Assets, attributes, and ownership

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Institut for Industriøkonomi og Virksomhedsstrategi
Working Paper 2000-3

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5th revision, 9. January 2000

Acknowledgments
We are grateful to Yoram Barzel, Eric Brousseau, Jerome Davis, Thorbjørn Knudsen, Henrik Lando, Peter Møllgaard, Thomas Riis and two anonymous reviewers for comments on earlier drafts of this paper. Of course, all errors and obscurities are entirely our responsibility.

JEL Classification: D23, D80, L22

Key words: Ownership, property rights, economic organization

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Abstract
The notion of full asset ownership is important in economics, for example, in recent work on the boundaries of the firm, which has been taken up with the issue why it matters who owns an asset. However, recognizing that assets have multiple attributes, and that these may be subject to capture in world of positive measurement and enforcement costs, implies that the notion of full asset ownership is problematic. New property theorists sidestep these issues by implicitly assuming that residual rights of control are perfectly enforced (i.e., full asset ownership obtains). We discuss the notion of property rights and ownership in a positive enforcement and measurement cost setting, and suggest that the new property rights model is a part of a more overarching perspective, which also includes older contributions to property rights economics.

Introduction

Considered from an economic point of view, what does it mean to own an asset? Until the publication of Coase (1960), this issue did not receive much attention from economists. However, the 1960s and 1970s witnessed intensive debate on aspects of the issue of asset ownership within what we here call "the old property rights approach" (henceforth, the "OPRA") (Alchian 1965; Demsetz 1967; Barzel 1997). Much of that work was taken up with identifying differences between alternative systems of property rights as alternative ownership arrangements (collective vs private ownership). However, the economic meaning of asset ownership was never precisely pinned down in this literature (*"Ownership and Property Rights in the "Old" Property Rights Approach*").

Instead, attention has since the mid-1980s turned to the related issue of why it matters *who* owns an asset – the key concern of what is here called "the new property rights approach" (henceforth, the "NPRA") (Grossman and Hart 1986; Hart 1995) ("*Ownership and Property Rights in the "New" Property Rights Approach*"). However, as we shall argue in this paper, understanding the issue of "why it matters who owns an asset" is made problematic by the fact that the very meaning of asset ownership is still not fully clear. More specifically, we argue that there are suppressed issues in the NPRA that relate to the meanings and functions of asset ownership. In our view, the NPRA builds on somewhat extreme assumptions, for example, that ownership is perfectly and costlessly enforceable.[1] Thus, the issue of the meaning of asset ownership under less than costless enforcement is suppressed.

Characterizing approaches as "new" and "old" may invoke an image of unbroken and unambiguous scientific advance. As already indicated, we

[1] The more methodological aspects of this are treated in greater detail in Brousseau and Fares (1999) and Foss and Foss (2000).

consider this view false with respect to the specific approaches under consideration here. Seemingly, the NPRA has been able to resolve a number of unresolved problems that beset the OPRA, such as the central issue of what it means to own an asset. The notion of residual rights of control seems to offer a clear-cut answer to this. However, we shall argue that this notion amounts to sidestepping a number of important issues that the OPRA wrestled with. Among these are the problems posed for the notion of ownership of multi-attribute assets, the composite nature of ownership with respect to rights, and the distinction between the formal (legally defined) structure of ownership and the real structure, as defined partly by agents' capture of property rights. A critique informed by OPRA thus reveals the partial nature of NPRA ("*Some Problems in the New Property Rights Approach*"). For example, we shall point out that with a broader and more realistic notion of residual rights one may obtain other results with respect to ownership patterns than those obtained in the NPRA. We show this by means of a simple example ("*Toward a Broader Understanding of Ownership Patterns*").

Perhaps because of a surprising lack of interaction among OPRA and NPRA writers,[2] these points have, to our knowledge, not been developed in the earlier literature. There are, however, similarities to other contributions, notably Aghion and Tirole (1997) and Holmström and Milgrom (1991, 1994). Like these writers, our aim is integrative. Thus, we are interested in making both more precise and encompassing the notion of ownership in order to more clearly identify the implications of ownership for economic organization.

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[2] Werin and Wijkander (1992) appears to be the sole exception.

Ownership and Property Rights in the "Old" Property Rights Approach

Property Rights in Coase (1960)

The pioneering paper on the economics of property rights is conventionally and justifiably taken to be Coase (1960). In this paper, Coase examines the economic implications of the allocation of legally delineated rights (liability rights) to a subset of the total uses of an asset, namely those that have external effects on the value of other agents' abilities to exercise their use rights over assets. As a part of his critique of the Pigovian tradition in welfare economics (see Demsetz 1996), Coase (1960: 155) notes that a reason for the failure of this tradition to fully come to grips with the externality issue lies in its "faulty concept of a factor of production," which – according to Coase – should be thought of, not as a physical entity but as a right to perform certain actions. These rights are property rights. Given this, private ownership is defined as the possession of "the right to carry out a circumscribed list of actions" (idem.), that is, private ownership of an asset is the possession of a vector of rights to use that asset.[3] The vector of rights is circumscribed partly by legal or governmental restrictions, partly by the ability of the holder to exclude other agents from the specific uses defined by the rights. Thus, in Coase's view ownership does not provide the owner with exclusive rights to assets, only to certain uses of the asset.

However, ownership *per se* does not appear to be what primarily interests Coase; his major concern is the allocation of use rights. In principle, this allocation is conceptually separate from the issue of ownership, since one can imagine that all possible uses (including future ones) of assets are known and

[3] In the following, we shall simply treat "private ownership" and "ownership" as synonymous, unless otherwise stated.

can be contracted for. Thus, one can conceptually analyze the allocation of use rights without involving the notion of ownership at all, as in complete contracting theories (e.g., agency theory). Coase does not use this construct, though, but rather the zero transaction cost setting underlying the Coase theorem. In this setting, the concept of ownership and the issue of who owns an asset are truly insignificant. Even when Coase relaxes the strict zero transaction cost assumption, his interest lies more in understanding the allocative consequences of different legal delimitations of use rights than in ownership issues. Thus, a major problem left unaddressed by Coase is how much one needs to "relax" the assumptions underlying the Coase theorem to produce a role for ownership.

Ownership in the "Old" Property Rights Approach

Coase's paper gave rise to a spate of work on property rights and ownership (e.g., Alchian 1965; Demsetz 1964, 1967; Alchian and Demsetz 1972; Barzel 1982, 1987, 1994, 1997, 1999; Cheung 1969a&b, 1983; Umbeck 1981), that is, the OPRA. In retrospect, it is possible to see much of this work as concentrating on clarifying issues relating to ownership that Coase had not mentioned or had left as puzzles in the 1960 paper. These issues concern the meaning of ownership, the relationship between property rights and ownership, and the importance of legal considerations for understanding ownership.

Recall that Coase had simply thought of ownership as the possession of some vector of use rights over an asset. In itself, this raises questions such as: How much exclusivity over uses of assets is required before one qualifies as "owner"? Moreover, Coase's understanding left unresolved the role played by other types of economic rights than use rights – such as income rights or rights to alienate the asset – in the understanding of ownership. What economic considerations determine the concentration of these types rights in the hand of

one person? Finally, what is the role played by legal considerations in the understanding of ownership; for example, is it possible (and/or desirable) to completely divorce economic and legal notions of ownership?

The OPRA literature of the 1960s and 1970s[4] only partially succeeded in giving answers to the puzzles left by Coase. Common to the various contributions to the OPRA is the overall conceptualization of property rights as social relations pertaining to the use of scarce resources and supported (enforced) by the formal laws, mores and customs of a social system (Alchian 1965; Demsetz 1967) as well as by private enforcement (Umbeck 1981; Barzel 1997). Furthermore, the literature developed a more refined categorization of property rights, for example, introducing distinctions between use rights, income rights, rights to exclude, and rights to alienate assets. Given this, the concept of ownership becomes linked to the possession of different types of property rights, so that ownership also becomes contingent on the factors that regulate the interaction among agents with respect to scarce resources and is typically used when property rights are bundled (Alchian 1965).

However, there is still much vagueness in the OPRA literature about what truly distinguishes an owner from a non-owner. There are two main manifestations of this vagueness. The first one is ambiguity with respect to which bundles of rights one has to possess in order to be identified as owner. The second one is an ambiguity with respect to the extent to which ownership is defined by the recognition of others of a claim to ownership, that is, the extent to which exclusivity is based on a (explicit or implicit) recognition by other parties of the property rights of the owner or by the owner's own ability to maintain exclusivity.

With respect to the first type of ambiguity, it is notable that ownership tends to be defined depending on the analytical purpose. For example,

[4] Furubotn and Pejovich (1972) is a classical overview of the early research.

Demsetz and Alchian both put much emphasis on the rights to exclude and alienate as the relevant criteria of private ownership in their work on systems of property rights, and see owners as those agents who can exercise these rights (Alchian 1965; Demsetz 1967). However, they slightly change these latter criteria when they analyze the organization of the firm and corporate governance, where owners becomes defined as those possessing control rights (Demsetz 1967) or residual income rights (Alchian and Demsetz 1972). With respect to the second ambiguity, the OPRA literature is confused on the issue of how many rights must be exclusive in order for ownership to obtain, and what are the determinants of exclusivity of rights. For example, does ownership mean that the owner can exclude others from *any* use of his asset (as in Alchian 1965), or does ownership allow for some sharing of use rights (as in Coase 1960)?

Strategies for Dealing with the Ambiguities of Ownership

Such ambiguities have often been recognized by OPRA writers themselves. "The meaning of full private ownership … is vague," Demsetz (1988: 19) notes, although he thinks that " … certain rights of action loom more important than others. Exclusivity and alienabiliy are among them." Given the complexity and ambiguity surrounding the economic notion of ownership, several strategies of clarification appear to have been explored by OPRA writers.

One is to drop the concept entirely for purposes of economic analysis (while recognizing that the concept makes perfect legal sense), and instead concentrate exclusively on property rights. This seems to be reflected in Coase's (1960) reluctance the use the concept of ownership. However, this strategy arguably runs into problems in the face of unforeseen uses of assets. In

this case, there is a need for an institution that allocates these use rights. In fact, this institution is normally called private ownership.

A second strategy is to adopt a working definition of ownership as always comprising a certain minimum bundle of property rights, irrespective of time, place and institutions.[5] For example, one may argue that ownership is fundamentally defined by exclusivity and alienability. An obvious problem with this strategy is that, for example, it is unclear what is meant by exclusivity independently of institutional and historical considerations.

A third strategy, therefore, is to identify ownership with claims to exclusivity that are privately enforced and / or are enforced by various legal and non-legal institutions. This strategy, which may be associated with Umbeck (1981), makes ownership contingent on what is historically seen as constituting a recognized claim. More specifically, "... the abilities of individuals, or groups of individuals, to forcefully maintain exclusivity" (Umbeck 1981: 39) are different across spatio-temporal and institutional characteristics, since they turn on positions of power and the ability to exercise force. Thus, ownership essentially becomes an expectation that an agent holds with respect to his ability to use certain resources. This view makes it clear that answering the question "why it matters who owns an asset" must be heavily dependent upon the concrete institutions and allocations of force that define and enforce the rights of the owner — an insight that we shall make extensive use of in the following.

Barzel on Attributes and Assets

A particularly interesting OPRA contribution is represented by the work of Barzel (1982, 1987, 1994, 1997, 1999). Barzel's work is particularly useful with

[5] The economic reason for the existence of such a bundle can be found in the existence of transaction costs which imply that "… the partitioned rights will re-aggregated into more convenient clusters of rights" (Alchian 1965: 134).

respect to make problematic the issue of "why it matters who owns an asset." His central contribution, which we shall make use of the following, is to introduce the notion of multi-attribute assets and to argue that it is more fruitful to focus on the ownership of attributes rather than of assets. Attributes are characteristics and possible uses of assets.[6] To Barzel, it is crucial that ownership in the *economic* sense pertains to the attributes of assets rather than to the assets themselves. There are two reasons for this.

The first one is that most assets have so many attributes – of which many may not be specified – that the notion of ownership of assets is vague.[7] This also explains why Barzel makes a categorical distinction between legal and economic notions of ownership. Whereas the former refers to a legally recognized holding of a title to an asset, the latter refers to those property rights over the attributes of an asset that are controlled by an agent. Nevertheless the concept of asset must remain important in economic analysis (and not just in property law). This is because it is often assets rather than attributes that are priced (because of measurement costs). Agents then may have different degrees of control over attributes of assets and thus more or less secure economic rights over the asset. Barzel (1994: 394; emphasis in original) explains economic rights 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 exhange. 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.

[6] Thus, although Barzel does not mention this, the notion of "attributes" also covers contingent goods, such as the use of an umbrella at noon 16 April 2001 in Cambridge if it rains.

[7] This is related to Demsetz' point that the notion of "full private ownership" over assets is "vague", and his argument that "[i]n one sense, it must always remain so, for there is an infinity of potential rights of actions that can be owned … It is impossible to describe the complete set of rights that are potentially ownable" (Demsetz 1988: 19).

However, the expected valuation of an asset depends on the attributes of the asset that one holds property rights over, so that attributes remain the fundamental unit of analysis.

The second reason for focusing on attributes rather than on assets is that Barzel's central concern is to determine the structure of ownership that will maximize the value of an asset when there are high measurement costs. High measurement costs implies that it will be efficient to leave some attributes unspecified. Allocation of ownership to such attributes takes place by means of capture. Those unspecified attributes that are captured become subject to control by agents, where by "control" is meant "… one's freedom to manipulate the particular unspecified attribute without making marginal payments to others " (Barzel 1999: 5-6). The efficient pattern of ownership over the attributes of an asset is the one that minimizes uncompensated exploitation of attributes – which is a sophisticated restatement of the Coasian (1960) concern with the internalization of externalities. Relatedly, Barzel, like Coase, stresses that ownership — whether to attributes of assets or to assets themselves — is seldom fully exclusive. The refinement introduced by Barzel relative to Coase consists in adding the notion of measurement costs which explains the presence of unspecified attributes, attempts to capture these, and the institutions that constrain capture.

Although a focus on the multiple attributes of assets rather than on the assets themselves is an extremely helpful perspective that we shall make use of later, it may be necessary to warn against completely neglecting transactions relating to assets (rather than to attributes). This is because the legal system and jurisprudence distinguishes between the law relating to contract and the law relating to ownership of assets. Moreover, the law relating to ownership is more than simply part of a low-cost enforcement institution; it is also a "standard contract" that reduces information and communication costs and has

allocative consequences for this reason. Moreover, legal ownership may also be perceived of as a property rights system in the sense that it is a low-cost way of allocating hitherto undiscovered uses of assets. For example, giving somebody legal ownership implies that he holds the legal right to future, as yet undiscovered, attributes of the asset, in the sense that the courts will not interfere with the use of the asset by the party identified as the owner.[8] As we shall see, this is a crucial point in the NPRA.

Ownership and Property Rights in the New Property Rights Approach

In the same way that the emergence of OPRA may conveniently and justifiably be dated to the publication of Coase (1960), the emergence of NPRA can be dated, just as conveniently and justifiably, to the publication of Grossman and Hart (1986). The approach outlined in that paper has swept economics and it is not too much off the mark to say that it defines the way the modern formal economist thinks about ownership and property rights.[9] In the following, we shall mostly refer to and rely on Hart's (1995) recent authoritative and widely cited statement of the fundamentals of the NPRA.[10]

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[8] Thanks to Thomas Riis and an anonymous reviewer for stressing this point.

[9] In addition to the issues traditionally considered in the theory of the firm – such as the boundaries of the firm – the NPRA 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).

[10] To the best of our knowledge and understanding, our points also applies to more formal statements of the NPRA, such as Grossman and Hart (1986), Hart and Moore (1990, 1994, 1998), Rajan and Zingales (1998).

Answers to the Coasian Puzzles in the New Property Rights Approach

Recall that Coase (1960) had left unaddressed a number of issues concerning the meaning of ownership, the relationship between property rights and ownership, and the importance of legal considerations for understanding ownership. The OPRA was only partially successful in constructing a unified and consistent approach to these issues. There are many reasons for this limited success, such as a verbal style of theorizing, the lack of one well-defined problem that could structure analysis towards a more consistent approach, and a willingness to let definitions depend on the analytical purpose at hand. In contrast, the NPRA is explicitly formal, most of the analysis has centered on the problem of vertical integration, and it has, because of its formal nature, adopted (seemingly) unambiguous definitions. This has allowed its proponents to state straightforward answers to the puzzles left by Coase.

With respect to the meaning of ownership and how it relates to property rights, the central idea in NPRA is the distinction between specific rights of control and residual rights of control. The former can be delineated and directly allocated through contractual means, whereas the latter is obtained through the legal ownership of assets and implies the "… right to decide usages of the asset in uncontracted-for contingencies" (Hart 1996: 371). However, residual rights to control encompass not only the rights to use assets, but also to "… decide when or even whether to sell the asset" (Hart 1995: 65). In NPRA ownership is defined as the legally enforced possession of an asset. The economic importance of ownership stems from the owner's ability to exercise residual rights of control over the assets. This economic conception is thus explicitly derived from the juristic conception.[11] In other words, the function of

[11] 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

ownership is to allocate residual rights of control. Thus, the meaning of ownership, and its relation to property rights and the legal system are addressed in a straightforward manner.

As we shall later argue, however, reflection and evidence suggest that the notion of residual rights of control is not so unambiguous after all; in actuality, the specific meaning that NPRA writers attach to the concept is strongly dependent on background institutions, notably the ability to costlessly enforce ownership. This has implications for the economic understanding of the allocation of ownership, as we shall later show. Also, the limitations of the NPRA with respect to explaining legal ownership should be clearly understood. The NPRA is not a law and economics theory of the legal institution of ownership *per se*, but rather a theory of the efficient allocation of ownership. Before we enter into a more sustained critical discussion of the NPRA, we need to more fully characterize the NPRA.

Complete and Incomplete Contracts and Economic Organization

A crucial distinction in the NPRA is the distinction between complete and incomplete contracts, a distinction that was never made explicit in the OPRA.[12] To make clear the importance of this distinction has been one of the major analytical strengths of the NPRA. In the literature two causes of contractual incompleteness are emphasized. One is a bounded rationality interpretation, according to which some future states cannot be anticipated, although the agents may hold a probability distribution over the pay-offs from their relation (Grossman and Hart 1986).[13] Alternatively, all states are in fact anticipated, but for some reason agents are unable to specify their plans or the nature of these

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less protected in excluding other people from such interference. The owner is allowed to exclude all, and is accountable to no one."

[12] Although Coase (1937) had of course focused on incomplete contracts.

[13] For a critique of this, see Kreps (1996).

states in such a way that a court can ascertain whether a certain plan was carried out or a state materialized. The contract is left incomplete for this reason (Hart and Moore 1990).

According to NPRA writers, incompleteness of contracts makes it possible to understand the economic function of ownership. The argument is that if one accepts that ownership confers residual rights to control, it must follow that it is only possible to understand the economic consequences of ownership under incomplete contracting,[14] for the basic reason that residual rights of control are only defined when this kind of contracting obtains.[15] In the terminology that we use here, these control rights refer to the holder's ability to manipulate unspecified attributes *in the future* without making marginal payments to others. Note, however, that there is no mention in the NPRA of the holder's ability to manipulate unspecified attributes without making marginal payments to others in a setting where all — present and future— contingencies and attributes are known, but where there may be costs of measurement and enforcement (as in Demsetz 1988; Holmström and Milgrom 1991; Barzel 1999). We shall later focus on this possibility by means of an example.

The implication of the NPRA reasoning is that theories that are based on an complete contract logic, such as OPRA (?) or formal agency theory, cannot explain neither the allocation of ownership over asset, nor the owner of an

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[14] However, this does not mean that ownership as a legal category cannot exist under complete contracting.

[15] 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.

asset.[16] An important further implication is that these theories cannot address the issue of the boundaries of the firm, the main issue of concern of the NPRA. In contrast, Hart argues that the NPRA can unambigiously define *the* owner of an asset. This is particularly important for the analysis of the boundaries of the firm.

The Basic NPRA Set-Up

Historically and conceptually, the NPRA 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) (Demsetz 1998). Applied to firms, the approach begins from the idea that ownership of non-human assets is what defines the firm. Thus if two different assets are owned by one person, we are dealing with one firm, whereas if the same two assets are owned by different persons, we are 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.

[16] Complete contracting obtains when contracts are such that they have "… the relevant decisions (transfer, trade, etc.) depend on all verifiable variables, including possible announcements by the parties (concerning their valuation, costs, etc.)" (Tirole 1988: 29n). In such a contracting regime, there will be no need for residual rights of control. 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." Note how this quotation indicates that the NPRA is really a theory of the allocation of ownership in a setting where ownership is a perfectly well-defined concept. This may be contrasted with the analysis of the emergence of the institution of ownership in, for example, Umbeck (1981).

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 investments have been made, and thus the expected payoffs from the investments.[17] 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 allocation of ownership and hence the efficient boundaries of the firm. Thus, the central issue is why it matters who owns an asset or a bundle of assets. Underlying this is that it is possible to unambiguously identify *the* owner of an asset.

[17] 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 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 NPRA approach.

Some Problems in the New Property Rights Approach

In this section, we shall argue that the NPRA claim of being able to unambiguously identify *the* owner of an asset is strongly dependent on the specific analytical set-up adopted by most NPRA writers.[18] This set-up is characterized by an implicit assumption of zero cost enforcement of ownership (i.e., residual rights of control) and thus full exclusivity in the use of assets. In other words, the NPRA implicitly black-boxes part of the institutional environment (Brousseau and Fares 1998). In more realistic settings, characterized by positive costs of enforcement, measurement costs and multi-attribute assets (but not necessarily asymmetric information among the contractual parties), it may be more problematic to single out *an* owner of an asset. As we shall point out, the rather extreme set-ups that characterize most NPRA models also account for their inability to discriminate between a number of ownership arrangements, such as vertical quasi-integration and vertical integration.

The Notion of Residual Rights of Control

At first glance the NPRA notion of residual rights of control appears to be a conceptual sword that cut through the Gordian knot of the meaning of ownership in the literature. However, on closer inspection the concept turns out to be not completely unambiguous. We here discuss whether residual rights of control unambiguously identify an owner. We shall argue that this depends on the divisibility and enforceability of these rights. Consider the divisibility issue first.

In a discussion of the connection between ownership, residual control rights, and residual income rights, Hart (1995: 63-66) notes that the latter is "...

[18] In his review of Hart (1995), Demsetz (1999: 449; emphasis in original) also notes that "Hart writes as though he thinks that *asset* ownership is an unambiguous concept."

not a very robust or interesting theoretical concept" (1995: 64).[19] The reason given is that residual income rights are not well defined since they can easily be divided which residual control rights cannot "in the same way" (p.64n). It is not clear what he has in mind here, but presumably Hart means that it is non-sensical to allocate residual rights of control *ex ante* between parties. For example, it does not make sense to *ex ante* allocate 80 % of the residual rights control to one party (which of course is possible in the case of residual income rights).

However, this view neglects that assets have many attributes – and formal control over such attributes may be divided. For example, one may imagine joint ownership of a taxicab, where one chauffeur drives it on Monday to Wednesday (one attribute), and the other one drives it from Wednesday to Sunday (another attribute), both having full rights to the use of the asset within certain pre-negotiated contractual stipulations. Timesharing of condominiums is another quite prevalent phenomenon that also illustrates the division of control over attributes. Based on this alone, it is not easy to say who is the "true" owner.

However, Hart has a way out. He admits that residual rights of control are in fact divisible, for example, when he talks about "forms of intermediate ownership" (p.61).[20] But he is quick to add that included in the notion of residual rights to control are also the rights to veto the use of an asset and to alienate that asset – and *these* rights are not divisible. In the context of the example above, one of the taxi drivers thus got to be the ultimate owner. Even this will not do, however, as Hart's own work on cooperatives illustrates (Hart

[19] Hart's specific reasoning on this is not easy to follow, however. He argues that "[g]iven that profit-sharing contracts are not in principle costlty to write if profits are verifiable (and it is unclear how residual income is to be allocated if profits are not verifiable), the conclusion is that residual income may not be a very robust or interesting theoretical concept" (1995: 63-64). This would seem to be a *non sequitur*.

[20] In this connection he refers to delegation (citing Aghion and Tirole 1997).

and Moore 1994). In a cooperative (or partnership) control is exercised by means of majority rule. But this implies that no single agent or group of agents can have a veto. In turn this means that if ownership is in fact identical to the right to veto, the ownership of a cooperative may be completely fleeting.

A final problem concerns the claim in the NPRA that residual rights of control are only indirectly tradable through the exchange of ownership titles. But this may not be the case in certain contexts (cf. also Demsetz 1998). For example, leasing on a long term basis may effectively be identical to obtaining ownership, particularly if the leasing arrangement lasts through the economic lifetime of the asset (Wiggins 1991: 610n) or if the arrangement comes with a first-buy clause.

Asymmetric Treatment of Enforcement

In a number of contributions to the OPRA, there is an explicit distinction between the legal formal title to assets and the economic rights to those assets (e.g., Coase 1960; Alchian 1965; Barzel 1997). In the presence of costs of measurement and enforcement, this distinction is important for *any* asset, whether human capital assets or non-human capital assets. While there is thus a symmetric treatment of the two asset categories in the OPRA, the treatment in NPRA is asymmetric. This is because ownership to, and contracts over, physical assets are supposed to be fully and costlessly enforced by the legal system, whereas contracts involving investments in human capital are assumed to be completely unenforceable because of an asserted non-verifiability. Thus, in the NPRA approach there is only one clearly identified possibility of capture, namely with respect to capturing other parties' investments in their own human capital. However, in actuality there are other capture possibilities – because of the simultaneous presence of high costs of enforcement and multi-attribute assets – but these are assumed away in the NPRA by the assumption of costless enforcement.

Some Empirical Anomalies

The neglect in the NPRA of the multi-attribute nature of assets and of positive measurement and enforcement costs means that the NPRA has difficulties coming to grips with a number of real-world phenomena. Among these is the difference between quasi-vertical integration and full integration, a distinction that relates to the understanding of the employment contract.

Quasi-vertical integration is the ownership arrangement of one firm owning a number of the specific assets used by, for example, its supplier. Under *full integration* the manager of supplier is turned into an employee of the firm. However, the economic rationales behind these two ownership arrangements are hard to distinguish in the NPRA. Note that quasi-vertical integration may be seen as an attempt to protect against hold-up on the part of the supplier – that is, exactly what vertical integration is supposed to do. Moreover, note that on the NPRA logic (Hart and Moore 1990; Hart 1995, 1996), the manager-owner of the supplier firm in a quasi-vertical integration relation has decreased incentives to invest in his human capital, *exactly* as if he had been turned into an employee of the firm. The relative bargaining positions of the parties with respect to sharing the joint surplus from their relation would appear to be the same under the two arrangements (*ceteris paribus*).

As this indicates, it is difficult to explain *the employment contract* using the NPRA; in fact, the existence of that contract is simply taken for granted in the NPRA. 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, Hart speculates, 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, hence, valuable to the employer and thus possibly increasing his future wage. However, one may counter that quasi-vertical integration may accomplish

exactly the same, since ownership of the specific assets of another firm would have the same effect on information revelation. The NPRA approach may explain authority, but it does not explain the employment contract.

The inability of the NPRA to come to grips with these phenomena has to do with its neglect of the multi-attribute nature of assets in a setting with measurement and enforcement cost (where the latter depends on the institutional environment). In such a setting, an agent may engage in capture of unspecified attributes of assets that goes beyond the types of capture investigated by the NPRA, namely under-investment in human capital or hold-up. Making telephone calls to friends in far-away countries, using company cars for holiday trips, withholding effort, inefficiently using or maintaining assets, etc. are all examples of capture that cannot easily be pressed into the NPRA categories of hold-up or under-investment in human capital. However, such activities may be essential for discriminating between vertical integration and quasi-vertical integration, that is, explaining the employment contract.

It may be argued that invoking these examples means switching to an asymmetric information (agency) setting. This need not be the case, however. Even in a symmetrical information setting capture will take place, since even here resources will have to be expended on verifying actions to third parties or estimating economic consequences of capture that are unknown to all parties. Minimizing resources expended on preventing capture (i.e., measurement and enforcement costs) requires that measurement takes place at minimum cost. This may, however, depend on whether measurement takes place within the frame of an employment contract or within the frame of a contract between independent parties. The employment contract confers to the employer the right to monitor and sanction the employee in ways that for legal reasons cannot be applied to an independent contractor. This means that the employer is in a better position to choose where and when to monitor the exercise of capture. Thus, the employment contract will be chosen when it minimizes the

costs of measuring capture.[21] However, this conclusion can only be reached if explicit allowance is made for that part of the institutional environment that regulates the employment relation.

Costs of measuring are likely to be some positive function of the number of attributes of the relevant assets, given a certain measurement technology. Multi-attribute assets tend to imply the presence of many margins of substitution (Demsetz 1988; Barzel 1997), some of which may not be specified *ex ante* by the contractors. In a broader context, Demsetz (1988: 18) points out that "[t]he general conclusion is that constraining the ability of persons to exercise specific rights of ownership causes them to rely in greater degree on substitute margins in their attempt to maximize utility." Applied to the issue of the choice between vertical integration and quasi-integration, this implies that multi-attribute assets tend to produce a bias towards the employment contract (cf. also Holmström and Milgrom 1991, 1994). This is due to the adaptability advantage of the employment contract. An employer's constraining of an employee's abilities to exercise control in some directions likely results in the employee substituting towards hitherto unspecified margins. The employment contract allows for adaptive handling of such behavior.[22]

An interpretation of the above reasoning is that making room for agents' capture of property rights over unspecified attributes in a setting characterized by multi-attribute assets and positive costs of measurement and enforcement adds to the explanatory power of the NPRA framework. We pursue this further in the following section.

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[21] This can be interpreted in an agency theory framework (Holmstrom and Milgrom 1991, 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.

[22] This is not to say that this is in any way the full explanation of the employment contract. Other considerations, such as bargaining and communication costs, are also relevant.

Toward a Broader Understanding of Ownership Patterns

In the preceding pages, we have implicitly extended the notion of residual rights of control. In the NPRA, these are rights to decide usages of assets in future, uncontracted-for contingencies, and are derived from the legal ownership of assets. The rights of ownership of these assets are perfectly enforced. As we have pointed out, assuming perfect enforcement is tantamount to making the notion of asset ownership completely dependent on a specific, and – we think – unrealistic institutional set-up.

However, a more realistic setting characterized by less than perfect enforcement, multi-attribute assets, and measurement costs must imply a broader notion of residual rights of control. This is because in such a setting a number of attributes of assets are rationally left unspecified, and possibly also unenforced. Hence, they will be subject to capture attempts, that is, attempts at being able to acquire and manipulate the services of various attributes without compensating others on the margin. Such capture may well go beyond the type of capture treated in the NPRA where capture only relates to the hold-up problem. In a more realistic setting, minimizing the costs due to capture may help determine ownership patterns in a way that is at variance with the NPRA. In the latter, the costs of capture are only represented by inefficient investments. However, there are other costs of capture, such as dissipation of wealth (Barzel 1997). In the following example, we construct a stylized setting, in which these costs are also included and help determine ownership patterns.

An Example

Consider a person, N, who considers whether to make a specific and non-contractible investment in his human capital (repair skills) that makes his costs of repairing three specific but identical cars lower than the prevailing market

price of car repair.[23] There are three potential drivers, A, B, and C of the specific cars. Moreover, we assume that N's investment is complementary to the human capital investments undertaken by A, B and C, in such a way that N prefers to have the investing drivers as customers, and the investing drivers prefer to have N repairing the cars.[24] Thus, there are potential gains from trade. We also assume that N's marginal investment costs are much greater than A, B and C's costs.

This example stays close to the basic NPRA set-up. And according to NPRA logic, efficiency dictates that in the example ownership should be allocated in such a way that N assumes ownership of the cars. Otherwise he will be held up by the owner(s) of the cars in the sense that they will share the rents on N's investments according to the Nash bargaining solution. However, we shall argue that a different ownership pattern may result, if provision is made for the possibility that A, B and C can capture unspecified valued attributes of the cars when N cannot perfectly verify such capture.

The efficient rationing of the use of durable assets, such as the three cars, requires not only that they are paid their marginal products, but also that they are paid for use-induced depreciation. Use-induced depreciation may take place with respect to a number of attributes of the car. N has two options of recovering use-induced depreciation, namely 1) to charge an *ex ante* price that is independent of the actual (*ex post*) depreciation, or 2) to negotiate *ex post* a charge reflecting the depreciation. The problem with the first option is that of

[23] For example, we may assume that N specializes in repairing racing cars. However, he still preserves outside options, since he can continue to repair ordinary cars, although his productivity in these options is not improved. Thus, his threat points is unchanged by his human capital investment.

[24] A, B, and C still preserve the option of driving non-specific cars or have their specific cars repaired by another mechanic than N, but their utility from these outside options is not improved by their human capital investments. Thus, their threat points are unchanged by their human capital investments. To simplify the example, we also assume that A, B and C's marginal benefits of investing in their human capital are equal.

moral hazard, while the problem with the second option is one of strategic behavior under bargaining. Remedying both problems requires costly verification of the actual depreciation.[25]

Assume, realistically, that it is costly to verify the depreciation of cars after they have been used.[26] This implies that an owner who rents out the cars will confront costs that can be avoided by the owner/driver. Because of his opportunity costs of time, an owner who rents out cars will rationally choose not to verify the depreciation of some attributes. Hence, he will not price these. Assume also that it is less costly to carelessly drive than to carefully drive the car, because careless driving reduces driving time. This means that while an owner/driver must trade-off time against depreciation and safety, the renter/driver must only trade-off time against safety.[27]

We shall here concentrate on the situation where N is owner, and A, B and C are renter/drivers, and examine whether this ownership pattern is efficient. Consider Figure 1.

XXXXXXXX Insert Figure 1 About Here XXXXXXXX

The figure shows the different opportunity cost schedules of the three drivers. Driver A has high opportunity costs of careful driving while driver C has the lowest opportunity costs of careful driving. Also shown in the figure are three cost lines. The one that lies farthest to the north-east (i.e., hh) corresponds to the cost-schedule confronted by a hypothetical owner/driver if N does not

[25] We abstract from reputation effects and effects from repeated interaction. For example, one may assume that only A, B and C can drive the cars and that the model is a finite horizon one.

[26] We regard costs of verifying performance and contractual compliance as part of measurement costs.

[27] Thanks to an anonymous reviewer for pointing this out.

invest in his human capital or if the owner/driver drives a non-specific car. This schedule reflects the market price for repair services for different degrees of care. For example, if driver A exercises the degree of care corresponding to N_{AO}, he will impose a depreciation on the car that can measured by the costs of remedying that depreciation through repairing the car by others than N (i.e., Q_{AO}). The opportunity cost schedules of A, B and C as owner/drivers cross this schedule at the points (Q_{AO}, N_{AO}), (Q_{BO}, N_{BO}) and (Q_{CO}, N_{CO}). These points represent A, B, and C's optimal trade-offs between the degree of care they exercise and the costs of depreciation in a situation where either N has not invested in his human or the driver/owners drive a non-specific car.

The cost line, jj corresponds to the cost schedule of repairing specific cars confronted by N after having made a specific investment in his human capital and with A, B, and C as customers. It is closer to the origo than the hh line, because the investment reduces N's cost of repairing the specific cars. For a given degree of care, the vertical distance between the hh line and the jj line represents the rents from N's human capital investment if N were an owner and if there were no costs of verifying depreciation. This corresponds to the basic set-up in NPRA (e.g., Hart 1995). However, when he rents out the cars, he will not perfectly verify depreciation, and this decreases the rents he can appropriate. This is different relative to the basic NPRA set-up.

The cost line, ii represents the market price of repair of the depreciation N chooses to detect. For high degrees of care, he will choose to verify most of the depreciation. The vertical distance between the ii and the hh line indicates (for any degree of care) the rent from N's human capital investment that the driver/renter captures. The driver/renter can capture this rent because N chooses not to verify the depreciation of certain attributes.[28] The vertical

[28] We simplify by assuming that the distance between hh and ii is the same for any degree of care (and therefore for both driver/renters). A possible interpretation is that certain attributes are inherently more difficult to verify than others and therefore will be left unverified for any

distance between the ii and jj lines indicates for any degree of care the rent on his own human capital investment that the owner himself can capture when renting out the cars. We make the strong assumption that this line also shows the division of rents between N and A, B and C, respectively, if they are owners of the specific cars, that is, it shows A, B, and C's abilities to hold-up N for half of the rents on specific investment (for each repair service). This also corresponds to the basic NPRA set-up. Given this set-up, what is the optimal pattern? In particular, will N rationally choose to own all specific cars (bearing in mind that according to NPRA logic, he should in fact own them all)?

Consider Figure 1 again. N wishes to extract the maximum rents from his investment; in turn, how much rent he can extract influences his incentives to invest, as in the NPRA. This means that he wishes to bring the rental price of depreciation as close as possible to the opportunity costs to an owner/driver of owning a non-specific car, that is, Q_{AO}, Q_{BO} and Q_{CO} in figure 1, where A, B and C are indifferent between owning a non-specific car and renting a specific car. However, N cannot reach these three points because of the costs of verifying depreciation, and will accordingly charge for the depreciation at points that lie below these points.

To find out what are the consequences of his inability to perfectly measure depreciation, consider driver/renter C in figure 1. In a first-best world of zero costs of verification, total rents accruing to N would amount to be equal to the vertical distance between hh and ii, measured at N_{CO} that is, the difference between the market cost of repair and N's cost of repair. However, given non-zero costs of verification, N will charge C a rental price that reflects the market price of repairing the *verified* depreciation (Q_{CM}). Given this, C will adjust his

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degree of care (and type of driver/renter). A possible (self-experienced) example concerns minor scratches on rental cars in Palermo, Sicily, where rental firms apparently expects any car to be harmed in this way, which makes verifiability particularly costly. One is thus not charged for minor scratches.

exercise of care accordingly (i.e., choose N_{CR}). This set of choices will induce a sharing of rents equal to that obtaining if C owns the specific car. Quite similar operations may be performed with respect to driver A and C.

Recall from figure 1 that Q_{CO} is the charge that leaves C indifferent between being an owner and being a renter, when he is paying the full marginal costs for the depreciation he imposes on the car. Thus, if C is a renter, N can at most choose a mark-up on the rental services amounting to $Q_{CO} - Q_{CM}$. This mark-up may reflect both measurement costs and N's attempt to extract more rents of the driver/renters.

As the opportunity cost schedules of the drives are drawn in Figure 1, N can impose a higher mark-up on B and an even higher one on A, leaving them indifferent between being an owner of a non-specific car and being a renter of a specific car. N's overall optimization problem is to choose the mark-up such that the rent he can extract from all drivers is maximized. If he chooses a too high value of the mark-up, he will induce one or more of the drivers to switch to non-specific cars, making him loose rents on repair services. Therefore, it will be efficient for him to let these drivers own a specific car, continue to repair their cars, and allow them to extract half of the rents on his investment.[29] This may imply the existence of an equilibrium in which A and B are renter/drivers and C is an owner/driver. This is because A and B's gain from not being fully marginally charged for the depreciation they impose on the car he drives is not overwhelmed by the mark-up.

Implications and Discussion

The above example has shown that capture, costly measurement (verification) and different types of individuals (A, B and C) may explain who owns an asset. Moreover, although it stays very close to the basic NPRA set-up, the example tells a story that contradicts the NPRA prediction that an

individual who undertakes a human asset investment that is specific to some physical assets should also be the owner of those assets. Ownership may fall in the hands of C rather than N in the example, not in order to create threat points under *ex post* bargaining and avoid inefficient (i.e., third-best) investments, but in order to avoid a mark-up. Ultimately, the mark-up arises as a consequence of the driver/renters' capture of unspecified use rights over the car which leads to depreciation of the cars, costly attempts to verify this depreciation on the part N, and an imposition of a mark-up that is uniform over the driver/renters because of N's costs of verifying depreciation.

Note that, like in the NPRA, there is a link between the economic function of ownership in the example and the legal system. This link is established through the notion of costly verification, although in a way that differs from the NPRA. Costly verification influences who owns an asset, not because it creates a hold-up problem (as in the NPRA), but because it makes it costly to charge a correct marginal price of rental services.

Although ownership is structured to minimize capture, the example thus suggests that this structuring can take place in ways that differ from the NPRA model. In turn this suggests that the NPRA model is a special case of a more encompassing model of ownership – yet to be fully formally developed – in which the notion of capture of unspecified attributes also include those that are left unspecified due to measurement costs. To illustrate the partial nature of the basic NPRA set-up, NPRA conclusions may be derived from the basic setting of the above example. Recall that NPRA reasoning would lead to the conclusion that N should own all cars. In the context of the example, this requires that an incentive contract is made between the owner and the renters of the cars. The contract makes the charge contingent on the verified depreciation. Moreover, the verification of all attributes has to be sufficiently precisely so that an agent

[29] We assume that wealth constraints are absent.

has a sufficient belief that he will be charged a correct rent. Otherwise, some of the renter / drivers may still prefer to be owners.

In their multi-task agency models, Holmström and Milgrom (1991, 1994) arrive at conclusions that are somewhat related to the ones above. What they call "multi-tasking" is thus one representation of the multi-attribute nature of many assets. Relatedly, they also stress measurement costs. However, in contrast to this paper, they assume risk-aversion on the part of agents and asymmetric information. We only assume risk-neutrality and a certain degree of non-verifiability. Most importantly, however, in the Holmström and Milgrom models, capture is seen as function of measurement errors on signals on effort whereas in our example, capture is a function of purposefully leaving certain attributes unspecified. This means that in our example an incentive contract will not diminish the amount of capture.

Conclusion

The notion of asset ownership is one of the most vexing ones in economics. This is partly because the notion is highly context-specific and hard to discuss in isolation from legal considerations (Demsetz 1998). This has produced a certain amount of confusion. On this background, it is hardly surprising that the NPRA has emerged as a dominant approach to the study of ownership and the economics of organization. It is seen (and advertised) as a clear formal approach that unambiguously defines the notion of asset ownership and builds a theory of economic organization on that basis.

However, in this paper, we have argued that the clarity of the NPRA is acquired at the cost of narrowness and a certain lack of explanatory power — a critique that we have developed by viewing NPRA ideas through a lens provided by the OPRA. Specifically, we have argued that the NPRA

conceptualization of ownership as fully enforceable residual rights of control is too narrow with respect to identifying the nature and function of ownership. The NPRA neglects the difference between the legally defined structure of ownership (the holding of titles to assets) and the structure of ownership over attributes of assets that emerges from agents' capture. This also means that ownership only partakes of the role of a bargaining chip in situations of bilateral monopoly, and the role played by ownership of minimizing the costs of capture is only partially reflected in the NPRA.

A possible implication is that, in spite of its clarity and elegance, the NPRA is not an unambiguous scientific advance over the OPRA. Another implication is that there is room for cross-fertilization between the OPRA and the NPRA.

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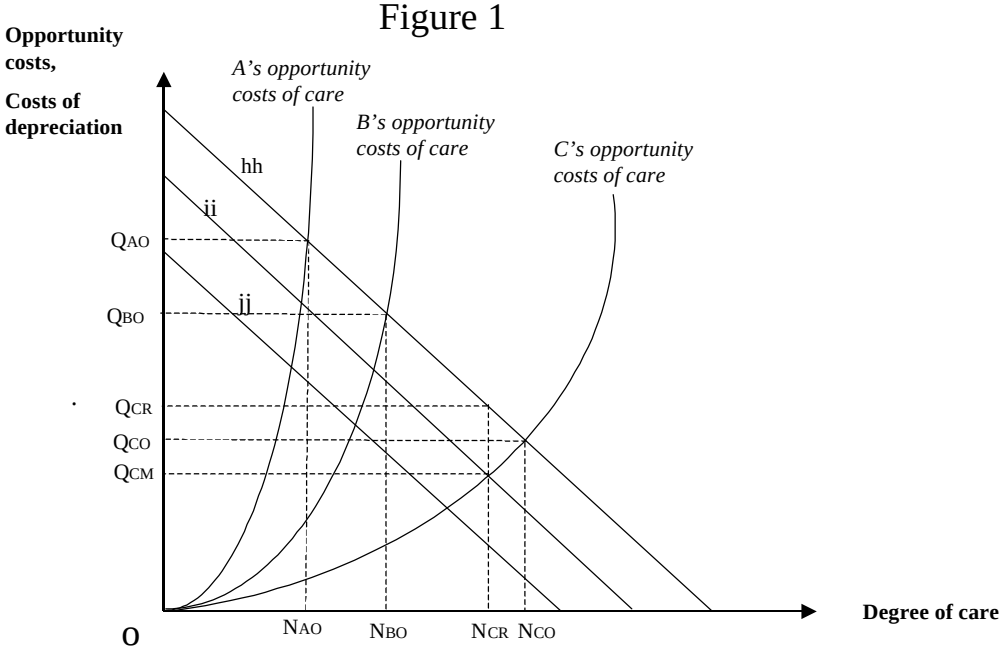
Figure 1


Opportunity costs,
Costs of depreciation
A's opportunity costs of care
B's opportunity costs of care
C's opportunity costs of care
hh
ii
jj
QAO
QBO
QCR
QCO
QCM
O
NAO
NBO
NCR NCO
Degree of care