Towards a Theory of Incomplete Property Rights

by

ANTONIO NICITA^{*}

MATTEO RIZZOLLI[♦]

MARIA ALESSANDRA ROSSI[♥]

Abstract

The aim of this paper is to critically revise the well-established attitude towards economic theorizing of property as a complete bundle of rights over well-defined uses. While some authors have previously introduced the incomplete dimension of property in their discourse, they have conceptualized incompleteness either in terms of undiscovered uses, weakly enforced rights or weakly partitioned rights. We move from a different idea of incompleteness, namely the initial lack of attribution of well-defined rights over new undefined uses of an asset. We suggest a possible direction of future research towards a theory of incomplete property, namely a theory of property intended as an incomplete bundle of defined and undefined rights over the uses of an asset. The elements of the theory here delineated may contribute to reconcile and to integrate under a common framework some of the main debated issues on the nature and the dynamics of property rights. Moreover, it reframes the relation between externalities and property and shows the existence of a complex coevolutionary relationship between property and externalities.

Keywords: property, rights incompleteness, externalities, transactions

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^{*} University of Siena, Dept. of Economics, nicita@unisi.it

[♦] University of Siena, Doctoral School in Law and Economics, mrizzolli@unisi.it

[♥] University of Siena, Dept. of Economics, alessandra.rossi@unisi.it

1. INTRODUCTION

Contracts and property are arguably the two most investigated topics in the literature of law and economics and New Institutional Economics. It is however striking how scholars in the first field are as well aware of the incomplete nature of contracts¹ as the experts of property are inclined to forego any such thing with regards to property rights. In the analysis of contractual practices, there is ample room for uncertainty, bounded rationality, ambiguity, non-contractibility of uses, vagueness and incompleteness². Nothing as such can be envisaged in the literature on property rights. One may thus observe a tension, if not a contradiction, between the economic analysis of contracts and the economic analysis of ownership. While the literature on contracts is replete with all sorts of references to the reasons why the latter should be regarded as incomplete and the notion of contractual incompleteness is now widely undisputed, scant attention has generally been paid to the consequences of the circumstance that property³ may not be fully definable ex-ante. Indeed, whenever property is invoked, it tends to take the appearance of a fully defined object whose primary characteristics is that of securing full control over resources, thus promoting stability of expectations and incentives' alignment.

Of course, problems of definition are not completely absent from economic theorizing on property. It is remarkable, however, that definitional problems are generally considered from an ex-post perspective and mostly relate to issues of enforcement or weak partitioning of rights, as in the analysis of common pool resources. Luckily, there are some notable exceptions. Demsetz (1988, pg. 188), for instance, points out that the notion of "full private ownership" over assets is "vague", and 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*" (p. 19). The theory of property developed by Barzel (1989) and others also touches upon the idea that, as assets have multiple attributes many of which may not be specified, the very notion of ownership may remain vague. These insights, though, have gone largely unnoticed. As we see it, acknowledgement of the consequences of recognizing the intrinsic incompleteness of ownership is still far from sight.

In this paper, we proceed from a number of questions so far neglected: why should property enjoy, to economists' eyes, the attributes of certainty and completeness denied to incomplete contracts? Why in one case (the theory of property) the uses related to someone's property are assumed to be clearly and perfectly defined and in other cases (incomplete contracts theory) some of these uses are assumed to be non-contractible? According to one of the most authoritative definitions of contractual incompleteness (O. Hart, 1995), to say that some uses are non-contractible means saying that they are unverifiable by a third party, say a Court. However, if Courts are deemed unable to solve controversies over incomplete contracts, it is at least odd to assume that they can easily

¹ See, for a survey, Nicita and Pagano (2005)

² See also Hart (1995) and Bolton and Dewatripont (2005)

³The terms ownership, property and property rights are often used interchangeably. In this paper, we use the terms "ownership" and "property" interchangeably. In the tradition of property rights theorists, however, we distinguish between "ownership" and "property rights", assuming the former to be a bundle of the latter.

ascertain the exact content of property. More generally, one might rightfully suspect that the sources of incompleteness in contracts may also extend to property. What happens to the traditional economic approach to property when we explicitly allow for incompleteness?

The aim of this paper is to critically revise the traditional attitude towards economic theorizing on property as a complete bundle of rights over well-defined uses and suggest a possible direction of future research towards a theory of incomplete property, namely a theory of property intended as an incomplete bundle of defined and undefined rights over the uses of an asset.

We start by investigating the main features of the traditional notion of property in the law and economics literature. The latter can be rather uncontroversially identified in: (i) the interpretation of ownership as a bundle of rights and (ii) the definition of ownership as 'full control' over the uses associated with proprietary rights. While these two features appear to be consciously or unconsciously in the background of any economic treatment of property, we show that in a world in which the implicit assumption of completeness of the property bundle is adopted, these attributes lose their economic relevance. When, for every use in property, there is a clear relationship between owner's rights and non-owners' duties to abstain from interfering, the interpretation of property as a bundle of rights leads to a tautology and the notion of "full ownership" over the (defined) uses embedded in the bundle is deprived of any clear economic meaning.

On the contrary, the bundle of rights view of property and the notion of ownership as 'full control' over resources recover their economic meaning in a world of incomplete property, i.e. in a world in which property over an asset is intended to be a bundle of both defined and undefined rights over actual and potential uses of that asset. According to this perspective, ownership should be interpreted as having a core of defined and contractible uses, which define standard rights and duties attributed to property, and a periphery of undefined uses. While for defined uses it should be always possible to delineate a clear social relationship of rights and duties between owners and non-owners, for undefined uses this relationship is transformed in one of liberty-exposure according to the Hohfeld-Commons categorization. In this framework, the degree of power enjoyed by right-holders depends on the dimension and the composition (in terms of defined vs. undefined uses) of the bundle. Ownership thus attributes 'full control' to the owner when it assigns also a 'residual right to control' over undefined and non-contractible uses bundled in property. What it is important to stress is that the incompleteness of property gives rise to controversies over those uses that are left undefined, when there are alternative claims over rival uses. Controversies of this kind are, in fact, a reciprocal negative externality and are solved by a process of property rights re-definition implemented by alternative institutions like Courts' decisions, private orderings, public institutions and regulation.

The theory of incomplete property here proposed induces us to reformulate, to some extent, standard definitions of property and externalities as the two sides of the same coin. That leads us also to revisit the nature and the role of transaction costs in affecting the emergence and the dynamics of property rights. The resulting picture will extend Demsetz's (1967) and Barzel's (Y. Barzel, 1989, 2002) theories allowing for the analysis of the co-evolutionary dynamics between externalities and property rights and outlining the role played by public and private institutions in affecting the evolutionary path of property rights.

The paper proceeds as follows. In section 2 we revisit the standard definition of property as a bundle of rights showing the ambiguities surrounding the implicit definition of property as a complete bundle which is pervasive in the literature. In section 3 we introduce the notion of incompleteness as applied to the analysis of property by looking at previous relevant contributions. Section 4 proposes the bulk of a theory of property as an incomplete bundle of defined and undefined rights over uses embedded in property. In section 5 we consider the implications of our theory for some controversial issues in the theory of property. Section 6 opens up the “Pandora box” of the issue of the efficient allocation of property, hinting at the consequences of explicitly acknowledging property incompleteness for the analysis of this issue. Section 7 explores potential new directions of research and section 8 concludes..

2. PROPERTY AS A COMPLETE BUNDLE OF WELL-DEFINED RIGHTS

The notion of ownership in economics is a rather elusive one (D.W. Bromley, 1988, 1991, G.D. Libecap, 2004a, 2004b, A. Ryan, 1998) and no universally accepted definition of the concept exists⁴. In spite of its acknowledged importance to economic reasoning, the definition of ownership, property and property rights is often functional to the specific analytic purpose at hand. Moreover, there is some terminological confusion, as some scholars often use the terms ownership, property and property rights interchangeably, while others define ownership (or property) as a set of specific rights each attached to the vast array of uses accessible by the owner. Nevertheless, a few key aspects of the way in which economists think about ownership can be singled out. Starting with the so-called “property rights school”, property rights have been conceptualized as social relations inherent to the use of scarce resources and enforced through a variety of means that include formal laws, informal norms and private initiatives. Ownership has thus been interpreted as a form of aggregation of such social relations – a bundle of rights over the use of scarce resources (A.A. Alchian, 1965). Strictly related to this aspect is the perception that the stability and predictability of the enforcement of these social relations, by granting owners full control over given resources, performs a variety of economically useful functions, and particularly an incentive alignment function. Thus, the notion of *ownership as a bundle of rights* has generally gone hand in hand with the idea that ownership assigns to right-holders a socially enforced power to exert full control over the uses that make up the bundle (see, for instance R.A. Epstein, 1997, T.W. Merrill and H.E. Smith, 2001)⁵.

One definition that summarizes well these two aspects is given by Cooter and Ulen (1988), who define property rights as a comprehensive list of “*what a person may or may not do with the resources he owns: the extent to which he may possess, use, transform, bequeath, transfer, or exclude others from his property*”. The owner is intended to be “*free to exercise his rights over his property, by which we mean that no law forbids or requires him to exercise those rights. [...] The legal conception of property is, then, that of a bundle of rights over resources that the owner is free to exercise and*

⁴ It should be specified that, in this paper, we refer primarily to *private* property, although some of the insights we propose might also be extended to state and common ownership.

⁵ The notion of ownership as full control has a long tradition that goes back to Blackstone and Bentham. It has recently been noted that there is a contradiction between the notion of ownership as bundle of rights and the notion of ownership as full control (Merrill and Smith, 2001), but it remains true that both of these aspects of the notion of ownership are strictly intertwined in the minds of economists thinking about ownership.

whose exercise is protected from interference by others. [...] Property creates a zone of privacy in which owners can exercise their will over things without being answerable to others”.

In other words, ownership is associated to the possession of a wide assortment of use rights that range from the traditionally recognized rights of *usus*, *fructus* and *abusus* first identified by Roman law⁶, to the vast array of implicit uses that an owner could decide to activate over the resources she owns. Generally, rather than specifying all the alternatives available to an owner, it is remarked that the owner has the liberty (the full control) to select among several alternative and complementary uses in a way that maximizes her utility. Sen defined that also as ‘minimal liberty’ (1970)⁷. Of course, the term ‘use rights’ should not be confined only to what is commonly meant by ‘use’, rather it should be extended so as to cover the wide range of property rights included in the ownership bundle, as subsequent refinements in the property rights literature have made clear. In addition to use rights, ownership may also entail income rights, rights to alienate the resource, rights to exclude from access to the resource and so on. Honoré (1961) has listed eleven characteristics that should be present for full ownership to obtain⁸.

At the cost of oversimplifying, we can thus distinguish three interdependent attributes that have traditionally characterized economic thinking about property:

- a) Property can be defined as a bundle of rights over uses of given resources;
- b) Property assigns to the owner full control to select the uses therein bundled, safe from interference from nonowners;
- c) Full control over bundled uses is the source of the economic value of property for the owner.

A corollary of the above attributes is that the value of property rights is increasing in the width of the bundle and in the degree of full control exerted by the owner over the uses embedded in the bundle. The narrower is the bundle of uses, the lower is the private value of property. The lower is the degree of control exerted by the owner, the lower is the private value of property (G.D. Libecap, 2003).

In a similar setting, in order to define the very notion of ownership and to evaluate its economic significance, two issues become unavoidable. First, it is necessary to investigate the way in which the process of bundling and unbundling of uses actually shapes the institution of ownership. Second, attention should be paid to evaluating the conditions under which owners are able to exert full control over the uses bundled in property. With respect to both questions, it seems to be relevant to ascertain whether owner’s full control should be interpreted only as the liberty to select the existing uses embedded in property or also as the residual right to control all the potential uses, known and unknown, new and unforeseeable.

At a first glance, it may thus appear rather surprising that these two questions seem to be quite neglected in traditional approaches to property, with the notable exceptions of

⁶ The term *usus* refers to the right to use property, the term *fructus* indicates the right to receive income from property, and the term *abusus* identifies the right to dispose of property by transforming it, transferring it, or even destroying it (E.G. Furubotn and R. Richter, 1997).

⁷ For a critical appraisal of the definition of rights as minimal liberty in Sen (1970), see also Nicita and Savaglio (A. Nicita and E. Savaglio, 2005 - forthcoming).

⁸ See also Bromley (1988, pg. 188) for a discussion.

Demsetz (1967) and Barzel (1997). On closer inspection, the scant attention paid to questions of this sort is revealing. In our view, it depends on a characteristics of the bundle of rights picture of property that has generally gone unnoticed, namely that ownership is interpreted as a complete bundle of rights. Here, complete means that the bundle encompasses all the possible uses of the resource over which property is defined and that each use embedded in the bundle is completely specified. The main consequence, as we will clarify below, is that even if one does not assume that all the uses that are embedded in a given property are specified and define ownership as the liberty to select the uses therein bundled, we are implicitly assuming that (i) property of a given resource encompasses all actual and potential uses of the latter and that (ii) the rights attached over each use are well-defined, in the Hohfeldian sense (for each right a corresponding duty not to interfere is imposed on – and enforced by – society).

This notion of “completeness” of property might be exemplified by the definition of (complete) property rights provided by Shavell (2004) as rights “*to use things and to prevent others from using them*”. Thus a right of an agent A is always coupled with a duty on all other society members not to interfere with A’s exercise of his rights. Consequently, according to Shavell (2004), “*a particular possessory right is a right to commit a particular act or a right to prevent others from committing a particular act.*” In Shavell’s terms, “*a completely specified act includes in its description the place, time, and the contingency under which it is committed – for example digging at a designated location, on Thursday at 4:00 p.m. if it is not raining (the contingency)*”. A well-defined property right, thus, would specify the relevant attributes of each use and the contingencies that characterize such uses. In that case, there is no uncertainty over the definition of the use of the digging machine and of the land to be dug. The definition of property is complete since it includes all the relevant attributes necessary to exercise the rights and to be sure that none in society will interfere (or that if she interfered by accident she would be forced to pay an appropriate compensation). This notion of ‘complete property somehow recalls the notion of complete markets in the Arrow-Debreu-McKenzie paradigm (K.J. Arrow and D. Gerard, 1955, L.W. McKenzie, 1981). As for any other economic good, property is defined in terms of all its attributes regarding space, time and contingencies: ownership provides exclusive access to all the possible uses embedded in property (i.e. to all the possible uses in all possible contingencies); to each use is associated a well-defined right and thus for each right a corresponding duty is defined. There is no empty core or *missing property right* in such a system. Rather, there is a sort of general equilibrium among legal positions⁹ both at the level of the bundle of rights (owners/nonowners) and at the level of each specific use embedded in ownership (rights/duties).

What it is important to note is that the completeness of property implicitly assumed by most theorists entails two other equally troubling underlying assumptions. The first is that the ex-ante transaction costs of defining all the uses bundled in property are assumed to be zero. In other words, the sort of evils that are commonly assumed to plague other domains of human endeavor (bounded rationality, unforeseeability of events, limited ability to describe contingencies etc.) are ruled out when it comes to define the content of property. Whoever is in charge of delineating property rights can do so at no cost.

The second assumption is that, consequently, also enforcement costs are assumed to be zero since it is assumed that every use related to a property bundle carries out a

⁹ See also Pagano (U. Pagano, 2000, 2005 - forthcoming)

correspondent entitlement protected against non-owners' interference¹⁰. As long as each of the use rights embedded in ownership is assumed to be known, well-defined, observable and verifiable, it is always possible to define an entitlement associated to each use and a correspondent duty for non-owners to abstain from interfering with that entitlement. Conversely, a right that does not include in itself a description of all the relevant attributes (defining place, but not time) could fail in inducing the correspondent duty. In Shavell's example, I may interfere at 4:00 p.m. with your right of digging if your right was weakly defined concerning your digging time schedule. Using the complete market metaphor we can say that *complete property rights* imply owners' abilities to effectively exclude non-owners from interfering with well-defined rights in all their relevant attributes.

The combination of these implicit assumptions has deep consequences for the tightness of the notion of ownership that we are discussing. If property rights over specific uses can be completely specified ex-ante and, consequently, there is a clear correlation between any right attributed to the owner and the corresponding duty not to interfere imposed on and enforced by the society, it becomes truly unclear why ownership should be conceptualized as a bundle of rights. The notion of ownership as a complete bundle of rights is, in such a setting, deprived of any economic meaning. Any relevant issue pertaining to the exercise of property rights could be analyzed without recourse to the unifying concept of ownership. Given all the possible uses of a resource x, y, z, w, all that would matter would be the possibility of defining and enforcing a social relationship of correlative rights and duties over such uses. Any reference to the fact that these use are aggregated in a bundle would be redundant. This, in turn, might explain the difficulty incurred by proponents of the bundle of rights view in explaining what amount of rights should be comprised in the bundle in order to qualify someone as owner. Indeed, the bundle of rights view is consistent both with interpretations according to which owners can exclude others from *any* use of a given resource (as in A.A. Alchian, 1965) and with interpretations according to which *some* uses might be shared (as in R. Coase, 1960). Related, the inconsistencies inherent in the notion of ownership as a complete bundle of property rights make it hard to clearly determine the limits that should be set to State intervention in modifying the content of the bundle according to some welfare criterion (see below, section 4).

3. THE MEANING OF INCOMPLETENESS IN PROPERTY: WHERE DO WE STAND

In the previous section we have emphasized how most of the literature basically assumes property to be complete. As seen, this hypothesis is seldom made explicit, as in the case of Shavell (2004), and more often lies on the background of the discussion. This is not to say that the notion of incompleteness has never surfaced before. Quite the contrary. Most authors these days are ready to grant property a dimension of incompleteness, although there is little if nothing on the origin and nature of this "incompleteness" (see among others D.W. Allen, 2000, D. Lueck and T.J. Miceli, 2005) nor on its consequences. Paradigmatically, it should be noted that in the original work of Demsetz (1967), the incomplete dimension of property is not even considered although he more recently

¹⁰ In addition to this it might be noted that, as Bowles and Gintis (S. Bowles and H. Gintis, 1993) have pointed out with reference to the case of a Walrasian world, the enforcement of rights/duty relationships implies the assumption of moral agents.

recognized it to be a pervasive feature of property¹¹. By now there should be no fear of affirming that “complete and well defined” property basically does not exist and it is only assumed as a benchmark against which to measure ordinary and inherently incomplete property. However, how this conclusion has been reached is not entirely clear, since the concept of “incompleteness” has largely been left “incomplete”¹². In the following paragraphs, we attempt to outline the main ways in which the incomplete dimension of property has been understood and declined in the previous literature.

3.a. Incompleteness as the costs of digging out new uses

The notion of incompleteness has been declined in terms of transaction costs primarily by Yoram Barzel. Whenever transaction costs are positive, Barzel (1997) argues, property rights are not perfectly defined.

In order that rights to an asset be complete or perfectly delineated, both its owner and other individuals potentially interested in the asset must possess full knowledge of all its valued attributes. [...] When transaction costs are positive, rights to assets will not be perfectly delineated. The reason is that, relative to their value, some of the attributes of the assets are costly to measure. Therefore the attributes of such assets are not fully known to perspective owners and are often not known to current owner either
(Y. Barzel, 1997, pg. 4-5).

Transaction costs thus generate incompleteness because they make the discovery of every attribute of assets an expensive action. Thus, some of the attributes of an asset will be left unknown and this adds uncertainty over the value of the asset itself. In other words, we may speak of some unknown sticks of the bundle of rights. At any point in time, some uses are not yet known because too costly to discover. We may use the simple examples of Alchian (1998) to illustrate the case. A newly planted tree may block the view from someone else’s land. However it is not clear whether the other had the right to look across the land. If the use “looking across the land” or conversely the use “planting a tree”, was anticipated and singled out, a price might have been negotiated to “preserve the view” or “allow the planting” in a Coasian fashion. Other unknown uses may be quarried in unpredictable circumstances such as the notorious case of the boat that attempted to harbor at a private dock during a sudden storm without owner’s permission¹³. Does there exist a use of the dock in case of emergency or does the property right over the dock include also the right to exclude anyone under any contingency? As Alchian argued, if such

¹¹ “Of course there is never complete certainty about the scope of allowed and disallowed uses of resources so a right-defining and conflict resolving institution, such as the court system, the legislature, or some community authority, is inevitably part of any property right system” (H. Demsetz, 1998).

¹² Barzel (1997, pg. 90) recognizes that “the notion that rights are not well defined has not been pursued” and when Lueck and Miceli (2005) argue that “Little work has been done to understand the forces that determine the optimal complexity of property rights” they seem to introduce a concept with regard to property that resemble a notion of incompleteness. More on this in section 3.c

¹³ The example clearly refers to *Ploof v. Putnam*, 81 Vt. 471, 71 A 188 (Supreme Court of Vermont, 1908). In the case a person was refused to tie-down a boat at a private dock during a severe storm. The court declared “that it was a duty of the defendant by its servant to permit the plaintiff to moor his sloop to the dock, and to permit to remain so moored during the continuance of the tempest” ordered the user to pay for the use of the asset”.

emergency action is deemed appropriate, then rights to the use of the dock do not all belong to the owners, as he might have thought. In section 4 we will go deeper into the original intuition by Alchian.

3.b. Incompleteness as weak enforcement

Sometimes incompleteness is also referred to as arising from uncertainty over the enforcement of property rights. When enforcement cannot be guaranteed, the value of the property decreases because the owner discounts the expected value of its right by the probability of it not being protected in case of violation. Since Adam Smith's days, economists have long stressed how a weak protection of property is often thought to be the root of many developmental problems (D.C. North, 1990, 1992) and generally undermines economic performance by jeopardizing owners' expectations about use of assets (G.D. Libecap, 2003). In this strand of literature incompleteness becomes the evil to be evicted and securing property rights is the first public objective. Transaction costs are thus the costs of establishing and maintaining property rights (D.W. Allen, 1991) and as long as these remain high, no complete rights can be secured.

Furthermore, it is possible to identify in the literature another approach to incompleteness as incomplete enforcement. According to some authors, the attenuation of property rights may also take place through the adoption of liability rules as a rule of entitlement's protection. Liability rules are routinely used in common law and civil law countries as means of entitlement's protection. As Calabresi & Melamed (1972) have stressed, courts may choose one family of rules vis-à-vis the other, on the ground of efficiency reasons as well as society's *distributional preferences* and other *justice reasons*. Behind the Calabresi & Melamed framework, lays a definition of transaction costs, that looks at the costs of individuating the parties of a bargain, their inclination and capability to negotiate. Information and coordination costs are relevant to the choice of one rule vis-a-vis the other. Moreover, in attributing property to parties a court may stir liability rules so as to implement a large variety of distributional outcomes without affecting efficient allocation (I. Ayres, 2005, I. Ayres and R. Gertner, 2001). This comes to be very useful for courts when the exact ownership of the bundle of rights cannot be verified and "fair" solutions need to be implemented. However, by changing the remedy from a property rule to a liability one, some critics argue, property becomes weaker because liability rules run the risk of systematically underestimating the value of the property by not considering elements such as subjective loss (J. Standen, 1995)¹⁴. Some go even further than this and argue that a liability rules simply decreases the value of the right by removing the use "transfer" from the bundle (L.A. Bebchuk, 2001, R.A. Epstein, 1997)¹⁵. For these authors the simple observation that liability rules attenuate property should lead us to reconsider their use in many circumstances.

¹⁴ For a discussion of the "systematic under-estimation" argument see (I. Ayres, 2005, L. Kaplow and S. Shavell, 1996)

¹⁵ These authors tend to emphasise the difference between the two rules in term of the strength they confer to the protection and enforcement of the right. Elsewhere Nicita and Rizzolli have argued that the notion of property rights' incompleteness helps to reframe the dichotomy in terms of how the two different devices are used in the process of continuous redefinition of incomplete property rights. See (A. Nicita and M. Rizzolli, 2004)

The two approaches differ in that the first one privileges the ex-ante view of securing owner's expectations, while the second is more concerned with the ex-post efficient allocation. However, while not neglecting that the goal of securing property is highly valuable for the society, the literature on property and liability rules suggest that some strength in the enforcement of property may be forgone in exchange of more efficient and "fair" distributions of property. In other words, sometimes it is worth to leave property more incomplete because less enforced, to have it more complete because its uses have been re-defined and assigned (C.M. Rose, 1998 see also footnote 20).

3.c. Incompleteness as weak rights' separability

Lueck and Miceli (2005) have noted how in many real world situations, assets are handled with mixed regimes that have to face the complex articulations of uses and relative rights bundled in the property. They use the example of a rancher's land to illustrate the case. They observe that, while the use of the land for grazing might be private, the use of the stream through the property might be open access, the underlying oil reservoir may be governed by a unitization contract that mimics a common property and other regimes might be in use to govern other uses of the asset land. Different property regimes are needed because for any of these uses of the bundle, there exist a different optimal ownership of the land¹⁶. This problem arises from the fact that "*land is adjacent to other resources, notably air, water and wildlife stocks, these environmental resources are considerably more difficult to divide into individual properties. [...] owners of land simply "piggy-back" uses of these common resources onto their use of land (C.M. Rose, 1998).*

Traditionally, land ownership disregards these considerations and simply defines property through the *ad coelum* doctrine prescribing ownership of land to encompass all attributes in an infinite projection above and below earth's surface¹⁷.

The *ad coelum* doctrine thus packs-up in the right to a portion of land also some attributes of other assets (air, underground resources, water) that can be potentially claimed by others, or at least the efficient use of which would entail different surfaces of projection. In these terms, property is always poorly defined in respect to some of the uses of the land, either because the use would request a different surface to be exploited optimally (the oil reservoir), or because the use is potentially non rival (the stream used for fishing) or because some uses are potentially rival against other uses bundled in someone else's property (noise) but forcefully entangled into a private bundle. Land ownership under the *ad coelum* doctrine is weakly separable, hence incompletely definable.

3.d. What's incomplete in the above meaning of incompleteness?

Why does incompleteness matter at all? Libecap (2002) argues that "*how property rights are structured has important efficiency attributes because if complete, they can directly align individual decisions with relevant social marginal benefits and costs, eliminating externalities. [...] Property rights must be*

¹⁶ *The optimal ownership of land for a home may be one acre, but for an oil reservoir it may be ten thousand acres* (D. Lueck and T.J. Miceli, 2005). See also (G.D. Libecap, 1998, G.D. Libecap and J.L. Smith, 2002)

¹⁷ This way of defining property of land has always been appealing for its straightness and powerfulness. Land is a resource that responds to investment; it can be easily divided; can be fenced and trespasses and other violations can be easily observed. These characteristics make land easy to be proprietized and this may explain why land has always been used as the paradigmatical example of property because it is relatively easy to turn it into property (C.M. Rose, 1998).

clearly specified [...] to be effective." His view is shared by most of the scholars in the field that would agree that, the more property is complete, the more it functions as an economic institution by internalizing more efficiently externalities¹⁸. When rights are not well defined, when they are poorly enforced or attenuated – for instance by the application of a liability rule – they imply a decrease in assets' value (G.D. Libecap, 2002). The primary concern of scholars in the field over incompleteness takes mostly the form of uncertainty of the exchange value of the asset which the property insists upon. Since any asset may or may not have other valuable uses waiting in the pipeline, or some of these uses may be neglected ex-post, its value¹⁹ is a stochastic variable. Incompleteness in other words shrinks down to uncertainty over the market value of the property right. Certainly the process of completion of the specification of the property evolves over time: as soon as new uses are discovered, or enforcement problems are addressed, the right becomes more defined and more valuable. Eventually, property might become complete and thus more valuable²⁰.

Expressed in these terms, however, the idea of incompleteness seems to lose much of its relevance and shrinks down to another cost of the property right regime. In other words, in the Demsetz framework, while valuating the costs of establishing a property right regime, one should also discount some uncertainty over the first best value of the asset in addition to all other variables.

It seems to us that incompleteness may lead us beyond this conclusion. Certainly, at any moment in time, most of the uses of a bundle are clearly specified and the rights that command them are assigned to the owner of the property right. However, due to some sudden events (shift in taste, increased scarcity, technological innovation) new uses emerge and the rights over them are not initially attributed. Here lies what we believe is a more interesting notion of incompleteness. At any point, most of the uses are specified but other are or may be on the point of emerging. Property is incomplete in the sense that at any point in time not to all uses of the bundle are covered by a well-defined right. Certainly not all uses of an asset can be defined ex-ante because of transaction costs. However, while some scholars seem to be concerned with the "still missing uses", it seems to be more interesting to look at the "yet un-attributed jurial relations of newly discovered uses".

Let us imagine three points in time. At $t=0$ a property is made of a given set of uses. At $t=1$, some new uses are uncovered and at $t=2$ these uses are assigned. While Barzel and others seem to be concerned with what happens between time zero and time one, it seems to be worth exploring the interval between time one and time two. In fact, to say that there are many other uses that are too costly to be uncovered does not add much to our understanding of property until at least one of these uses is effectively dug out and some economic value is extracted from it. However between $t=1$ and $t=2$, another source of incompleteness emerges, which does not refer to the "un-knowledgeability" of other residual uses, nor to the concern of how the property will be secured but rather to the

¹⁸ Or in the words of Allen: "*as property rights become better defined, the gains from trade increase. other things equal, individuals prefer better defined property rights to poorer defined ones because they prefer more wealth to less*" (2000, pg. 897)

¹⁹ Intended here as the value set by an hypothetical volunteer fully informed Walrasian auctioneer

²⁰ There are few notable exceptions to the common wisdom that more complete property rights imply more efficiency. Ayres (1999) focuses on the ex-ante dimension of enforcement and argues that "*uncertainty and delay in patent litigation may be a way of giving patentees constrained market power to reduce [monopoly pricing] inefficiency*". On the other hand, Carol Rose (1998) contests the ex-post argument of attribution and argues that "*sharply defined property rights may display a quite unattractive appearance ex-post especially when a more informed person appears to use hard-edged entitlements to the disadvantage of a less knowledgeable or less capable person*".

uncertainty about who should own the use that has emerged. An intuition which however needs some more qualifications.

4. A SKETCH OF A THEORY OF INCOMPLETE PROPERTY

In this section we outline the basic elements of a comprehensive theory of incomplete property that incorporates some of the original insights seen in section 3 and attempts to uncover additional elements and implications of the notion of incompleteness as applied to the economic analysis of property.

Let us start from the ideal-type of complete property rights, and remove the assumption that the ex-ante transaction costs of defining all potential uses related to a given property are equal to zero. The main consequence of removing this assumption is that for at least some uses, it will not be possible to define and enforce a corresponding duty not to interfere. Let us go back to the example provided by Alchian (1998) (see section 3.a) and imagine two economic agents, Mr. A and Mr. B, who are respectively the owners of two neighboring pieces of land. Mr. A decides to plant a new tree. After some years, the tree has grown up to the point of blocking the view of the landscape from B's land. Thus, Mr. B might want Mr. A to cut the tree so as to enjoy the view, while Mr. A might want the tree to remain at its place and would be harmed by its removal. In this situation, both A and B might rightfully assume that ownership of their respective pieces of land gives, besides other rights, the right to plant a tree as well as the right to enjoy the view of the landscape. However, the way in which these rights are jointly exercised by A and B creates a conflict over the use of a portion of their respective lands, i.e. over the space in which the growth of the tree inhibits B's access to the view. Economists would call this situation a negative externality stressing, as Coase (1960) did, the reciprocal nature of the exercise of joint claims over the rival use of the 'space' which allows A's tree to grow and B to enjoy the view.

The case portrayed above exemplifies well the notion of externality we would like to propose. In the above example, although Mr. A and Mr. B hold property rights over their respective pieces of land, the right to plant and grow trees or the right to enjoy landscape view constitute undefined uses bundled in their respective property bundles. In other words, Mr. A's and Mr. B's bundles are incomplete since they do not clearly specify all the possible uses of the land. Both A and B hold the expectation that having access to the bundle of rights included in their ownership allows them to exercise the right over the use of the 'space' which allows A's tree to grow and B to enjoy the view. It is the decision of Mr. A to plant a tree in a certain way (of Mr. B to use the space around her land to watch the landscape) that reveals to B the undefined nature of her claim to watch the landscape (that reveals to A the undefined nature of his claim to plant that tree). The ex-post emergence of an externality thus takes the form of a *joint claim over a rival use* that reveals the undefined nature of some of the rights bundled in property.

Contrast this with the case in which the right over the uses of land we are discussing were defined ex-ante, so that either A had the right to plant a tree and let it grow independently of any neighbor's claim, or B had the right not to have the panoramic view hindered by any neighbor's tree. Suppose that the right over the conflicting use was attributed first to A. This means that society would enforce the exercise of this right by A and would impose a corresponding duty on B to abstain from interfering with A's rights without A's consent. In such a case, any action taken by B to stop A's exercise of her right, without A's consent, would be equivalent to a taking, namely to an unjustified violation of

a well-defined property right for which restoration of some kind (compensation but most likely an injunction) seems necessary. Regardless of the way in which A's right is protected (by a property, a liability or an inalienability rule) if A's right over the conflicting use was well-defined in the first instance there would not be any reciprocal externality, but only an illegitimate interference on A by B. This hints at the fact that if a reciprocal externality does emerge, it must be because each agent's claim over a rival use is not covered by a well-defined property right.

One thing it is important to note is that, although the most intuitive way to think about incompleteness is by interpreting it as the consequence of ex-ante transaction costs to know and foresee all the potential uses, as in Demsetz (1967), Alchian (1998), Barzel (1989, 1997), there is more than that. Incompleteness, in our view, regards not only the 'bounded knowledge' or ignorance over all potential uses but also and mainly ignorance over the complex network of possible interdependencies or externalities that may emerge over that use. Bounded knowledge matters most when it concerns the degree of rivalry of one's uses with respect to someone else's and viceversa. It is to this aspect that we now turn.

4.a. Bounded knowledge vs. Externalities

Let us turn back to our example. There, the incompleteness of A's bundle of rights is not only related to the unforeseeable and undefined use of planting and growing a tree in a certain way, but also to the existence of a neighbor like B who intends to carry out a use which is rival to that potentially claimed by A. Putting it in another way, incompleteness should be related not only to the mere existence of potential unknown uses, but also to the circumstance that such use is claimed by someone else for a rival purpose. Thus, if A was the sole owner of all the pieces of land that give access to landscape view or if B had no interest in viewing the landscape, there would still be an ex-ante undefined use, but no externality would emerge in that case. Incompleteness is thus relevant when it may generate externalities. That means, in turn, that the degree of incompleteness of property is strictly related to the potential externalities that the ex-ante definition of property rights may generate. Any bundle of property rights is endemically incomplete in the above sense unless we assume that all economic agents in a society have full common knowledge of the way in which everyone else will use his own property.

Property incompleteness is, of course, a matter of degree. The degree of incompleteness depends on the composition of the bundle in terms of defined and undefined uses, although incompleteness constitutes an intrinsic attribute of any property bundle. Tangible property, like a piece of land, may present a lower degree of incompleteness with respect to an intangible asset covered by an intellectual property right. The uses related to land have been standardized over time and consequently the relative rights are well-defined as their correlative duties are. However, even in the case of land property, new uses can emerge and create negative externalities among rival claimants. Let us be more clear about that.

4.b. Externality vs. Presumptive rights

For the sake of simplicity three distinct consequences of the incompleteness of property might be distinguished:

- *case 1- ex-post definition of a new right:* a new use emerges that is commonly reputed not to belong to an existing bundle or not accessible through any existing bundle of rights and the emergence of this new use roughly coincides with the definition of

rights over the new use (one case in point might be the emergence of a new use for the radio frequencies used for 3rd generation cell-phones' networks);

- *case 2- ex-post emergence of a presumptive right*: a new use emerges through exclusive access to an existing bundle and it does not conflict with someone else's rival claim (we can think of the above case of A's decision to plant a tree and let it grow with no objection on the neighbors' side);
- *case 3 – ex-post emergence of an externality*: a new use does emerge through exclusive access to several adjacent existing bundles and it is in conflict with someone else's rival claim (this is the above example of A's and B's claims over the rival use of the 'space' allowing A's tree to grow and B's enjoyment of landscape view) .

Let us assume that $\Omega = \Delta \cup \Delta'$. $\Delta = \{X, Y\}$ is the set of all actual and potential uses or actions over which a system of private ownership rights is defined in $t=0$ in a society composed by just two individuals A and B. Δ' is the set of uses complement to Δ , with $\Delta' = \Omega / \{\Delta\}$. $X = \Delta / \{Y\} = \{x_1, x_2, x_3, \dots, x_n\}$ is the bundle or well-defined rights held by A and $Y = \Delta / \{X\} = \{y_1, y_2, y_3, \dots, y_n\}$ is the bundle of well-defined rights held by B. Since rights are well defined, the partition of $\Delta = \{X, Y\}$ is such that all the uses known in $t=0$ are exclusively assigned, so that A has a duty not to interfere with Y and B has the duty not to interfere with X .

Definition 1 : (Ex-Ante) Complete Property

If, under the above setting, $\Delta' = \emptyset$ and $X \cap Y = \emptyset$ property rights are complete.

This definition captures the idea that when the above conditions persist indefinitely over time, no new uses can be imagined that are not included in one of the two bundles. Now, let us assume that at a certain date, $t=1$, new uses become available.

Case 1 is equivalent to assume that a new use z is available and that access to z is not possible through access to X or to Y (in the sense that it requires a specific technological equipment or an administrative authorization and so on). Thus, we have the following definition.

Definition 2: (Ex-Post) Complete Property

If, under case 1 setting, in $t=1$ $\Delta = \{X, Y, z\}$ with $X = \Delta / \{Y, z\}$, $Y = \Delta / \{X, z\}$, $\Delta' = \emptyset$ and $X \cap Y = \emptyset$ then property will be complete ex-post.

In this case, if a right is defined over z and it is assigned, by auction or by lottery, to A, with $X = \{x_1, x_2, x_3, \dots, x_n, z\}$, or to B, with $Y = \{y_1, y_2, y_3, \dots, y_n, z\}$, so that non-owner is charged with the duty not to interfere, then one of the two bundles is enriched by the new use and no any externality will occur since $X \cap Y = \emptyset$ will ex-post holds.

Definition 3 : Presumptive Rights

Let us assume that in $t=1$, the new uses z and w emerge, respectively, from A's access to X and B's access to Y , so that $\Delta' = \{z, w\}$. If, $X = \Delta / \{Y\} \cup z$, $Y = \Delta / \{X\} \cup w$, and $\{X \cup z\} \cap \{Y \cup w\} = \emptyset$, then z and w are defined as *presumptive rights*.

Case 2 illustrates the circumstance in which the new uses derive from having access to a pre-existing bundle. Since undefined in $t=0$, these new uses are not covered, in $t=1$, by a socially enforced system of rights/duties relationship, thus $\{z, w\} \notin \Delta$. If A's access to the use z does not interfere with B's access to w , and vice-versa a presumptive right is a *de facto right* as long as society does not define to which bundle, if any, z and w should belong. However as long as no one interferes with the exercise of the new uses, presumptive rights are treated *as if* they were socially recognized rights.

Definition 4: Externality

If, under the above setting, $X = \Delta / \{Y\} \cup z$ and $Y = \Delta / \{X\} \cup w$, but $\{X \cup z\} \cap \{Y \cup w\} = \{z, w\}$, then *presumptive rights* generate an externality.

- *Case 3* depicts the situation in which, as before in $t=1$ the new uses z and w are accessible, respectively through X and Y , although they are now assumed to be mutually incompatible, or rival uses for A and B. Since A's access to z would preclude B's access to w and vice-versa, each agent would behave *as if* he had access to both z and w . *When two presumptive rights constitute a joint claim over a rival use they generate an externality.*

The cases analyzed above show the different implications of interpreting incompleteness merely as the acknowledged existence of potentially unknown uses or as the case in which new previously undefined uses are potentially exposed and/or could generate an externality, as in the above case 3.

Of course rivalry should be here interpreted in a wide sense. It can be due to physical, geographical or technological constraints, or to agents' tastes and preferences. A world with a sole owner, in this sense, would be a world without externalities since ownership will automatically include in the bundle all the (rival) uses that may emerge over time and the difference between defined rights and presumptive rights loses any meaning. The emergence and the relevance of externalities will depend on the original definition of the bundle: the higher is the degree of completeness over potential uses, the less relevant are the externalities that may potentially arise. The emergence of a presumptive right does not mean that an externality could not emerge in the future, nor the emergence of an externality implies that it would not be possible to complete ex-post property rights. Case 1 illustrates the way in which new uses are defined ex-post in such a way that externalities are eliminated. The Coasean decentralized solution implies unification of property, when the bundle of A or B extends to $\Delta = \{X, Y\}$, or unbundling/re-bundling of property when, for

instance, one of the two claimants agrees to renounce to its claim over a rival use. However, Coasean bargaining depends on the dimension of transaction costs and on the number of actual and potential agents involved. When contractual bargaining cannot be enforced *erga omnes* a publicly enforced system of organized consent (B. Arrunada, 2003) over the definition and re-definition of property rights is necessary (that is not to say that it is necessarily optimal, see par. 6 below).

4.c. Incomplete property rights and fundamental jural relations

The incomplete property perspective is entirely compatible with and may help to shed new light on the jural correlations outlined by Commons (J.R. Commons, 1924)²¹ through a re-formulation of Hohfeld's (1913) fundamental jural relations. These relations are fundamental in that they define the necessary relations occurring between the two agents *A* and *B* when a given system of private property rights has been implemented. A distinction exists between *first order* and *second order* jural relations²². First order relations identify the *actual* system of rights assignment according to which *authorized transactions* take place in a given jural system. Second order relations depict the actual system of agents' power to induce a change in first order relations.

First order relations are characterized by two distinct relationships:

- (i) *right/duty*
- (ii) *liberty/exposure*.

The *right/duty* jural relation identifies the narrow Hohfeldian definition of right: A's right to *X* implies B's duty to abstain from interfering with A on *X*, while B's right to *Y* implies A's duty to abstain from interfering with B on *Y*. However, according to Hohfeld and Commons this relationship identifies only one side of the jural relation, we may call this clearly defined and socially enforced system of rights. In our view, even if Hohfeld and Commons do not mention the term 'incompleteness', the assumption that, beside narrow rights/duties relations, there is always room for liberty/exposure correlatives corresponds to our assumption of the existence of uses not currently covered by a legally enforced system of right/duty in the above case 2 and case 3. The following quotation exemplifies this point:

All rights and duties are relative. If we say that a right of one person is absolute, we can only mean that it is unlimited, and corresponds to an unlimited duty of an opposite person. [...] An absolute right, being unlimited, is an infinite right and therefore a zero-right. [...] an absolute right-duty is without content. [...] It simply does not exist as an actual or potential right and duty.

(J.R. Commons, 1924, pg. 84).

The second kind of jural relations identifies a broader meaning of right, named *privilege* or *liberty*, as opposed to a weaker notion of duty, named *no-right* or *exposure*. The jural relation *liberty/exposure* says that if A has the liberty to plant a tree, B, even if it has not the

²¹ Here we opted for Commons's reformulation of Hohfeld's correlatives.

²² See also Pagano (2000, 2005 - forthcoming) and Nicita and Pagano (2005).

duty not to interfere with that, is exposed to A's action. Here the liberty of A to plant a tree is opposed to B's inability to exercise a right to stop A from planting a tree (that is why *exposure* has also the meaning of *no-right*). At the same time since exposure is the result of B's lack of right to stop A, the dimension of A's liberty depends on the duties imposed to A, and that is why who has no-right could be exposed to someone else's liberty to act or not.

Table 1 - First order jural relations.

'Liberty', in the Hohfeld-Commons paradigm, can be interpreted as analogous to what we have defined above a *presumptive right* as long as the agent who is "exposed" to it does not react in some ways (for instance by going to court). In a sense, liberty/exposure relations create the potential for an *externality* to emerge. Of course, for an externality to emerge, and given the reciprocal nature of an externality, one should imagine the case of A and B jointly exercising their own liberty over a rival use. In other words, this might be the case – partly disregarded by both Hohfeld and Commons - of two opposite exposures between A and B, as in table 2.

Table 2 - Complete Rights, Presumptive Rights and Externalities.

<i>Complete Rights</i>	<i>Presumptive Rights</i>	<i>Externalities</i>
<div style="text-align: center;"> Right of A(B) <div style="display: inline-block; width: 20px; height: 20px; border: 1px solid black; margin: 0 auto;"></div> Exposure of A (B) </div> <div style="text-align: center; margin-top: 20px;"> Duty of B(A) <div style="display: inline-block; width: 20px; height: 20px; border: 1px solid black; margin: 0 auto;"></div> Liberty of B(A) </div>	<div style="text-align: center;"> Exposure of A (B) <div style="display: inline-block; width: 20px; height: 20px; border: 1px solid black; margin: 0 auto;"></div> Liberty of B(A) </div>	<div style="text-align: center;"> Exposure of A <div style="display: inline-block; width: 20px; height: 20px; border: 1px solid black; margin: 0 auto;"></div> Exposure of B </div>

As we may see from an inspection of the above table, one side of first the order jural relations (liberty/exposure) is only possible in a world in which we allow individuals to take actions not already covered by a right/duty jural relation. Thus, what is important to stress here is that some degree of incompleteness of property has been implicitly interpreted by Hohfeld and Commons as an endemic component of fundamental jural relationships. Presumptive rights and externalities are not exceptions to a world otherwise characterized by complete rights, rather they are a constitutive element of ownership.

What happens in the Hohfeld-Commons paradigm when an economic agent is exposed to someone else's liberty and would like to revert that situation? Second order jural relations serve that purpose. They illustrate agents' ability to transform right/duty relationships (thus re-defining previously defined rights), to transform a presumptive right into a defined right or to transform an exposure into a right (not to be exposed). Second-order jural relations are characterized by the following correlatives:

- (iii) *power/liability*

(iv) *disability/immunity.*

A has a legal *power* over B to bring about a particular legal consequence for B if and only if some voluntary actions by A are legally recognized to have this consequence for B who then will be liable for implementing the legal consequence claimed by A. On the other side, an agent B has a legal immunity with respect to A's legal action to obtain a specific legal consequence, if and only if A does not have the legal power to do any action that according to the law would have the desired consequence on B. Second order jural relations also entail symmetric correlation between the positions of the two agents. In this case too, the boundary between powers and disabilities of A should coincide with the boundary between liabilities and immunities of B and vice versa. According to the Hohfeld-Commons paradigm, the working rules of every transaction include the definition of the rights, duties, liberties and exposures of the agents or, in other words, their entitlements. The incompleteness of the transaction is here referred to what we have defined as the system of incomplete property rights²³.

4.d. Incomplete property as a bundle of core and periphery

The formulation of the Hohfeld-Commons' fundamental jural relations is relevant to explain a distinguishing feature of incomplete property. To say that property rights are inherently incomplete does not mean denying any clear, defined and socially enforced attribute of ownership. Moreover, casting doubts on the idea that property rights are absolute does not mean suggesting that property rights are always relative and without any clear content.

Incomplete property is a bundle of defined and presumptive rights, with the latter potentially exposed to an externality. Ex-ante defined rights constitute the *core* of ownership rights over uses socially enforced by organized consent at any given time. For a right to belong to the core of the bundle of rights embedded in ownership it must be coupled with societal duties not to interfere. Then the core of ownership refers to jural right/duty relations and generate expectation of full control by the owner. Infringement of the core constitute a *taking* in this respect. Access to the core, however, may give rise to uses over which no clear right-duty relationship has been defined ex-ante. These are presumptive rights, as we have defined them, or privileges (liberties) in the Hohfeld-Commons paradigm. They do not belong to the core, even if they could be treated as de facto rights as long as no other agent exercises an opposed presumptive right, privilege or liberty over a rival use, generating an externality. That is why presumptive rights stay at the periphery of the core of rights bundled within property. The dimension of the core of ownership thus depends on the extent to which rival uses are both included in it, i.e. are covered by a right/duty relation. That in turns depend on ex-ante transaction costs in defining uses and rights over them in a clear and socially agreed fashion.

To use the above notation, being $\Omega = \Delta \cup \Delta'$ the set of all actual and potential uses or actions over which a system of private ownership rights is defined in $t=0$, in a society composed just by two individuals A and B, which is partitioned in two set of property

²³ In this connection, it is worth noting that Commons (1924, p.67) argued that "*there are an indefinite numbers of possible disputes between the parties to the transaction that may arise before or after the completion of a transaction*". That might resemble an *ante litteram* definition of what nowadays is indicated as contractual incompleteness. However, in our perspective, that is also the consequence of property rights incompleteness.

rights $X = \Delta / \{Y\} = \{x_1, x_2, x_3, \dots, x_n\}$ and $Y = \Delta / \{X\} = \{y_1, y_2, y_3, \dots, y_n\}$ with $X \cap Y = \emptyset$, the following definition outlines the notion of incomplete property.

Definition 5 – Incomplete Property

A's ownership $\Delta_A = \{X \cup Z\}$ is defined as a bundle of defined rights (the *core* X) and presumptive rights (the *periphery* Z), where $Z = \{z_1, z_2, z_3, \dots\}$ with $Z \subseteq \Delta$, since by assumption no element of Z is already covered by an ex-ante defined right belonging to Δ .

A similar notation could be derived for the bundle Δ_B of B.

Definition 4bis: Externality with Incomplete Property

When $\Delta_A \cap \Delta_B = \bar{Z} \subseteq Z$, at least some of the presumptive rights in Z result to be ex-post rival uses between A and B and they will generate an externality.

Joint claims over an undefined rival use result in a sort of reciprocal veto between the parts over the full exercise of their reciprocal claims over that use. There is an inverse relationship, we may say, between the degree of completeness of property and the emergence of externalities. Incompleteness of rights is pervasive in the sense that notwithstanding the ex-post role played by courts (and regulation) in completing rights over time, there is always a positive degree of incompleteness that implies the potential for some uses to be poorly defined and to cause the rise of externalities. In a sense, property and externalities are two sides of the same coin. Thus, while some scholars tend to interpret externalities as special cases of non-separability of rights (R. Cooter and T. Ulen, 1988) we suggest that they are an endemic feature of any property bundle in whichever way it is defined ex-ante.

This perspective extends the original intuition of Demsetz, who recognizes that there is a pervasive relationship between property and externalities. However, in his approach the direction of causality moves from externalities to property rights²⁴. The notion of incompleteness here proposed, by contrast, outlines the co-evolutionary and reciprocal shaping of rights and externalities: property rights do emerge to solve externalities but access to existing property rights may generate new externalities and so on. New uses of existing resources might emerge for a variety of circumstances, including technological innovation, changes in tastes and preferences. When this occurs, the previous equilibrium between rights and duties is transmuted in disequilibrium, generating an externality in which alternative economic agents jointly claim a right over rival uses. Once an externality emerges, in turn, its absorption depends on the parties' position with respect to Hohfeld-Commons' *second order* jural relationships. The decision of a Court, the process of legislation

²⁴ As Demsetz (1967) pointed out, “*changes in knowledge result in changes in production functions, market values, and aspirations. New techniques, new ways of doing the same things, and doing new things – all invoke harmful and beneficial effects to which society has not been accustomed. Therefore, given a community's tastes in this regard, the emergence of new private or state owned property rights will be in response to changes in technology and relative prices*” according to “*a principle that associates property rights changes with the emergence of new and revaluation of old harmful and beneficial effects*”.

and public regulation, as well as private orderings all constitute means through which externalities might be solved through a process of bundling, unbundling and re-definition of previously undefined uses..

5. RECONCILING FEW LONG-STANDING CONTROVERSIES IN A NEW FRAMEWORK

The incomplete property perspective allows us to shed new light on some controversial issues in the theory of property, including the question of the appropriate distinction between trespass and nuisance, and between tangible and intangible property, as well as the question of the alleged contradiction between the “bundle of rights” picture of property and the view of property as “full control over resources” . In this section, by briefly looking at the implications of our theory for some of these issues, we attempt a test of the theory’s robustness in reconciling old controversies in the new framework proposed.

5.a. Trespass vs. Nuisance

Trespass and nuisance have been widely discussed in the law and economics literature (see R. Cooter and T. Ulen, 2004, H.H. Smith, 2004). They are the principal common law actions that define what a landowner can do to enforce its right to exclude. In the conventional distinction between the two legal instruments, they differ in such that “*trespass protects against invasion that deprive the landholder of exclusive possession of land [whereas] nuisance protects against intrusions that interfere with the use and enjoyment of land*” (T.W. Merrill, 1998). The distinguishing feature in such a definition seems to be the degree of impact that an action conducted by an external element has on the integrity of the asset protected by the property right. The impact here should not be intended in terms of the harm caused to the property by the intrusion, but rather it has more to do with the physical violation of the “space of the property” regardless of the harm caused²⁵.

By the same admission of Merrill, this distinction is more easily understood by looking at the practice rather than trying to draw a clear-cut theoretical line (p. 619). In a Blackstonian fashion (1766), trespass violates the *sole and despotic dominion* of the owner and thus holds the violator strictly liable regardless of whether the intrusion caused any harm to the plaintiff. In terms of remedies the tort action of trespass usually takes the form of a property rule (G. Calabresi and A.D. Melamed, 1972) that allows the owner to seek injunctive relief. The law of nuisance differs in that it allows for significant judicial discretion and no legal action can be triggered unless significant harm has been caused. Moreover most of the times it entails a judicial balancing of plaintiff’s and claimant’s interests and remedies take the form of liability rules (T.W. Merrill, 1998). Last, whether the tort action of trespass is also backed by criminal sanctions, nuisance is supplanted with extensive regulation. The application of the two rules produces two very different outcomes, however the rationale that leads to the decision whether a violation should trigger one action instead of the other seems to us quite controversial. It is difficult to distinguish “the exclusive possession of land” (the criterion that should lead us to opt for trespass) from the “use and enjoyment” of the same (the criterion for nuisance). And recurring to criterion that distinguishes between a violation by a tangible entities (squatters,

²⁵ Merrill (1998) for instance indicates “squatters, building encroachments and vehicles accidentally driven off the road onto private property” as examples of trespasses and “air and water pollution, foul odours and noise” as examples of nuisances.

cars, buildings) *vis-à-vis* a more ethereal ones (gasses, noise, odours or electromagnetic pollution) seems to be at most a good proxy but still missing the point of what really should lay at the hearth of this traditional distinction. After all, odours, noise and electromagnetic waves all intrude and alter the physical state of the property as much as the intrusion of a solid object. We think that the problem here is not the degree of tangibility²⁶ of the violation but rather the degree of incompleteness of the property violated. When violations regard those uses belonging to the core of the bundle, there is a clear violation of a right-duty Hohfeldian jural correlative. Such a violation triggers quite un-controversially a remedy in the form of a property rule (injunctive relief likely backed by a criminal sanction). However when the uses violated are only presumptively belonging to the periphery of the bundle, the problem becomes more controversial. In Hohfeldian terms, both the plaintiff and the claimant have a privilege that correspond to a no-right from the other part. However the privilege insists on two uses that are rival and this gives rise to the externality and ultimately to the conflict over the attribution. In such a case, a hypothetical court must clarify whether the use belongs to the property right bundle of the plaintiff and then decide upon the remedy²⁷. It seems to be reasonable that this process needs more judicial discretion and the controversy of the issue claims for a balance of interests. We are clearly here thinking of the nuisance law. The incomplete property paradigm reconciles and encompasses the ones mentioned above. First of it may suggest that a violation of the core of the bundle is qualitatively different than a disturbance at its periphery. This is why we act with trespass (almost automatic injunction, no regard to harm, property rule) in case of the former and with nuisance (more discretion, relevance of harm, liability rule) with the latter. Even the distinction between violation of tangible vs. intangible entities (or between physical and intellectual property) is enlightened insofar as we think of intangible objects as assets the uses of which are more difficult to define and therefore the property of which shows a higher degree of incompleteness and, thus, potentially, a higher exposition to externalities.

5.b. Bundle of rights vs. “full control” views of property

In the above section 3, we have singled out two attributes of property that seem to be pervasive in the economic discourse about property – the notion of property as a bundle of rights and the notion of ownership as full control over resources. These two attributes often go hand in hand, as noted, although a tension might indeed exist between them. Merrill and Smith (2001), for instance, have recently maintained that the bundle of rights view is intrinsically incompatible with the notion of ownership as “full control” over resources. According to these two authors, conceiving of property as a bundle of (*in personam*) rights necessarily implies that property comes to possess no distinctive characteristic at all and becomes just an infinitely plastic collection of “sticks”, each stick being a given right over a resource. The malleability of the bundle, in turn, implies that ownership loses its traditional role in establishing “a basis of security of expectations regarding the future use and enjoyment of particular resources”, emphasized by the “in

²⁶ see also (L. Kaplow and S. Shavell, 1996) for another attempt to use the tangible-intangible dichotomy to distinguish between nuisance and takings. See also (I. Ayres and P.M. Goldbart, 2001).

²⁷ Of course there is never complete certainty about the scope of allowed and disallowed uses of resources, so a right-defining and conflict resolving institution, such as the court system, the legislature, or some community authority, is inevitably part of any property right system (H. Demsetz, 1998)

rem” conception of property that was central to the work of writers such as Blackstone, Smith, Bentham and others. In the words of Merrill and Smith (2001): “[i]f property has no fixed core of meaning but is just a variable collection of interests established by social convention, then there is no good reason why the state should not freely expand or, better yet, contract the list of interests in the name of general welfare” (T.W. Merrill and H.E. Smith, 2001, pg. 365). Therefore, we may add, there can be no certainty of control associated to ownership.

The bundle of rights perspective on property, however, need not be incompatible with the notion that property establishes a sphere of private domain over resources. The incompatibility only exists if the bundle is considered complete - that is - if it is considered to encompass ex-ante any foreseeable use of the resource over which ownership is defined. In this case, any ex-post modification of a given ownership bundle (induced by the State or by the judiciary) should always be considered an interference with the private sphere of control ownership confers to right-holders.

Conversely, if ex-ante costs of definition of property are explicitly allowed for, not all forms of state intervention in regard to private ownership will have the same meaning. Sometimes state intervention will take the form of ex-post transfer or modification by the state of a well-defined right over a resource (as in the case of the exercise of the power of eminent domain). Other times, however, state intervention will be required to redefine rights over uses that were intrinsically undefined. In the latter circumstances, there is no clear reason why the stability of expectations as regards the possibility of exercising control over the use and enjoyment of a resource should be undermined. In sum, once the existence of ex-ante costs of definition of property are expressly taken into account, there need not be an inconsistency between the view of ownership as a bundle of rights and the notion that ownership confers control over resources.

5.c. Residual Control Rights vs. Incomplete Rights

The view of ownership that we propose, by explicitly recognizing the existence of ex-ante transaction costs in the definition of the content of the property bundle, identifies property as an institution that is responsible for the allocation of rights over undefined uses and guarantees in this way the stability of expectations and the economic value of the possession of a given bundle of rights. This view sounds, to some extent, familiar to insights provided by the so-called New Property Rights Approach (hereinafter, NPRA), associated to the contribution of Grossman and Hart (1986), Hart and Moore (1990) and Hart (1995), among others. In this perspective, “*the owner of an asset has residual control rights over that asset: the right to decide all usages of the asset in any way not inconsistent with a prior contract, custom or law*” (O. Hart and J. Moore, 1995, pg. 30) The economic value of ownership thus stems from the fact that it allocates rights to use a certain asset in ways that are not otherwise defined, in circumstances in which contracts are incomplete.

This is undoubtedly one of the key contributions offered by this strand of research. However, the NPRA is really a theory of the allocation of property, rather than a theory of the legal institution of property *per se*. This implies that, as a theory of property, the insights offered by the NPRA would prove too much. Indeed, underlying the notion of property adopted by New Property Rights theorists is the implicit assumption that *any* new use of property not previously specified by “contract, custom or law” would always be included ex-post in the owner’s bundle. In other words, one might say that the NPRA regards ownership as always ex-post complete, irrespective of the ex-ante problems of definition (of contracts). This assumption is the outcome of the theory’s focus on bilateral and

multilateral relationships governed by contract, which implies the black-boxing of economic agents external to the transaction (A. Nicita, 2001) and explains why the allocation of ownership plays such a powerful role in the NPRA.

In a more realistic setting, it is not apparent that ownership of a given resource by one person necessarily entails that the rights to any new use of such resource will be attributed to the owner. Legal ownership of a given resource does not generally imply that any conflict over the use of the latter will be resolved in favour of the owner. Our theory allows to capture just this, by explicitly pointing to the ex-ante costs of definition of property rights and by revealing the co-evolutionary relationship between property and externalities.

6. THE EFFICIENCY OF PROPERTY RIGHTS REVISITED

The reasoning of the previous paragraphs aimed at bringing the reader from the acknowledgement of the existence of ex-ante costs of definition of property rights to the appreciation of the important consequences that this insight might have for a theory of the institution of ownership. In this paragraph, the focus will be on the evaluation of the implications that a theory of incomplete property brings about in considering the issue of the efficient allocation of property. In what follows, differently from old property right theorists, we explicitly carve out an efficiency reason for aggregating property rights in an ownership bundle. Also, differently from the New Property Rights Approach, we explicitly consider the issue of the efficiency of the unbundling of property rights over specific uses from the ownership bundle and we allow for the presence of ex-post transaction costs in the exchange of property, as suggested by previous literature.

The perspective of incomplete property sheds new light on the economic theory of property and provides a rationale for the traditional interpretation of property as a bundling of rights reconciling it with the idea that property provides full ownership to right holders. Incompleteness of property reflects the ex-ante transaction costs to be sustained to clearly define all the uses associated to the exercise of a given property right. In order to reduce the ex-ante transaction costs of rights definition, the right holder is attributed the right to freely exercise all the uses bundled in her property *as long as an externality over undefined uses does emerge*. That means that property confers to the owner a residual right to control bundled undefined uses. However this right is not absolute, as in the case of rights on well-defined uses; rather it is a *presumptive right* subject to the emergence of a potential conflict raised by rival claimants. What the owner can do with his property is only partially clear and well-defined at any time. It also depends on the emergence of externalities and on the way in which controversies are solved. Property rights thus do emerge as institutions aimed at minimizing the ex-ante transaction costs of defining all the uses bundled in property. That means that the scope of uses (defined and undefined) bundled in property is always greater than that delineable in a word of complete property rights. This is the reason why, in a world of incomplete property rights, property is a powerful device for incentives alignment. Not only owners maintain property rights over defined uses, they also have residual right to control undefined uses until an externality does emerge. The emergence of an externality starts the Demsetzian process of right re-definition through bundling and unbundling of rights attributed to property. This process could be affected by several motivations, such as efficiency and distributive justice (Calabresi and Melamed, 1972). It should be clear, however, that internalization of externalities of this kind does not grant a Coasean ex-post efficient allocation of property rights, which depends on ex-post transaction costs of well-defined rights. It only intervenes in delineating previously undefined rights.

The incomplete property rights perspective allows us to make three principal claims. The first is that the institution of ownership, conceived of as an incomplete bundle of rights, serves a double efficiency function: it provides ex-ante incentives and it allows to economize on the ex-ante costs of definition. The second is that there should be no presumption on the optimality of complete property bundles. The third claim is that state intervention in the form of a redefinition of property bundles plays an important efficiency role and does not necessarily impair ex-ante incentives. We will consider each of these claims in turn.

Let's start by elaborating on the first claim. In introducing the concept of incomplete property, we have traced a distinction between the core and the periphery of property bundles. The core comprises well-defined uses over which clear right-duty relationships are established. No uncertainty exists on the characteristics of these uses and the law serves the basic purpose of introducing rivalry over them. The existence of this core of rights over well-defined uses performs the kind of efficiency functions emphasized by proponents of the "full control" theories of property: it ensures certainty of expectations and therefore provides ex-ante incentives. At the periphery of the property bundle, we have placed those uses that are rival in nature and determine the emergence of externalities. This also may be interpreted to serve an efficiency function. Indeed, the fact that the rights over some of the uses bundled in property are defined only ex-post might be said to have the effect of minimizing ex-ante transaction costs. Rival claims will normally not arise on each of the undefined uses bundled in property, so that only the ex-post transaction costs connected to the solution of externalities will be incurred.

The "strength" of property depends, in this framework, both on the breadth of the core and on the scope of the undefined uses over which a clear right-duty relationship is established ex-post in favor of the holder of rights over the core. In other words, one might say that the "strength" of property, and therefore the extent to which property can provide ex-ante incentives, is inversely related to its degree of incompleteness.

Let us now turn to the second and related claim: there should be no presumption on the optimality of complete property bundles. In talking about incomplete property, we do not mean to suggest implicitly that optimal policy would always call for an increase in the degree of ex-ante definition of property. Quite on the contrary we think that, in presence of both ex-ante definition costs and ex-post transaction costs of various kinds, there is no reason to assume that there is a positive relationship between the degree of completeness of the property bundle (and consequently the "strength" of property) and overall efficiency.

In interpreting property as inherently incomplete, it becomes unclear whether increased strength necessarily translates into increased overall incentives. This would be the case in a world in which there was no friction in the ex-post reallocation of rights over each of the uses bundled in (complete) property. In such a world, perfect unbundling of rights over uses of a given resource would occur and rights would smoothly flow towards those with maximum incentives to invest. As long as ex-post transaction costs do exist, however, it might not be assumed that assigning ex-ante all the available rights over a given resource maximizes overall incentives. Given that allocation of use rights to one party minimizes the incentives of the parties excluded from ownership, the existence of an invariably positive relationship between the degree of completeness of property and overall efficiency in the allocation of ownership might only be presumed if the assumption that the efficient owner will always be selected ex-ante is made.

Finally, consider the third claim in light of the first two. Some proponents of what we have called “full control” theories of property place great emphasis on the need for the state to refrain from interfering with the private sphere of control property grants to right-holders. The state should not, according to this view, modify in any way the content of private property in order not to undermine security of expectations and incentives.

The incomplete property perspective suggests, on the contrary, that the state may perform an important efficiency function when intervening in the redefinition of property and that this form of intervention does not necessarily decrease ex-ante incentives. If property is understood as inherently incomplete, not all forms of state intervention in regard to private ownership will have the same meaning. Sometimes state intervention will take the form of ex-post transfer or modification by the state of a well-defined right over a resource (as in the case of the exercise of the power of eminent domain). Other times, however, state intervention in various forms will be required to redefine rights over uses that were intrinsically undefined: state intervention thus constitute an essential component of the coevolutionary relationship between property and externalities. While in the first case the possibility that ex-ante incentives might be undermined should be acknowledged, in the second case attribution of rights over previously undefined uses to one of the rival claimants over such uses is likely not to decrease ex-ante incentives, if anything because the uses were not previously known. Moreover, as mentioned above, this form of ex-post intervention might be interpreted as a cost-reducing device, in that it allows to save on ex-ante costs of property definition. The efficiency calculus should thus balance these two effects. The framework we propose thus complicates the efficiency picture considerably. Greater ex-ante definition of property cannot be considered invariably a good thing for efficiency, as it is often maintained. The achievement of efficient outcomes hinges upon the relative dimension of ex-ante and ex-post transaction costs. In particular, if ex-ante transaction costs are particularly high, it might be efficient to let the state “complete” property bundles ex-post only when and if externalities arise.

7. THE COMPLEX GOVERNANCE OF TRANSACTIONS WITH INCOMPLETE PROPERTY: A RESEARCH AGENDA

We believe that describing property as a bundle of both a core of defined rights and a periphery of presumptive rights potentially exposed to externalities, casts new light on how we understand the mechanisms of the governance of transactions. In this section we will not deepen the vast array of implications induced by property incompleteness on the theories of institutional governance of transactions; rather we only suggest possible directions for future research.

(a) A first direction of research regards the role played by property incompleteness in the Coase theorem. The Coase theorem affirms that if transaction costs are assumed to be zero and the rights of various parties well defined, the final efficient allocation of resources would be the same under any initial allocation of property rights²⁸. Here, there are two conditions for the theorem to hold: zero transaction costs and well-defined rights. Without further qualifications, the second assumption is somewhat redundant. If rights are well defined that means that ex-ante transaction costs to define right/duty relationships are zero. From this intuition derives the conclusion of Coater (1987) that the theorem is a

²⁸ see Medema and Zerbe (2000) for a definition and discussion of the Coase theorem

tautology since it simply affirms that when transaction costs are zero we are in a first best world. If rights are well defined there are no externalities, but simply ex-post market exchange. However, introducing the notion of incomplete property in the Coase theorem allows us to overcome the above tautology and to highlight the complementarity relationship between the process of 'public' definition of rights and duties and the role of the market in promoting efficient allocation of rights. Under an incomplete property framework, the Coase theorem could be reformulate as follows: *if an externality occurs over undefined uses, and if ex-post transaction costs are zero, the (re)definition of rights over rival uses will always lead to ex-post efficient allocation of newly defined rights*. In this respect, if the ex-ante transaction costs to define rights are zero, and ex-post transaction costs to exchange rights are negligible, then the sole market mechanism will lead resource to the most efficient use of rights. However, when ex-ante transaction costs are relevant, the market may perform well only if a system of rights definition is implemented. There are at least two ways of (re)defining property rights. The first is the unification of property's bundles through market exchange. The second is to publicly define new rights, through a process of bundling and unbundling of rival uses from which the externalities emerge. As a consequence, in the latter case, market performance in allowing ex-post efficient allocation goes hand in hand with society's ability to define property rights.

(b) A second potential venue of research opened by the introduction of property incompleteness in a Coasean framework moves from the comparison between Coase (1937) and Coase (1960). Property incompleteness may suggest that decisions to vertically integrate may derive not only from the analysis of compared transaction costs of *make vs. buy*, as in Coase (1937), but also on the dimension and on the direction of ex-post transaction costs to be carried on in order to properly define a right over a rival use between neighboring properties. In other words, the owner of the firm can be induced to 'buy' all the assets over which someone else's use may produce an externality, when those rights are undefined. The nature of the firm thus is also affected by the degree of completeness of property, in the sense that integrating rival uses under the same ownership minimizes the potential for externalities. Thus the optimal dimension of property may depend, not only on the ex-post transaction costs of enforcement as in the Williamsonian framework, but on the ex-ante and the ex-post transaction costs of definition of rights. The perspective of incomplete property may here suggest that the Coase theorem maintains its relevance if we apply it to the problem of allocation of presumptive rights that generate externalities rather than to the exchange of core rights. That means that we need to distinguish and compare ex-ante and ex-post transaction costs. Moreover, another point that future research may investigate is whether we should expect, besides other correlations, higher property concentration when both the degree of incompleteness and the ex-post transaction costs of bundling and unbundling rival uses are very high.

(c) The above argument implies that, with incomplete property, transactions could be plagued by the emergence of externalities in a world of complete contracts. This suggests that the efficient allocation of property rights may also be affected not only by owners' ability to efficiently use their core rights, but also by their ability to cope with externalities when they arise. In Williamson (1985, 1996), for instance, the emergence of private orderings characterized by the 'forbearance' role of the manager who maintains the authority over firm's assets, is functional to the overcoming, for a given transaction, of the inefficiencies related to the incompleteness of contracts. However, since externalities may raise the need of publicly (re)defining property, the role of 'forbearance' may extend also to

the process of presumptive rights' definition in private orderings among corporate constituents (E. Brousseau et al., 2004).

(d) The perspective of property incompleteness outlines the institutional complementarities existing between first order and second order jural positions in the Hohfeld-Commons paradigm, as envisaged by Pagano (2005): the degree of property incompleteness in first order jural relationships is affected also by second order jural relationship, i.e. by the way in which individuals have access to the power of changing first order jural relations. Since, according to Commons (1924), this power is affected by several concurring institutions - such as the legal system, the degree of market competition, corporate governance, trade unions, consumers associations, lobbies, culture and social norms - the way in which these public and private institutions interfere with each other shapes economic and legal transactions and thus the co-evolution of property and externalities in economic systems. In this respect, since the process of new rights' definition affects the use and the value of property, a promising direction of research seems to be the investigation of the impact of legal origins on the dynamics of incomplete property and on its regulation (E.L. Glaeser and A. Shleifer, 2002, 2003).

8. CONCLUSIONS

This paper makes a first attempt at elaborating on an attribute of property that has often gone unnoticed in economic theorizing: its inherent incompleteness. Differently from the previous contributions that have touched upon this issue, we do not conceptualize property incompleteness as the outcome of limited human capabilities in forecasting future uses of resources, of weak enforcement or of weak partitioning of rights. Rather, we cast attention on the fact that incompleteness matters principally because of the interdependence of human actions, namely in circumstances in which uses unknown *ex-ante* become the object of rival claims – circumstances we term “externalities”.

Our principal claim is that looking at the incomplete dimension of property is a promising research avenue for scholars in the Law and Economics and in the Institutional Economics fields. To give substance to this statement, we first uncover some latent contradictions in the conventional view of property as a complete bundle of rights over well-defined uses of resources. We then remove the assumption of completeness introducing the notion of incomplete property intended as a bundle of both defined and presumptive rights, where the latter are potentially exposed to the emergence of externalities. *Ex-ante* defined rights constitute the *core* of ownership rights over uses socially enforced by organized consent at any given time. In other words, we envisage the core as comprising only well-defined right/duty jural relationships, in Hohfeld's terminology. All those uses for which no clear right/duty relationship is defined belong to the *periphery* of the property bundle. In their regard, right-holders can only exercise presumptive rights, subject to the emergence of externalities. This perspective highlights the existence of a complex coevolutionary relationship between property and externalities: while property rights do emerge to solve externalities, access to existing property rights may generate new externalities and so on. Moreover, the incomplete dimension of property may allow to shed new light on some controversial issues in the economic analysis of property.

The paper surely raises more questions than those it solves. In particular, we suspect that making explicit the intrinsically incomplete nature of property may have deep consequences for the theory of efficient allocation of property and of the optimal dimension of economic organizations. We propose some preliminary thoughts on this

issue, although a comprehensive understanding of it is outside the scope of this paper. Similarly, issues of governance deserve much more attention than it is presently the case. Hopefully, future work might address these deficiencies.

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