractual terms.³ Strictly speaking, ownership doesn't exist under complete contracting according to the GHM approach. Complete contracting obtains when contracts are such that "... the list of conditions on which the actions are based is exhaustive, that is, ... the contract provides explicitly for all possible conditions" (Shavell 1998: 436).⁴

Third, under complete contracting, economic organization is indeterminate, exactly as economic organization is indeterminate under Arrow-Debreu contracting (i.e., full contingent claims contracting with no asymmetric information). Per implication, perspectives that work out of a complete contracting set-up, such as principal-agent theory or measurement cost theory, cannot explain, for example, the boundaries of the firm and are in general lacking of a convincing theory of ownership.

Given these basic assumptions, the GHM approach may now be summarized thus. Historically and conceptually, the GHM approach has been developed in the context of the theory of the firm, more precisely the analysis of the vertical boundaries of the firm (Grossman and Hart 1986). Applied to firms, the approach begins from the idea that ownership of non-human assets is what defines firms. Thus if two different assets are owned by one person, we are dealing with one firm, whereas if the same two assets were

² Hart (1995: 30) refers to "common sense" as justification.

³ Incomplete contracting obtains if performance of the original terms of agreement leaves gains from trade unrealized *given* the information available to the parties to the contract at the time performance takes place (Masten 1998). Incomplete contracting implies that some actions and payments will have to be determined *ex post*. The difference between complete and incomplete contracting also has to do with the role of the court. In complete contracting theories, courts are assumed to enforce the original agreement, and ordering is efficacious, even if all information may not be available to the court. This is in contrast to the incomplete contracting approach where the incompleteness of contracts introduces opportunities for recontracting and where court enforcement of the original terms would leave gains from trade unrealized given the information available to courts at the time performance takes place.

⁴ However, although all contingencies can be specified, the court may not be able to verify some contingencies or outcomes. The parties may therefore not be able to condition performance on every relevant contingency. However, under complete contracting, all payments and actions can be specified *ex ante*.

owned by different persons, we would be dealing with two different firms. The assets that are relevant here are non-human assets, since human assets are non-alienable. The importance of non-human assets derives from their (potential) function as bargaining levers in situations that are not covered by contract. This may be crucially important in situations where the parties have invested in specific assets – notably, investments in the parties’ own human capital – and these assets are complementary to specific non-human assets. Crucially, the parties’ investments in human assets are assumed to be non-contractible.

All bargaining that follows after the parties have made their investments in human assets is assumed to be efficient (in contrast to, e.g., Williamson 1996). Therefore, the model revolves around the effect of ownership of non-human assets on the incentives to invest in human assets. Specifically, bargaining determines the allocation of returns from investments, so that each party gets his opportunity cost plus a share (they are assumed to share 50: 50) of the (verifiable) profit stream. Since in this set-up individual returns will differ from social returns, and agents are sufficiently farsighted to foresee this, investments will be inefficient. It is possible to influence the investment of one of the parties positively by reallocating ownership rights to non-human assets. A reallocation of ownership of physical assets alters the parties’ opportunity costs of non-cooperation (the status quo point) after the specific investment have been made, and thus the expected payoffs from the investment. However, this comes only at the cost of reducing one of the parties’ investment incentives (excepting the situation in which the parties’ marginal costs of investment are equal). This trade-off determines the efficient boundaries of the firm. Thus, the central issue is why it matters who owns an asset or a bundle of assets.

Critiques of the Grossman-Hart-Moore Approach

The reasons for the success of the GHM approach are not hard to discern: It is taken to be a rigorous approach that successfully addresses many of the weaknesses of alternative (but related) approaches, such as the transaction cost economics approach of Oliver Williamson (1996). However, the approach has not gone entirely without criticism. In this section, we first very briefly state existing critique, and then turn to our own critical points.

Existing Critiques

In the GHM approach it is routinely assumed that agents can perform dynamic programming, even though they are taken to be boundedly rational. This has been subjected to criticism on the grounds of lack of plausibility (Kreps 1996). From a different perspective, the approach has been criticized for its supposed lack of rigor when it comes to the notion of contractual incompleteness, something which is postulated rather than derived within the model (Maskin and Tirole 1997). Moreover, it has been argued that the GHM approach tends to exaggerate the need to rely on allocating property rights when clever sharing rules can often do the same job (Tirole 1998). It has also been pointed out that the approach probably overestimates the extent to which specific assets are protected through the allocation of property rights, since relational contracting can often accomplish the same (Holmström and Roberts 1998). Finally, objections have been raised about the importance of residual rights in determining ownership. As pointed out by Demsetz (1998), the value of ownership derives from the value of *all* rights in an asset – and not just the residual rights emphasized in the GMH approach.

Our Critical Points

Our critical points are different from the ones above. In contrast to most of the above critics we are explicitly inspired by “older” property rights economics of Coase (1960), Alchian (1965), Demsetz (1967), Cheung (1983), Jensen, Meckling (Jensen and Meckling 1976) and Barzel (1994, 1997). In this largely non-formal tradition, ownership and property rights are more multi-dimensional than in the GHM approach. Specifically, the notion of property rights refers to a vector of rights, such as use rights, the rights to derive income from assets, and the rights to alienate the assets – and not just residual rights to control.⁵

Applied to the GHM approach, this insight means, in our view, that the link between residual rights of control and residual income rights is much more blurred than portrayed in the GHM approach. This is because recognizing the multi-dimensionality of property rights reveals a fundamental asymmetry in GHM approach. Specifically, ownership in the sense

⁵ However, even the latter notion is somewhat broader than it may seem at first sight, for in the GHM approach, residual rights to control are taken to encompass not only the rights to use assets, but also to “... decide when or even whether to sell the asset” (Hart 1995: 65).

of residual rights to exercise control is taken to be fully enforceable in court, while contracts are taken to be non-enforceable because of non-verifiable contract clauses. However, when one recognizes the multi-dimensionality of property rights, ownership may be no more of a protection against appropriation than contractual arrangements. For example, rental arrangements and employment contracts will give rise to agency costs, which stem partly from the loss of the agent appropriating control rights. These losses are incurred even in complete contract world, as principal-agent theory demonstrates (i.e., the difference between first-best and second-best outcomes). In fact, it is hard to understand rental agreements, quasi-integration and the employment contract at all, if one does not consider appropriable control rights.

The conclusion that we draw from these critiques of the GHM approach is that the allocation of appropriable control rights matters for, for example, the outcomes of the uses that are made of assets. This is sufficient to render ownership of such assets determinate. In other words, ownership (in the sense of an allocation of control rights) is determinate in a complete contracting world. In the following sections, we shall elaborate these critiques of the GHM approach and the more constructive lessons that we draw from these critiques.

Residual Rights to Control and Rights to Residual Income

In the writings of the “old” property right theorists ownership typically means possessing the rights to residual income rather than residual rights to control (e.g., Alchian and Demsetz 1972). The reason for the strong emphasis on rights to residual income is, of course, that it is the allocation of these rights that directly influence behavior, not residual rights of control *per se*. However, control rights and rights to residual income are clearly related. For example, in Alchian and Demsetz’ analysis rights to residual income are allocated to the monitor of the productive team to ensure that he confronts incentives to supply an efficient level of monitoring effort.

Hart (1989, 1995: 63-66) is explicitly critical of the notion of ownership as rights to residual income, which, he claims, is “... not a very robust or interesting theoretical concept” (1995: 64). Among the reasons given for this is that residual income rights are *divisible* which residual control rights are not “in the same way” (p.64n).

However, both in principle and in practice these rights are indeed divisible and transactable. For example, one may imagine joint ownership of a taxicab, where one chauffeur drives it on Monday to Wednesday, and the other one drives it from Wednesday to Sunday both having full rights to the use of the asset within certain pre-negotiated contractual restrictions. Timesharing of condominiums is another quite prevalent phenomenon. Indeed, Hart implicitly admits that residual rights of control are divisible when he talks about “forms of intermediate ownership” (p.61), and refers to delegation in this context (citing Aghion and Tirole 1997). However, Hart also includes in the notion of residual rights to control the right to veto the use of assets and to alienate the asset. A problem is that this does not necessarily make the distinction between who holds ownership and who does not more precise, since even this right may be not be exercised unanimously (as with joint ownership of assets in marriages).⁶

Moreover, inspection of the structure of GHM models reveals that residual rights to income are crucial also in these models, and that there is a close connection between these rights and control rights, exactly as there is in, for example, Alchian and Demsetz (1972). Recall from the summary made in the previous section that in GHM models what drives investment incentives is in fact expectations about the division of the surplus, that is, the rights to income that the parties establish through bargaining (see Barzel (1994) on this). The importance of residual rights of control with respect to influencing behavior only becomes apparent through the way in which they influence the “status quo point” and thereby the bargaining power of the parties. However, the influence of ownership over physical assets depends on the options for uses of assets provided by formal ownership. This in turn depends on the opportunity costs of alternative uses of the available assets⁷ and on the enforcement of ownership rights (which arbitrarily is assumed to be perfect).

⁶ In response to this argument, Hart (1995) probably would point out that joint ownership of assets is always suboptimal if investments is in human capital. This is because a division of control rights to assets must always leave the parties with strictly complementary bundles of control rights so that a human capital investment cannot increase the productivity of a bundle of rights without access to the complementary bundle. However, it cannot be assumed *a priori* that all divisions of rights create complementarities of this kind. It is, after all, an empirical question as to what extent it is possible to divide control rights into non-complementary bundles.

⁷ However, there are certain problems of defining all relevant opportunity costs in an incomplete contract world. Contractual incompleteness may be due to high costs of specifying and verifying certain uses of assets, the lack of ability to foresee all possible uses of assets, or the lack of ability to foresee all future contingencies. In the two latter cases, the opportunity cost of non-corporation may be ill-defined, simply because future contingencies may change what are the best alternative uses of assets and these contingencies

In sum, the implication of the reasoning in this section is that it is doubtful how much is added by focusing *exclusively* on residual rights to control. This is because, first, this concept is also inadequate with respect to providing a clear cut definition of who holds ownership (such rights are also divisible), and second, in reality, what is just as important in these models as control rights are residual rights to income. Finally, in the following sections, we shall argue that residual rights to income are not just influenced by residual rights of control but also by appropriable control rights.

Legal Ownership, Economic Rights and the Asymmetry in the Grossman-Hart-Moore Approach

As mentioned earlier, the GHM approach is certainly not the only tradition within the broader context of property rights theory. Important modern contributions to a different stream of property rights theory, which is more in line with the Coase-Alchian-Demsetz tradition, have been made by Yoram Barzel (1982, 1994, 1997). In order to understand better the notion of appropriable control rights, it is instructive to contrast his notion of property rights and ownership with Hart's notion. Barzel strongly emphasizes the difference between legal formal title to assets on the one hand and economic rights to assets on the other hand. For example, he (Barzel 1994: 394; emphasis in original) goes as far as defining economic rights over an asset

... as an individual's net valuation, in expected terms, of the ability to directly consume the services of the asset, or to consume it indirectly through exchange. A key word is *ability*: The definition is concerned not with what people are legally entitled to do but with what they believe they can do.

In this view, the thief literally speaking holds property rights to the car he has just stolen. It is a view of property rights that is completely divorced from legal considerations.

In contrast, the distinction between legal formal title to assets and economic rights to assets is not explicitly made in the GHM approach.⁸ Control rights, which are equated with

may not be foreseen. Thus, opportunity costs may change as new opportunities or contingencies become apparent and change the bargaining power of the parties and the value to the parties of ownership over assets. However, this is not part of the GMH approach.

⁸ A consequence of not adequately making a distinction between holding legal title to assets and economic ownership is that it becomes difficult to account for the creation of property rights in the context of the GHM

ownership rights, are supposed to be completely backed-up by the legal system, including the courts. In our terminology, these rights are non-appropriable or “secure”. Ironically, for an approach that has made so much out of its symmetrical treatment of the costs and benefits of ownership (Hart 1991: 139), this is a clear asymmetry, since some property rights are assumed - arbitrarily - to be fully enforceable, while others are not. What is the source of this asymmetry?

Arguably, one source can be found in the use made of bounded rationality and/or asymmetric information in GHM models. In a bounded rationality interpretation of the GHM approach (Hart 1990), all prices and uses of assets are supposed to be known to agents. However, although agents are assumed to be able to fully anticipate (perhaps probabilistically) the payoffs from their relations, they cannot anticipate some future states. Thus, contracts are left incomplete. This may alternatively be interpreted in terms of asymmetric information. Thus, all states are in fact anticipated, but for some reason, agents are unable to specify their plans or the nature of these states in ways so that a court can ascertain whether a certain plan/state materialized or not (Hart 1995). Either way it boils to an assertion that some rights are unenforceable in court while others are not.

However, no basic reason is given for why ownership rights are fully enforceable in court whereas some contractually stipulated rights are not. Lawson (1994: 139; emphasis in original) notes that “[l]awyers ... are likely to be more sensitive than philosophers to the real-world problems of *proof* that often accompany legal claims of ownership”. (Apparently, we may place economists in the same category as philosophers with respect to this issue). In fact, the bounded rationality/asymmetric information of courts is likely to be an impediment to a certain outcome of court litigation over ownership claims *as well as* over contracts.

approach (but see Rajan and Zingales (1998) for a recent attempt). To put it in the terms of Barzel (1997), in the GHM approach there is only one clearly identified “public domain” in which capture attempts may take place, namely with respect to capturing others’ investments in their own human capital. However, in actuality there are many other public domains in which capture attempts may take place, but in the GHM approach these are defined away by the assumption of symmetric information. Of course, this is related to the well-known critique that the GHM approach arbitrarily assumes that certain investments are contractible and enforceable in court, while others aren’t.

Ownership, Appropriable Control Rights and Complete Contracts

Appropriable Control Rights

It is a crucial idea in the GHM approach that ownership cannot be understood under a complete contracting regime. Thus, Hart (1995: 5) argues that

[i]f contracting costs are zero, we can sign a rental agreement that is as effective as a change in ownership. In particular, the rental contract can specify exactly what I can do with the machine, when I can have access to it, what happens if the machine breaks down, what rights you have to use the machine, and so on. Given this, however, it is unclear why changes in asset ownership ever need take place.⁹

The flip-side of this reasoning is that in order to find a room for ownership, it is necessary to make a break with the assumption of complete contracting, although the assumption of symmetric information may be (and is) introduced for an analytical convenience.

However, to make ownership indeterminate it is required not only to assume that contracting costs are zero, but also that there is symmetric information. In other words, we only agree with the quotation above if Arrow-Debreu contracting obtains. Our point is that even if complete contracting obtains, and the contract may "... specify exactly what I can do with the machine", there may still be costs of measuring my wear and tear of that machine. This means that, in effect, there will be control rights that while they can in fact be written into a contract may not be enforceable, because of measurement costs.¹⁰ These are *appropriable control rights*. This distinction between control rights that can be enforced and those that cannot (and which are therefore appropriable) because of measurement costs is essential to our reasoning in the following.

⁹ It is somewhat inconsistent that Hart talks about a rental agreement, which presumes the existence of an owner, and then talk about signing a rental agreement in the context of zero contracting cost, that is, when according to his own logic, there shouldn't be any owners (or at least, ownership is indeterminate) (thanks to Jerome Davis for directing our attention to this).

¹⁰ This may sound as if we have implicitly moved to an incomplete contracting setting. However, this is not the case. Contracts are incomplete if parties are unable to specify their plans ex ante to the time action take place; otherwise, they are complete.

Note that in contrast to the GHM approach, we provide a reason why some rights are appropriable while others are not.¹¹ Also note that our notion of appropriable control rights is *not* identical to the notion of residual rights of control in the GHM approach. Whereas the GHM approach stresses that residual rights of control arise from high costs of drafting contracts, we emphasize that appropriation of control rights will take place whenever there are costs of detecting appropriation, of taking precautionary measures against appropriation, and of verifying that appropriation has taken place to a third party. These costs may exist even under complete contracting, and so may appropriable control rights. Minimizing losses due to the appropriation of control rights may render ownership determinate, as we argue next.

Complete Contracting, Asset Ownership, and Appropriable Control Rights

We argue that when there are appropriable control rights, this may explain asset ownership. The use of a durable asset requires not only that it paid its marginal product but also that it is paid for use-induced depreciation. Assume that it is harder to detect the depreciation of the asset after it has been used than when it is being used (e.g., a rental car).¹² Thus, the costs of measuring the wear and tear differ in the two situations. Also suppose that it is less costly to carelessly use than to carefully use an asset.

Consider three different arrangements. In the first arrangement the residual claimant and the user are two different persons and the residual claimant monitors use himself. The optimal amount of monitoring performed by the residual claimant depends on his marginal opportunity costs of monitoring and the marginal benefit of monitoring. Assuming that the residual claimant has high opportunity costs of monitoring, the result will be an extensive monitoring with an imperfect specification of the depreciation of the asset and therefore also an imperfect pricing of the cost of carelessness in the handling of the asset. The user of the asset will be charged a premium that covers the residual claimant's opportunity cost of

¹¹ Furthermore, note that this also differs from principal-agent theory, where asymmetric information (of effort, the realization of some stochastic variable, etc.) is basically assumed/asserted, no economic reason being given for the asymmetry in question.

¹² This may not always hold true, but we believe it holds true with sufficient regularity to be interesting. We shall also assume that any user of an asset understands the causal connections between his actions and the rate of depreciation of the asset (at least broadly).

monitoring plus an additional premium, namely one that covers the expected losses from the imperfect pricing of the depreciation of the asset.

The second arrangement is one where the residual claimant hires a monitor. Assuming competitive conditions, the residual claimant will do this if the residual claimant's opportunity costs in monitoring exceeds those of the monitor plus the costs that the residual claimant has to incur in order to ensure that the monitor is monitoring efficiently (e.g., setting up an incentive payment). When these conditions are realized this arrangement results in a more intensive monitoring and a more precise pricing of the depreciation. This reduce the premium the user have to pay for expected excessive depreciation which in turn induces more uses with low costs of careful handling of the asset to participate in the arrangement.

The third arrangement is to grant the user the ownership in the sense of concentrating control rights in the hands of the residual claimant – a situation that in the case of complete contracts is not acknowledged by Hart (1995). This arrangement will result in the optimal rate of depreciation since the user having the lowest costs of measurement will come closest to setting marginal costs of carefulness equal to marginal benefits. From the perspective of a (careful) user of the asset, owning the asset instead means that he does not have to pay the premium to cover the higher measurement costs and expected greater depreciation (Alchian and Demsetz 1972).

Under certain conditions, the value of the asset is maximized by ownership rather than by arrangements where the residual claimant put the asset up for rent. What are these conditions? Important conditions have to do with whether the asset can only be used in a team-like manner and the scale of the asset. Thus, efficient use may require that the asset be used by a team. Because of the nature of team production, control rights will be divided among the members of the team (Alchian and Demsetz 1972). In the presence of measurement costs, this may preclude any of the holders of the rights to maximize their residual, even though all control rights can be contractually specified. Given this, enforceable control rights implicitly specify the limits to which each team member can contribute to the depreciation of the asset.

In this situation, it will pay to allocate appropriable control rights to those team members who have the lowest opportunity costs of exercising care in the use of the asset since this

will reduce the optimal monitoring costs. In turn, these opportunity costs can be influenced by the specification of rights to residual income from the team's activities and from the use of the asset. Since the careful user is more responsive to such incentives than the careless user, joint production will be maximized by this allocation. Therefore, it may pay to concentrate both the rights to residual income from the asset and the appropriable control rights over the asset in the hands of a limited subset of the team's members, possibly in the hands of only one team member.

This explains why ownership may be efficient relative to rental agreements with residual claimancy. Note that we have explained ownership here using Alchian and Demsetz' insights in team production. However, where they use team production to rationalize the existence of a monitor/residual claimant, we have used team production to rationalize asset ownership.

Scale considerations also matter. Thus, for reasons related to the case of team use of an asset. Operating large-scale assets efficiently normally (if not necessarily always) requires that several people have access to it, and this creates the same problems of measuring the depreciation of the asset, and the same solutions of concentrating control rights and residual income rights. From the point of view of a user, the advantage of small-scale assets, like the key to a lock or a telephone, is that they normally can be used effectively by only a *single* user. In this case, it is usually efficient to concentrate ownership in the hands of the single user right away, although even for such assets one may imagine various rental agreements, where control rights and possibly also residual income rights are divided (e.g., telephones in developing countries).

Clearly, these explanations of ownership have nothing to do with the hold-up situation that is so central in the GHM approach. In fact, the very set-up that we have briefly discussed cannot be treated within the GHM approach. This is because a holder of control rights can costlessly have his rights enforced by courts, even if he had signed an incomplete rental contract, leaving the use of the asset in the hand of somebody else. Of course, this is related to the asymmetry in the GHM approach that we discussed earlier, namely that while ownership is fully enforceable, some contractual terms are not.

Our conclusion is that patterns of ownership may well reflect economizing on the costs of measuring certain (levels of) attributes of assets (Barzel 1997), given variability and private

information. Crucially, the pattern of ownership can be rendered determinate even under complete contracting, supposing that there are costs of measuring the use of assets.

Related Approaches

Holmström and Milgrom (1991, 1994) and Holmström and Roberts (1998) arrive at somewhat related conclusions in their multitask agency models.¹³ It is an implication of the GHM approach that whether a person is employed by a firm or interact with the firm through market contracting turns on how much his non-contractible investments influence joint surplus. Non-human assets are also central in this story because the degree of complementarity between human and non-human assets influence joint surplus and because the holder of control rights to such assets has a strong bargaining lever that gives him authority over employees. Therefore, the degree of asset specificity should influence the extent to which firms employ or contract out.

Holmström and Milgrom (1991, 1994) and Holmström and Roberts (1998) discuss the issue of why some firms have their own sales force while other firms contract with independent agents. Empirically, asset specificity does not appear to be determinative of the choice between having an employed salesforce or independent agents, while measurement costs and agency concerns do (Anderson 1985). This is contrary to the GHM story, if not to a multitask agency/measurement cost story.

If agents work on multiple tasks, some of these tasks may be very costly to measure (e.g., preserving good relations to customers); however, performing them is vital to the firm. If employees are only rewarded in terms of how well they carry out measurable activities (outputs), they will shift all their effort toward these activities. Hence, firms that confront essential, but hard-to-measure, activities, will provide low-powered incentives and have their own employed sales force. Giving low-powered incentives to outside agents will not do, since this will only mean that they will shift their effort towards the products of other firms. In other words, measurement costs and agency concerns help explaining the

¹³ However, these models differ from our reasoning by not including the monitor's opportunity costs and by making assumptions about the risk-preferences of agents that we are not making. Moreover, the emphasis in their models is on ownership as rights to residual income. Finally, they do not consider as many margins as we do. Thus, in their models measurements costs are prohibitive so that it does not pay, for example, to hire a monitor or become self-employed as monitor.

boundaries of the firm, irrespective of considerations of assets specificity, and at variance with the GHM approach.

The reasoning in the previous sections suggests why one may be at least uncomfortable with this position. While it is true as a matter of definition that residual rights to control do not exist under complete contracting, the concept of ownership is not necessarily completely covered by the category of residual control rights. Rights to residual income are arguably just as important or perhaps more important for making sense of ownership, and these rights can certainly be defined under a complete contracting regime.

Implications for the Grossman-Hart-Moore Framework

Although we have criticized the GHM notion of ownership, we believe that ownership and economic organization may be determinate even in an complete contracting setting and that the notion of ownership as concentration of appropriable control rights have implications for the GHM approach. Thus, this paper should not be read as a call for abandoning the GHM approach, but perhaps for making it more realistic with respect to its analysis of the allocation of different types of rights. This may make the GHM approach better able to handle certain real-world phenomena that it cannot adequately explain at its present state of development. We consider these first, and then turn to a broader discussion of the relations between residual and specific control rights on the one hand, and appropriable and non-appropriable control rights on the other hand.

Anomalies for the GHM Approach

Consider the case of so-called “quasi-vertical integration”, that is, the ownership arrangement (which has been extensively used in the US automobile industry) of having a firm owning a significant number of the complementary alienable assets of its supplier. On one level, this is completely consistent with the GHM approach: The ownership arrangement reflects an attempt to protect against hold-up on the part of the supplier. On another level, however, quasi-vertical integration is puzzling in the context of the GHM

approach, since it is hard to rationalize why the firm that owns the complementary alienable assets hasn't also employed the persons working in the other firm¹⁴.

More generally, it is hard to rationalize the employment contract at all within the GHM approach. In a discussion of this, Hart (1995: 71) refers to the idea that a benefit of the employment contract is that carrying out activities within a firm means that information may be exchanged more readily. The reason, according to Hart, is that the employer's control over assets gives him bargaining power over the employee, which implies that the employee may have an incentive to establish himself as reliable (thus possibly increasing his future wage). But this argument may be countered by asking, Why can't quasi-vertical integration accomplish the same? The possession of ownership rights to the complementary alienable assets of another firm could do exactly the same with respect to information revelation. The GHM approach may explain authority, but it does not explain the employment contract.

The decision whether to employ or to use quasi-vertical integration, which cannot be addressed within the GHM approach, may be understood by adding appropriable control rights to the GHM framework. Specifically, if the exercise of appropriable decision rights crucially influence payoffs from the use of assets, the employment contract may be superior to quasi-vertical integration, whereas the opposite holds true when the exercise of appropriable control rights are not critical to payoffs. There are two reasons for this.

First, the courts treat employees and independent contractors differently; notably, employees have to meet obligations that independent contractors do not. This means that although the employment contract is incomplete, there are rather definite limits to what employees can do with respect to their exercise of appropriable rights. Second, the employment contract confers to the employer the right to monitor and sanction the employee in ways that cannot be applied to an independent contractor. These characteristics mean that the employer is in a superior position to monitor and sanction the employee's

¹⁴ The argument would probably run as follows: There is a number of other assets in the supplier firm which is specific to investments in human capital of the owner of that firm and for the use of which he needs employees. Transferring the employees to the owner of the specific assets is not efficiency enhancing since their marginal productivity is lower in that firm than in the supplier firm.

exercise of appropriable decision rights. Thus, the employment contract will be chosen when the exercise of these rights is important to payoffs.¹⁵

The Relations between Dimensions of Rights

In this paper we have discussed two conceptually different classifications of rights, namely the distinction between residual and specific rights on the one hand, and the distinction between appropriable and non-appropriable control rights on the other hand. However, as already suggested, these two classifications are not mutually exclusive, but are rather complementary. Table I juxtaposes the two classifications, and maps alternative theories according to which concepts of rights they (primarily) rely on.

TABLE I

Categorizing theories in terms of rights

	Appropriable rights	Non-Appropriable rights
Residual rights	<i>Theories of regulatory capture, rent-seeking, lobbying, etc. Also legal theories.</i>	<i>The GHM approach</i>
Specific rights	<i>Measurement cost and agency theory</i>	<i>Arrow-Debreu contracting</i>

So far we have primarily been taken up with discussing the “specific rights-appropriable rights” box and the “residual rights-non-appropriable rights” box. One of the remaining boxes, namely “specific rights-non-appropriable rights”, is one treated in Arrow-Debreu contracting. However, the final remaining box, namely “residual rights-appropriable rights”, has been given less attention. In our view, theories of, for example, regulatory capture and

¹⁵ This can be interpreted in agency theory frame (Holmstrom and Milgrom, 1994) as a reduction in the error in the signals of effort which agents produce in different tasks due to more effective monitoring in employment relationships.

other examples of interaction between the political and administrative process and economic agents belong here. This is because these theories directly address the change of property rights, for example, through influence activities. Moreover, legal theories about ownership, that is, theories that specify "... the actions and/or conditions necessary to establish an ownership claim" (Lawson 1994: 140), evidently also belong here.

One should also consider the interaction between the boxes, and we have taken some steps towards this (cf. also Milgrom and Roberts 1991, 1994). Specifically, we have argued that progress may be made by combining a focus on appropriable, specific rights with a focus on non-appropriable, residual rights. However, future research should also consider more fully appropriable, residual rights in the context of economic organization. For the moment, we rest content with illustrating by means of an informal example that it makes a difference to the GHM approach whether our concept of appropriable control rights is included. Specifically, we want to argue that it may produce implications that run counter to those that are produced by the GHM approach (without explicit consideration of appropriable control rights).

Combining Residual Rights of Control and Appropriable Control Rights:

An Example

Consider two agents, A and B, who want to establish an employer-employee relation. There is one physical asset, X, involved in the relation. The asset cannot be used if A and B does not both work with it. It is assumed that only A can undertake investments in human capital.

Thus, there are two possible arrangements, 1) A owns X and employs B, or 2) B employs A, and owns X. According to the GHM approach, 1) will be chosen, since this implies a lower loss because of hold-up than 2).

However, this conclusion may change if we introduce the possibility of shirking, that is, the capture of appropriable control rights. The specific form of shirking we here examine relates to how an agent operates the physical asset with which he works. He can operate it carefully or less carefully. It is costly to measure how much care a given agent takes in handling the asset. However, there are two types of activities that any agent can engage in. The first of these operates the asset in a routine way. Routine tasks are not costly to monitor, since a small sampling of the agent's effort or output is very informative about his

overall performance with respect to taking care in handling the asset. However, in the case of complex tasks, it is very costly to measure how much care the agent takes in handling the asset.

If B undertakes routine tasks, the GHM conclusion is reached: A should own the physical asset in the GHM sense of possessing residual rights of control to it. It is not very costly to measure how much wear and tear he has imposed on the asset, and these costs cannot overwhelm the loss from the possible hold-up. This changes if instead B is assumed to undertake a complex task.

From the perspective of agent A, the return on his investment in human capital depends on the joint surplus from the relation. The size of the surplus is influenced by the care that B takes in handling the physical asset. If B works in a complex way with the asset, it is very costly for A to measure the wear and tear that B imposes on the asset.

However, in this situation, it may pay to give B residual rights to control to the asset – although it is still only A who can undertake investments in human capital. This is because giving B the ownership to the asset improves his incentives to treat it in a careful way, and thus eliminates the need for monitoring. The resources saved on reduced monitoring may swamp the loss from B now being able to hold up A.¹⁶

Conclusions

The GHM approach has emerged as a dominant approach to the study of the economics of organization. This position has motivated the present discussion. Although we admire the approach, we also feel that it may have been oversold by its advocates and that it is not as unambiguous and clear cut as at least more informal discussions suggest (e.g., Hart 1995). Moreover, the "new" property rights economics, that is, the GHM approach, is not an unambiguous scientific advance over the "older" property rights approach of Coase, Alchian, Demsetz *et al.*

Specifically, we have argued that proponents of the GHM approach have been too hasty in identifying residual rights to control with ownership/the possession of property rights. These are multi-dimensional concepts (Paul, Miller and Paul 1994). Thus, we have argued

¹⁶ However, whether this will in fact be the efficient arrangement depends on the tasks that A undertakes. Specifically, it requires that A works with the asset in a routinized way.

that a strict identification of ownership with legally (completely) enforceable residual rights to control is unnecessarily restrictive. More importantly, thinking of ownership in this way obscures that other possible meanings that make economic sense. Thus, we have argued that it is essential to distinguish between secure and appropriable control rights. Control rights may be appropriable even under complete contracting, and even under complete contracting efficiency may dictate that such rights are concentrated, possibly along with rights to residual income.

However, we have suggested that our emphasis on appropriable control rights may actually be aligned with the GHM emphasis on residual rights of control. This helps remedying some deficiencies in the GHM approach, such as its inability to account for, for example, quasi-vertical integration, rental agreements, and the employment relation.

References

- Aghion, Philippe and Jean Tirole. 1997. "Formal and Real Authority in Organization," *Journal of Political Economy* 105: 1-29.
- Alchian, Armen A. 1965. "Some Economics of Property Rights," in idem. 1977. *Economic Forces at Work*, Indianapolis: Liberty Press.
- Alchian, Armen A. and Harold Demsetz. 1972. "Production, Information Costs, and Economic Organization," *American Economic Review* 62(5): 772-795.
- Anderson, Erin. 1985. "The Salesperson as Outside Agent or Employee: A Transaction Cost Analysis," *Management Science* 4: 234-254.
- Barzel, Yoram. 1982. "Measurement Costs and the Organization of Markets," *Journal of Law and Economics* 25: 27-48.
- Barzel, Yoram. 1987. "The Entrepreneur's Reward for Self-Policing," *Economic Inquiry* 25: 103-116.
- Barzel, Yoram. 1994. "The Capture of Wealth by Monopolists and the Protection of Property Rights," *International Review of Law and Economics* 14: 393-409.
- Barzel, Yoram. 1997. *Economic Analysis of Property Rights*, 2nd ed., Cambridge: Cambridge University Press.
- Brynjolfsson, Erik. 1994. "Information Assets, Technology, and Organization," *Management Science* 40: 1645-1662
- Cheung, Stephen S.N. 1983. "The Contractual Nature of the Firm," *Journal of Law and Economics* 26: 1-22.
- Coase, Ronald H. 1960. "The Problem of Social Cost," *Journal of Law and Economics* 3: 1-44.
- Demsetz, Harold. 1967. "Toward a Theory of Property Rights," in idem. 1988. *Ownership, Control, and the Firm*. Oxford: Basil Blackwell.
- Demsetz, Harold. 1998. "Review: Oliver Hart, 'Firms, Contracts, and Financial Structure'," *Journal of Political Economy* 106: 446-452.
- Farrell, Joseph and Robert Gibbons. 1995. "Cheap Talk About Specific Investments," *Journal of Law, Economics, and Organization* 11: 313-334.
- Grossman, Sanford, and Oliver Hart. 1986. "The Costs and Benefits of Ownership: A Theory of Lateral and Vertical Integration," *Journal of Political Economy* 94: 691-719.
- Hart, Oliver D. 1989. "An Economist's Perspective on the Theory of the Firm," *Columbia Law Review* 89(7): 1757-1774.
- Hart, Oliver. 1990. "Is 'Bounded Rationality' an Important Element of a Theory of Institutions?," *Journal of Institutional and Theoretical Economics* 16: 696-702.
- Hart, Oliver. 1991. "Incomplete Contracts and the Theory of the Firm," in Oliver E. Williamson and Sidney G. Winter, eds. *The Nature of the Firm*. Oxford: Oxford University Press.

- Hart, Oliver. 1995. *Firms, Contracts and Financial Structure*. Oxford: Clarendon Press.
- Hart, Oliver and Bengt Holmström. 1987. "The Theory of Contracts," in Truman F. Bewley. 1987. *Advances in Economic Theory. Fifth World Congress*. Cambridge: Cambridge University Press.
- Hart, Oliver and John Moore. 1990. "Property Rights and the Nature of the Firm," *Journal of Political Economy* 98: 1119-1158.
- Hart, Oliver and John Moore. 1998. "Foundations of Incomplete Contracts," *working paper*, Department of Economics, Harvard University.
- Holmström, Bengt and Paul Milgrom. 1991. "Multitask Principal-Agent Analyses: Incentive Contracts, Asset Ownership, and Job Design," *Journal of Law, Economics, and Organization* 7: 24-52.
- Holmström, Bengt and Paul Milgrom. 1994. "The Firm as an Incentive System," *American Economic Review* 84: 972-991.
- Holmström, Bengt and John Roberts. 1998. "The Boundaries of the Firm Revisited ," *Journal of Economic Perspectives* 12: 73-94.
- Klein, Benjamin, Robert G. Crawford, and Armen A. Alchian. 1978. "Vertical Integration, Appropriable Rents, and the Competitive Contracting Process," *Journal of Law and Economics* 21 (2): 297-326.
- Kreps, David M. 1996. "Markets and Hierarchies and (Mathematical) Economic Theory," *Industrial and Corporate Change* 5: 561-596.
- Lawson, Gary. "Proving Ownership," in Ellen Frankel Paul, Fred D. Miller, and Jeffrey Paul. 1994. *Property Rights*. Cambridge: Cambridge University Press.
- Maskin, Eric and Jean Tirole. 1997. "Unforeseen Contingencies, Property Rights, and Incomplete Contracts," *Working Paper*, Harvard University.
- Masten, Scott. 1998. "Contractual Choice," forthcoming in Gerrit de Geest and Boudewijn Bouckaert, eds. *Encyclopedia of Law and Economics*. Aldershot: Edward Elgar.
- Noeldeke, Georg and Klaus M. Schmidt. 1995. "Option Contracts and Renegotiation: A Solution to the Hold-Up Problem," *Rand Journal of Economics* 26: 163-179.
- Paul, Ellen Frankel, Fred D. Miller, and Jeffrey Paul. 1994. *Property Rights*. Cambridge: Cambridge University Press.
- Rabin, Matthew. 1993. "Information and the Control of Productive Assets," *Journal of Law, Economics, and Organization* 9: 51-76.
- Rajan, Raghuram G. and Luigi Zingales. 1998. "Power in a Theory of the Firm," *Quarterly Journal of Economics* : 387-432.
- Shavell, Steven. 1998. "Contracts," in Peter Newman, ed. *The New Palgrave Dictionary of Economics and the Law*. London: Macmillan.
- Tirole, Jean. 1998. "Incomplete Contracts: Where Do We Stand?," Walras-Bowley Lecture, forthcoming, *Econometrica*.
- Williamson, Oliver E. 1996. *The Mechanisms of Governance*. Oxford: Oxford University Press.

Danish **R**esearch **U**nit for **I**ndustrial **D**ynamics

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The DRUID-research programme is organised in 3 different research themes:

- *The firm as a learning organisation*
- *Competence building and inter-firm dynamics*
- *The learning economy and the competitiveness of systems of innovation*

In each of the three areas there is one strategic theoretical and one central empirical and policy oriented orientation.

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The theoretical perspective confronts and combines the resource-based view (Penrose, 1959) with recent approaches where the focus is on learning and the dynamic capabilities of the firm (Dosi, Teece and Winter, 1992). The aim of this theoretical work is to develop an analytical understanding of the firm as a learning organisation.

The empirical and policy issues relate to the nexus technology, productivity, organisational change and human resources. More insight in the dynamic interplay between these factors at the level of the firm is crucial to understand international differences in performance at the macro level in terms of economic growth and employment.

Theme B: Competence building and inter-firm dynamics

The theoretical perspective relates to the dynamics of the inter-firm division of labour and the formation of network relationships between firms. An attempt will be made to develop evolutionary models with Schumpeterian innovations as the motor driving a Marshallian evolution of the division of labour.

The empirical and policy issues relate the formation of knowledge-intensive regional and sectoral networks of firms to competitiveness and structural change. Data on the structure of production will be combined with indicators of knowledge and learning. IO-matrixes which include flows of knowledge and new technologies will be developed and supplemented by data from case-studies and questionnaires.

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The third theme aims at a stronger conceptual and theoretical base for new concepts such as 'systems of innovation' and 'the learning economy' and to link these concepts to the ecological dimension. The focus is on the interaction between institutional and technical change in a specified geographical space. An attempt will be made to synthesise theories of economic development emphasising the role of science based-sectors with those emphasising learning-by-producing and the growing knowledge-intensity of all economic activities.

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