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How Can Transaction Cost Economics Help Regulators Choose Between Environmental Policy Instruments?¹

Douadia Bougherara
INRA ESR

Gilles Grolleau (Corresponding author)²
UMR INRA-ENESAD (CESAER)

Naoufel Mzoughi
UMR INRA-ENESAD (CESAER)

Abstract: Environmental economics has employed the seminal contribution of Ronald H. Coase (1960) intensively but has remained relatively unaffected by the contributions of perhaps his most influential follower, Oliver E. Williamson. As an initial step in addressing this oversight, we apply the analytical framework of discrete structural alternatives to the choice of policy instruments. Environmental-related transactions, which differ in their attributes, are aligned with categories of policy instruments, which differ in their cost and competence, so as to effect a discriminating – mainly transaction costs-economizing – result. Insightful strategic and policy implications are stressed.

Key words: Transaction cost economics; Williamson; Environmental policy.

JEL Classification Numbers: D23; K32; Q58.

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² Gilles Grolleau. UMR INRA-ENESAD. 26, Bd. Dr PetitJean, BP. 87999, 21079 DIJON Cedex France. Tel: + 33 3 80 77 24 43 – Fax: + 33 3 80 77 25 71. E-mail: grolleau@enesad.inra.fr.

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“The problem is one of choosing the appropriate social arrangement for dealing with harmful effects. All solutions have costs and there is no reason that government regulation is called for simply because the problem is not well handled by the market or the firm. Satisfactory views on policies can only come from a patient study of how, in practice, the market, firms and governments handle the problem of harmful effects”

Ronald Coase (1960)

1. Introduction

Although the contribution of Ronald H. Coase (1960) has been used extensively in environmental economics and is now an integral part of environmental economics textbooks, the contribution of one of his most influential followers, Oliver E. Williamson, has been largely ignored in the same literature. Despite the importance of Williamson’s contribution, his systematic treatment of transaction costs in explaining governance structures has rarely been applied to the field of environmental economics. Although the reasoning of Coase shares numerous features with the 1937 article (Coase, 1988), nobody has undertaken an operationalization *à la* Williamson of its ‘fundamental insights’ in the environmental realm (Coase, 1992, p. 778).

The aim of this brief paper is to address this oversight, as an initial step towards developing further analysis. In particular, our contribution focuses on the application of the analysis of discrete structural alternatives – market, hybrid forms and hierarchy – to the choice of policy instrument. Indeed, the choice of the least costly instrument to reach a given result constitutes a major issue in the

policy arena. In the environmental economics literature, incentive-based instruments are considered as more cost-effective to achieve environmental goals than alternative policy instruments such as technology-based standards. While incentive-based instruments may minimize the direct abatement cost, they do not necessarily minimize the total social costs, especially the transaction costs (Richards, 2000). In other terms, the policy problem addressed here is the choice of the least costly (in terms of transaction costs) instrument to reach a given result. By assuming that policymakers pursue efficiency goals, selecting the right instrument that minimizes transaction costs is a main issue. An important insight is to consider that environmental problems have particular attributes that call for specific instruments in order to reach a transaction cost economizing result. For example, such rationale may provide an efficiency argument to support command and control and even integration to solve certain environmental problems. A natural extension to our contribution is to consider a framework integrating both abatement and transaction costs.

At first glance, the governance structures described by Williamson (1991a) may disconcert environmental economists. Nevertheless, ‘the choice of policy instruments’ which has ‘fascinated’ environmental economists (Russell, 2001, p. 73; Cropper and Oates, 1992) shares several features with the paradigmatic question of transaction cost theory, i.e., the so-called ‘make-or-buy’ decision. For Richards (2000, p. 254; see also Shapiro, 2003), a government’s choice of policy instrument is “analogous to a private firm’s “make-or-buy” decision about whether to produce goods and services directly or to contract with other firms for production”.

Once some initial difficulties are overcome, transaction cost economics (TCE) may provide exciting insights particularly for policymakers (Paavola and Adger, 2005; McCann et al., 2005). We briefly investigate the reasons behind Williamson's absence from the environmental economics literature³ and contend that his discrete analytical framework (Williamson, 1991a) may help policymakers in selecting policy instruments. Recently, Williamson called for such an enlargement when he states that "other transactions, such as the externality problem (Coase, 1960), needed to be reformulated to bring out their latent contractual features" (Williamson, 2002, p. 6).

The remainder of this paper is organized as follows. The next section applies the transaction cost economics framework to environmental problems. We introduce the concept of environmental transaction between regulated firms and the regulator, aimed at producing a certain level of environmental good (or reducing a certain level of environmental harm). The third section considers policy instruments – free market environmentalism, hybrid approaches and market-based/command-and-control instruments – as *grosso modo* equivalents of alternative governance structures in the theory of organisations, respectively, market, hybrid forms and hierarchy. The fourth section stresses some policy implications of applying Williamson's contribution to the analysis of policy instruments and demonstrates that the insights developed here constitute a challenging and exciting topic for further research. We also acknowledge the

³ Interestingly, the traditional textbook of Baumol and Oates (1988) and survey of Cropper and Oates (1992) do not mention Williamson's contributions while the seminal Coase contribution is used several times.

limitations of our extension and propose some testable implications that could form the basis of a continued research agenda.

2. Environmental-related transactions: definition and attributes

“The concept of ‘externality’ has come to play a central role in welfare economics, with results which have been wholly unfortunate (...) I never used the word ‘externality’ in ‘The Problem of Social Cost but spoke of ‘harmful effects (...).”
(Coase, 1988, pp. 26-27)

The *externality* is the basic unit of analysis in environmental economics (Baumol and Oates, 1988; Cropper and Oates, 1992) while the *transaction* is the basic unit of analysis in transaction cost economics (Coase, 1960; Williamson, 1998). This difference constitutes a major impediment to extending transaction cost economics to the environmental realm. Interestingly, coasean economists have heavily criticized the externality concept and its usefulness (Coase, 1960, 1988; Cheung, 1970; Dahlman, 1979; Randall, 1993; Zerbe and McCurdy, 2000), some of them calling for expunging it from the analytical toolbox (Cheung, 1970; Anderson, 2004). For instance, Cheung (1970) argues that "the concept of 'externality' is vague because every economic action has effects; it is confusing because classifications and theories are varied, arbitrary, and ad hoc. For these reasons, theories generated by the concept of 'externality' are not likely to be useful".

We identify two stages in our discussion. A first stage pertains to the proposed shift from the externality to the transaction as the basic unit of analysis. The second stage is an attempt to consider the economic implications of transactions

between the State and private agents. The State is no common party in the transaction. Its goal is not necessarily efficiency. Moreover, the question of why firms exist has a dimension different from the question of why governments exist. While the paper focuses on the first stage of analysis, it provides keys as to the second stage along the paper leaving deeper analysis for future work.

We contend that shifting from the externality to the transaction as the basic unit analysis is not only quibbles over words, but may generate fruitful theoretical advances. The transaction “contains in itself the three principles of conflict, mutuality, and order” (Commons, 1931, p. 4). While Williamson quotes Commons in order to define the transaction as the basic unit of economic analysis, his definition is less inclusive than that proposed by Commons (Williamson, 1985, p.1) and Coase (1960, 1992). Indeed, the Williamson’s transaction is the transference of a good or service “across a technologically separable interface” although “Commons conceives the transaction to be a unit of transfer of legal control, that is, to involve the transference of property rights” (Ramstad, 1996). Similarly Coase (1992) contends that he “explained in “The Problem of Social Cost” that what are traded on the market are not, as is often supposed by economists, physical entities but the rights to perform certain actions, and the rights which individuals possess are established by the legal system” (Coase, 1992, p. 717). The more inclusive definition of Commons and Coase seems more suitable to deal with environmental problems that can be considered as a competition over conflicting uses for scarce resources (Coase, 1960).

Basically, a transaction refers to an elementary coordination problem between two parties in conflict over resource use and potentially involves a transfer of property rights. Despite some differences with the conventional meaning of transaction – e.g., the lack of need for mutual consent or explicit contracts – the harmful effects discussed in Coase’s seminal paper share common features with more conventional transactions. In order to carry out such a “transaction, it is necessary to discover who it is that one wishes to deal with, to inform people that one wishes to deal and on what terms, to conduct negotiations leading up to a bargain to draw up the contract, to undertake the inspection needed to make sure that the terms of the contract are being observed and so on” (Coase, 1960). Transactions do not necessarily occur “between entirely willing parties of equal power, and herein, it will be assumed only that dealings take place between parties who each exercise some influence over how the transaction is executed and its goal met. Thus, an arrangement made between a regulatory government agency and a polluting firm fits squarely within the definition established here for a ‘transaction’” (Richards, 2002, p. 12). For Delmas and Marcus (2004), the primary purpose of a regulated agent is to acquire from the regulator the right to operate, that can be conceived as a right to pollute. Esty (2004, p. 142) concedes that “because Williamson’s analysis centers on corporate organization, his transaction cost-based categorization of institutional structures requires some translation to make sense in the environmental realm. The relevant “transaction” is not that of a firm but the effort to protect (or exchange) environmental property rights.” *In the scope of this contribution, the environmental-related transaction is somewhat restrictive and implies a transfer of rights (notably the rights to*

*perform certain actions) between a regulatory agency and regulated entities*⁴.

Based on this definition of transaction as the transfer of rights to perform certain actions, regulatory agencies really transfer rights to companies to pollute the environment at different levels. As stated by Cole (2002), all regulatory instruments “are more or less property-based to the extent that they recognize or establish enforceable rights and duties in otherwise unowned resources”. To be compatible with the transaction cost economics framework, we also assume that public authorities also pursue an efficiency goal, i.e., select the least costly instrument to reach a given result. Consequently, transaction costs may be defined as the resources used to define, establish, maintain and transfer property rights (McCann et al., 2005; Allen, 1991).

Drawing on Coase, we contend that there is not something called the environment which is a good into itself but conflicting uses of natural resources such as air and water. Consequently, the degree to which voluntary transactions can resolve conflicting uses will be a function of property rights and transaction costs (Dahlman, 1979). In this context, “pollution” is not something that is bad in and

⁴ Environmental-related transactions also occur in the private order. Examples are numerous (Anderson and Leal, 2001; Salzman, 2005; Déprés et al., 2005) but lie somewhat beyond the scope of this contribution, which is focused on the ‘paradigmatic question’ of environmental economics, i.e., the choice of the policy instrument. This choice limits the scope of the paper to *a subset* of transactions compared to the broader analysis of Coase (1960). Indeed, we only consider cases where governmental intervention is desirable from a welfare viewpoint (Coase, 1960) and attempt to provide theoretical guidelines for selecting the most appropriate policy instrument. We readily concede that more research is necessary to deal with the more general question described in the Coase seminal paper (1960), where he explicitly deals with private and public ordering.

of itself; it is simply the use of air or water for waste disposal. Whether bargains take place to increase or decrease the use of various disposal media for waste disposal will depend on property rights and transaction costs. Starting from this basic tenet of economics, transaction cost analysis can provide a refreshing way to evaluate alternative methods of resolving conflicting uses.

Governance is viewed as “the farsighted means by which order is accomplished, thereby to mitigate potential conflict and realize mutual gains.” (Williamson, 1998, p. 5). The attributes of the transaction include the frequency with which transaction recur, the uncertainty to which transactions are subject, and the type and degree of asset specificity involved in supplying the good or service in question (Williamson, 1991a). Much of the explanatory power of the theory turns on asset specificity. Asset specificity may play a major role in certain environment-related transactions. This role is obvious in the case of the transaction between Vittel and farmers discussed elsewhere (Déprés et al., 2005). Discussing extensions of the TCE framework to other fields, Williamson has recently suggested that weak property rights may play a role similar to asset specificity (Williamson, 2005a) by generating contractual hazards. Behavioral uncertainty is also likely to characterize environmental-related transactions because each partner may have vested interests in adopting an opportunistic behavior because of asymmetric information. About the frequency attribute, one-time pollutions may be distinguished from recurrent pollutions. We also consider other key attributes which characterize the environmental-related transaction: notably the *difficulty of measuring* the social output produced by each regulated entity and the *number and heterogeneity* of regulated entities.

Environmental economics is inherently a study of measurement problems. In our setting, the measurement dimension represents the capability of government in assessing the social outputs of a private party (Coglianese and Lazer, 2003; Esty, 2002). According to Coglianese and Lazer (2003), “assessing social output” (...) [means] that the government is able to measure outputs accurately. For example, in the environmental realm this would mean that the government is able to monitor emissions (or well-correlated proxies such as inputs) from the various facilities that are covered by an emissions regulation. The measurement dimension encompasses so-called ‘monitoring costs’ that are frequently assumed to be zero –i.e. perfect and costless monitoring– or to not vary between policy alternatives (Cole and Grossman, 1999). Although the field of application differs significantly from our topic, the measurement branch of transaction cost economics has nonetheless highlighted the significance of measurement hazards (Alchian and Demsetz, 1972; Barzel, 1982). Williamson himself (1991b) has suggested that ‘ease-to-measure’ may constitute a major dimension of transactions as asset specificity or uncertainty. Recently, Barzel (2004) argued that difficultness of measurement was more operational and general than asset specificity. Richman and Boerner (2004) explicitly consider these measurement problems in their analysis of the location of waste facilities. Environmental-related transactions frequently imply a high degree of ‘natural’ uncertainty inherent to the complexity of environmental processes and the many ways in which humans interact with natural environments. Consequently, some firms may use these complex interactions and private information strategically to confuse the issue and accrue undue advantage.

The second dimension represents the characteristics and degree of heterogeneity of the regulated entities, both across locations and over time. The characteristics of agents, such as point-source polluters versus non point-source or mobile polluters, their identity and number⁵ involved in environmental-related transactions are obviously important and frequently interact with the measurement dimension. “For a regulated sector to be homogeneous it means that (1) at a given point in time most private actors have similar operations and (2) the technology used by these actors tends to be stable over time.” (Coglianese and Lazer, 2003; Richards, 2000). A high degree of heterogeneity prevents the regulator from developing an appropriate “one-size-fits all” technology standard. Regulated entities or the regulator may take advantage of such heterogeneity. Certain agents who have private information may promote institutional arrangements that favour them in terms of compliance costs, regardless of the environmental impact. Consequently, the regulator does not receive the expected environmental benefits. Regulated agents seek to minimize costs to achieve the ‘right to operate’ and eventually harm those competitors who are different.

The previous attributes of environmental-related transactions are not mutually exclusive and likely to overlap. For example, measurement issues are likely to interact with uncertainty and asset specificity (Barzel, 2005). Indeed, the technical

⁵ Pigou and Coase explicitly consider the number of affected parties as a major determinant of state intervention (Aslanbeigui and Medema, 1998). Nevertheless, more is needed to reach operational arguments. Considering environmental related transactions as ‘market structures’ –e.g., monopoly, duopoly, oligopsony – according to the number of pollutees and polluters may constitute a cogent and productive perspective. Anecdotal evidence shows that a monopsony structure has made easier the achievement of private arrangements (Salzman, 2005).

inability to measure and attribute individual contribution, i.e., a kind of causal ambiguity, in a pollution problem gives rise to opportunistic behaviour. Moreover, the characteristics of the involved parties may constitute a subclass of measurement issues. Let us consider that measurement difficulty is the main attribute of environmental related transactions. As asset specificity in TCE, measurement difficulty can both vary in magnitude and vary in kind. We propose that measurement difficulty may arise both in terms of the sources and the consequences of pollution (Husted, 2004). For sources, measurement may be more or less difficult due to the type of pollution, e.g., small number and homogeneous emitters *vs.* high number and heterogeneous emitters, non point source pollution *vs.* point source pollution, immediate pollution *vs.* delayed pollution because of cumulative releases and so forth. Husted (2004, p. 252) illustrates this difficulty of measurement when “a factory’s output is, in and of itself, not noxious; however, in combination with the by-products of other production processes, it can be toxic.” On the ‘source’ side, measurement difficulty may also result from the difficulty in estimating the benefits generated by pollution or the costs of abating the pollution. For consequences, measurement difficulty depends upon the number and properties of affected parties and the effects due to the pollution. Measurement difficultness at the consequences level may mean few, identical and homogeneous affected parties (i.e., each entity is identically affected by the pollution) with a clear causality chain *vs.* numerous and heterogeneous (i.e., each entity is differently affected) with multiple and potentially unknown causality chains. On the ‘consequence’ side, measurement difficulty may also result from the difficulty in estimating the benefits generated by abating the pollution or the harm caused by pollution. In summary, more

academic attention is necessary in order to dimensionalize more precisely environmental-related transactions.

As stressed earlier, the attributes of environmental-related transactions may generate contractual hazards between the regulator and the regulated entities that governance structures try to mitigate (Richards, 2000; Richman and Boerner, 2004). If the contractual hazards generated by the regulated entities seem obvious, the regulator is similarly not exempt from opportunistic behavior. For example, the regulator can adopt an opportunistic behavior once private firms have invested in specialized assets. Firms can make expensive investments in plants which are expected to depreciate over a large number of years. The future environmental demands of the regulatory authorities may be somewhat unpredictable, making the security tied to predictability of future regulation very valuable to the industry (Mortensen, 2001, p. 157). Indeed, private firms incorporate legitimate regulatory uncertainty in their investment decisions and this can lower the cost of efficiency-enhancing adaptive changes in the goals of government programs. However, social welfare decreases when investors weaken their investments for fear of expropriation by the regulator (Richards, 2000; Mortensen, 2001; See also Keohane, 2000 for an alternative view of the risk of ‘hold-up’ by the regulator due to asset specificity in environmental-related transactions).

3. Dimensionalizing environmental governance

Williamson distinguishes three governance structures⁶ i.e. market, hybrid and hierarchy that are substitutable in achieving a transaction. Unlike the distinction between market and hierarchy that seems somewhat obvious, hybrid forms encompass a great variety of arrangements. Ménard (2004) has recently undertaken further investigation in order to emphasize regularities in their features. *A minima*, hybrid forms may be conceived as “agreements among legally autonomous entities doing business together, mutually adjusting with little help from the price system, and sharing or exchanging technologies, capital, products, and services, but without a unified ownership” (Ménard, 2004, p.4). We consider that the typology of policy instruments may correspond, *grosso modo*, to these governance structures, respectively (1) free market environmentalism, (2) contractual (or voluntary) approaches, and (3) pure market-based instruments and command-and-control instruments. In a world of zero-transaction costs, these instruments are perfectly substitutable in achieving an environmental purpose such as pollution abatement. In a world of positive transaction costs, the choice of an institutional alternative depends on minimizing the costs which arise in the presence of measurement and heterogeneity problems (first order economizing).

⁶ Goldberg (1976) and Williamson (1976) are the first authors who consider regulation as a response to transactions that are difficult to contract. In a more recent paper, Williamson (1999) has extended transaction economics to the public sector by characterizing public transactions (i.e. adding probity to the three other key attributes) and dimensionalizing public governance structures (i.e. incentive intensity, bureaucratization, adaptability, staff security, legalistic dispute settlement). Our analysis can be considered as positioned at an intermediate level between the levels 2 and 3 of social analysis, distinguished by Williamson (1998, p.25-29). Nevertheless, the analysis developed here must not obscure the role of the institutional environment (in the sense of Douglass C. North, 1990) that constrains the choice of policy instrument.

We consider each category of policy instruments in its purest theoretical form and are conscious that the similarity is not perfect and that several counter-examples can be found in the real world (see Shapiro and Glicksman, 2000 for a discussion). Indeed, real instruments may include properties from different categories, but their dominant features enable us to categorize them. Let us briefly explain the content of each category.

(1) *Free market environmentalism*⁷ is the use of market institutions particularly property rights, voluntary exchange, and common law liability rules to protect environmental resources. Free market environmentalism seeks to create and expand markets in environmental goods through the extension of market institutions to cover environmental resources that are external to market processes”, like the well-known example of Campfire in Southern Africa. At the beginning of the 90s, a ban on ivory market led to a decrease in the population of elephants due to poaching. But Zimbabwe and Bostwana experienced an increase in elephant populations after a conservation policy relying on property rights. “Local people have a strong economic interest in protecting elephants from poaching because the revenue from tusks and hides and a portion of the money made from selling hunting permits go to local communities where the elephants live” (Anderson and Leal, 2001; Adler, 2001). Unlike market-based instruments, free markets do not attempt to achieve a politically determined goal. Free market environmentalism leaves to

⁷ For an insightful and provocative discussion of the differences between market-based instruments and free market environmentalism, see Cordato (1997 and references therein). Despite its interest, the debate over free market environmentalism is beyond the scope of this paper.

interactions between agents through the market the role of determining both the outcome and the way to achieve it (Cortado, 1997). According to free market advocates, the intrusion of state must remain minimal. Free market environmentalism has been the subject of several criticisms which suggest that the circumstances within which this approach fulfils its promises are quite limited (Blumm, 1992; Gunningham and Grabosky, 1998, pp. 85-88). In some cases, the state may 'intervene' by doing nothing, i.e., a *laissez faire* alternative (Coase, 1960).

(2) ***Contractual approaches***, sometimes called mixed regulation, correspond to agreements or conventions between governments and polluting firms, under which regulated agents commit voluntarily to undertake pollution control measures, such as covenants in the Netherlands (For an extensive discussion and bibliography, see Mortensen, 2001). According to the European Commission (quoted by Mortensen, 2001, p. 155), a voluntary environmental agreement is “a contract between individual companies and/or association of companies on the one hand and public authorities on the other hand, concluded with the aim to protect or restore the environment.”

(3) ***Hierarchical approaches***

a) ***Market-based instruments*** (or more narrowly price-based instruments), attempt to reproduce the market mechanism by putting a price, sometimes predetermined (taxes) or not (tradable permits) on environmental goods. They rely on price signal and decentralized decision making by agents pursuing

their own self interest to induce pollution abatement (Beder, 1996; Stavins and Whitehead, 1992). The goal is politically determined but the methods to achieve it are left to regulated entities, allowing to reach the goal more efficiently than compared to command-and-control instruments. A recent example is the market permit for greenhouse emissions.

b) Command-and-control approaches correspond to direct regulation by a centralized public authority that, relying on its coercive power prohibits or imposes restrictions on environmentally harmful activities. These regulations frequently impose the same standard on all regulated entities, regardless of their ability to satisfy the standards. They are binding requirements specified in laws and regulations. We consider command-and-control in its narrowest sense, where public authorities impose on each regulated entity *what* to do and *how* to do it⁸. Distinguishing command-and-control instruments according to their ability to differentiate the requirements –‘one size fits all’ versus differentiated individual requirements or source-specific requirements– may allow a significant refinement of the discussion⁹ (For a discussion on the evolution of the concept of “command and control”, Shapiro and Glicksman, 2000). Note that this categorization is by no means stable and remains subject to discussion in the academic literature (Gunningham and Grabosky, 1998, pp.

⁸ In the United States, most regulation is "technology-based." That is, the regulator requires the regulated entity to reduce the amount of a pollutant to the level achievable by some model technology, typically the "best-available technology." The regulated entity, however, is free to meet this level by any means or method it chooses.

⁹ To avoid ‘nirvana comparisons’, researchers must compare either ideal instruments or real-world instruments but not a mix of the two groups. For example, ideal market-based instruments are frequently compared to real-world command-and-control instruments, putting the latter at a ‘competitive disadvantage’.

37-91; Cole and Grossman, 1999). At the extreme, the public authority may fully integrate the whole entity, i.e., produce the environmental goods, such as national parks (Richards, 2000, p. 242, 263). Moreover, sub-categorization is required to deal with real policy instruments, but is beyond the scope of this exploratory analysis. However, the theoretical polar forms seem to correspond sufficiently to justify the comparison.

The ideal types described above do not correspond exactly to real world instruments. Among recent innovations in environmental regulation, a prominent place is taken by informational instruments such as information disclosure laws. The conceptual economic foundation for disclosure strategies is the Coase theorem, which asserts that socially optimal risk sharing can be obtained if all stakeholders can negotiate at a very low cost. Information asymmetries constitute an impediment to such private bargaining (Tietenberg, 1998). Removing or at least attenuating such information asymmetries may enable to reach a more efficient outcome (Case, 2001). These informational instruments may be considered as a modification of the institutional environment at a meta level in order to facilitate free market solutions where decentralized decisions of individuals determine the overall environmental outcome. In other words, these instruments lower transaction costs of private agents allowing them to achieve environmental-related transactions. For example, the U.S. Toxics Release Inventory forces firms to disclose certain environmental information and allows individual agents to take informed decisions in the concerned market.

According to Williamson, governance structures differ in (1) contract law respects, (2) adaptability and, (3) the use of incentive and control instruments. Because of many common features, the dimensionalization of governance structures can be easily extended to the identified structural alternatives of policy. Let us further explore such a dimensionalization by focusing on categories of environmental policy instruments (see Richards, 2000).

(1) *Each type of policy instrument needs to be supported by a different form of contract law.* Free market environmentalism seeks to imitate the market and can be viewed as supported by something similar to classical contract law (dispute settling by courts) in which the identity of transacting parties is irrelevant and dependence weak. Free market environmentalism does not indicate the level of, or the means of achieving pollution abatement. Such decisions are taken by economic agents in response to market signals. Free market environmentalism sees the market as a ‘powerful ally’ and rely more on decentralised decision making and market mechanisms than do direct regulations. For advocates of free market environmentalism, common law liability rules are a key aspect in ensuring the success of this institutional arrangement (Anderson and Leal, 2001; Adler, 2001). Contractual approaches can be viewed as supported by neoclassical contract law or ‘private contract law’ (dispute settling by arbitration), in which the identity and dependence of transacting parties play a significant role (For a more in depth discussion of this point, see Webb and Morrison, 1999, pp. 229-259). This is clear in the bargaining, implementation and enforcement of voluntary agreements between the regulator and regulated entities (OECD, 1999). The use of binding legal obligations in environmental contracts can vary in importance –

located on a continuum from gentlemen's agreements to covenants imposing legally binding obligations related to clearly defined targets – for both parties. While the academic literature considers the obligations of the private party, the obligations of the public authorities are not analyzed. As far as we know, Mortensen (2001, p. 161-162) constitutes an exception and shows that this dimension is important, especially in relation to the risk of opportunistic behaviour by public authorities. Market-based instruments and command-and-control instruments can be considered as supported by administrative law and the discretion of public authorities (internal dispute settling). Indeed, market-based and command-and-control policies rely upon the power of a centralized authority, be it federal, state or local authorities.

(2) *The adaptive capacity* of free market environmentalism is located in the so-created market. According to Williamson (1991a, p. 277, quoting Hayek, 1945), “the economic problem of society is mainly one of rapid adaptation in the particular circumstances of time and place.” Market mechanism enables to put a price on environmental goods and the resultant price system encourages independent agents to undertake appropriate action (autonomous adaptability labelled as adaptability of type A). It is worthwhile to note that market-based instruments are regulations that encourage behaviour through market signals rather than through explicit directives regarding pollution levels or methods (Stavins and Whitehead, 1992). Conversely, the adaptive capacity of command-and-control locates this approach in the organization and cooperation generated by public authorities. A major advantage of command-and-control or hierarchical instruments are that they allow rapid adaptation to change. Formally, ‘rapid

adaptation' means that public authorities do not rely on markets or bargaining with private parties to achieve environmental progress. For instance, public authorities require only a small delay to ban a presumably harmful product, e.g., the ban of the Bayer insecticide *Gaicho* in France legitimated by the precautionary principle¹⁰. Therefore, command-and-control may appear the most appropriate choice where the optimal level of pollution is zero and no pollution can be tolerated. In this particular sense, the adjustment process is obviously quicker than what can be obtained by free market environmentalism, *laissez faire*, market-based instruments or contractual approaches. In the case of direct public provision, or full integration of the considered activity, the regulator has the residual rights to intervene, which constitutes an important option in the case of high uncertainty (Richards, 2002). Nevertheless, the political and administrative processes are frequently considered to be too long. This dimension devotes further attention to distinguishing the conditions under which the previous proposition about adaptation delay holds. This kind of cooperation is conscious, deliberate and purposeful (Williamson, 1991a). This cooperative adaptability is labelled as type C. Contractual approaches display semi-strong adaptations of both kinds. For example, contractual approaches may include a clause limiting the public authorities' right to pass additional or stricter regulation for a fixed period. Indeed, the environmental demands of public authorities are supposed to be maintained for the duration of the contract. This security for the private party can have negative effects, if new scientific investigations, new technologies or new international obligations call for updated targets. Such negative consequences

¹⁰ This anecdotal example must not occult the well-known fact that changes in command-and-control instruments are frequently a very slow process, notably because of the game between the different interest groups.

may be avoided, or at least reduced, by selecting a limited duration for the clause or including renegotiation clauses (Mortensen, 2001).

(3) Lastly, governance structures can be distinguished by their *incentives intensity* and level of *administrative control*. The academic literature argues that free markets generate high-powered incentives (but not necessarily to abate pollution) and require limited administrative controls that together lead to autonomous adaptability. Production decisions are left entirely to private parties (Richards, 2000). For defenders of free market environmentalism (Anderson and Leal, 2001; Adler, 2001), institutional arrangements combining a system of well-specified property rights and common law liability rules generate positive and powerful incentives to preserve the value of that which is owned, e.g., the environmental resources. A mechanism where individuals act in self-interest offers the greatest potential to protect the environment. If the owner's wealth depends on good stewardship, even a short-sighted owner has the incentive to act as if he or she cares about the future usefulness of the resource (Anderson and Leal, 2001). Command-and-control instruments are frequently criticized because of their high administrative costs and low-powered incentives that lead to a more cooperative adaptability (Richards, 2000, p. 263; Hahn, 1989). Command-and-control instruments, in their purest form offer little or no discretion to the polluting party and maximize regulator control (Richards, 2002). Moreover, market-based instruments often reflect the key role of incentives in defining their character through the use of such expressions as 'incentive-based instruments', 'economic incentives' and 'incentives-based systems'. According to a literature survey by Cropper and Oates (1992; p. 699), "command-and-control systems typically result

in substantial “overcontrol” relative to incentive based systems.” According to Stavins and Whitehead (1992, p.7), market-based instruments are approaches “that require less bureaucracy and governmental intrusion into business and household decisions.” Contractual approaches are characterised by semi-strong incentives and an intermediate degree of administrative apparatus (Webb and Morrison, 1999; Mortensen, 2001). Indeed, many contractual approaches include discretion sharing mechanisms, e.g. large building projects, development of new technologies that place them between free markets and hierarchical approaches, either market-based instruments or command and control instruments. The discussion above is summarized in table 1.

[Insert table 1 around here]

4. The institutional decision tree in the field of environmental regulation

The hazard that is posed by measurement issues (m) is that of maladaptation: as m increases, the maladaptation hazard both changes and grows and the need for added governance appears. Consider activities that generate environmental costs which can be classified as small, large, or catastrophic. Let us assume that these costs are either easy or hard to meter. And assume further that these are diffusely spread over a large population, i.e., they are not bilateral. Suppose we focus on the large cost case and substitute m in the single contractual schema of Williamson (2005b, p. 12). The state’s make-or-buy decisions reflect a series of decisions about contractual risks illustrated in Figure 1.

[Insert Figure 1 around here]

If there is no measurement difficulty ($m=0$), the state may decide not to intervene, leaving the ‘invisible hand’ of free (unassisted) markets determining the level of environmental quality produced and the way by which it will be produced (node A). Even if measurement difficulty is positive ($m>0$), the state may still leave free markets (without additional safeguards, i.e., $s=0$) determining the environmental quality or decide to intervene. In other words, there are two options: live with the hazard and no state intervention (*laissez faire*), that is to say, $s=0$ (node B) or state intervention to mitigate the hazard, that is to say, $s>0$. This last splits into two options: use hybrid contracts to credibly commit the originator to reduce the costs (maybe by agreeing to certain practices and procedures) (node C) or impose regulations (nodes D and E) – which can do some of the same but also could take the form of technology constraints, ongoing surveillance and reporting, additional penalties, and the like. As the measurement difficulty increases ($m\gg 0$) and the state desires more safeguards ($s\gg 0$), the state may impose regulations on regulated entities. Two sublevels can be distinguished. At the first sublevel, the state only fixes the overall goal that must be reached and leaves to regulated entities the choice of the methods to reach it. We will refer to this situation as market-based instruments (node D). At the second sublevel, the state fixes both the overall goal and the way to reach it, e.g., by imposing technological devices. This situation corresponds to command-and-control instruments (node E). According to the OECD (2001, p. 190), “there are many instances where command-and-control measures are necessary, nevertheless. This is the case, for example, where *technical or measurement problems* make it difficult to

continuously monitor the environmental damage attributable to individual agents, or where – as for some hazardous substances – it is desired to reduce emissions to zero.” While advocating for market-based instruments, Stavins and Whitehead (1992, p. 8) also explain that “in situations where monitoring problems are particularly severe, however, technologies are specified.” (See Richards, 2000, p. 265). At the extreme, the state will resort to internal organization (node E) only when this option has lower transaction costs than all other social alternatives. Discriminating alignment entails incurring mitigation costs in cost effective degree, to include concern for the costs of “over mitigation,” which is especially a concern under regulation. Catastrophic environmental costs pose “unacceptable” hazards – so we may ban such activities or nationalize them (although the government turns out to be a poor custodian in many cases) or take other drastic action.

In a very heuristic way, moreover, one can think of moving along one of these nodes as moving toward more intrusive controls by the state. This point is particularly true for policy instruments where free market environmentalism and *laissez faire* leave the higher degree of freedom for regulated agents. Contractual approaches and market based instruments occupy an intermediate position by leaving a certain but decreasing degree of freedom to regulated entities. Lastly, under pure command and control and full integration, public authorities take a hierarchical approach by retaining control over the target, the instruments selected and the tied rights.

5. Some policy implications and concluding remarks

Transaction cost economics constitutes an ‘empirical success story’¹¹ and has proved helpful in choosing between governance structures, especially in the private sector. This contribution is an attempt to extend Williamson’s analysis to the choice of policy instruments for regulating environmental-related transactions. We assert that transaction cost economics remains largely unexplored in environmental economics and politics despite constituting a powerful analytical tool.

For instance, transaction cost economics may provide guidance for policy makers choosing between categories of policy instruments. A major contribution of our exploratory analysis is to question the relevance of many economists’ prescription in favour of incentive-based instruments. Indeed, in some plausible circumstances, e.g., when output measurement is prohibitively costly, a command-and-control instrument may be more efficient by economizing on transaction costs. In other words, under a *ceteris paribus* clause, the measurement costs exceed the cost savings resulting from the greater flexibility allowed by other instruments. Moreover, the repartition of transaction costs between private parties and the regulator constitutes an important issue. Indeed, the desire to minimize overall costs may be mitigated by the regulator’s (or regulated entity’s) desire to attenuate his costs, regardless of the impact on the costs incurred by other parties. In certain circumstances, public authorities are likely to prefer command-and-control instruments, not because of their overall superiority in

¹¹ As of the year 2000, there were over 600 published empirical articles on transaction cost economics with exponential growth therein (...).” (Williamson, 2005a, p. 31).

terms of economic efficiency, but because they can economize on transaction costs incurred by public authorities. A testable implication of this would investigate if developing countries use command-and-control instruments to economize on their own scarce public resources, regardless of this approach's overall efficiency.

In some plausible circumstances, transacting parties may be somewhat prisoner to a particular environmental governance structure in the sense that other factors, e.g. historical context or 'rules of the game', force them to choose a given instrument. Because they cannot choose *ex ante* the governance structure that minimizes transaction costs, transacting parties may invest in modifying the attributes of the transaction. For instance, public authorities may invest in R&D in order to reduce measurement hazards and consequently making contractual approaches efficient. The logic of the discriminating alignment still holds but is inverted. Interestingly, different policy instruments frequently coexist to achieve environmental-related transactions in the real-world. This puzzle challenges the TCE predictions and deserves more attention (See Ménard, 2004, p. 369 stressing a similar puzzle about the industrial organization issue¹²).

As opposed to an in-depth analysis, our contribution constitutes a first step, an appeal for further research on the application of Williamson's analysis to environmental economics. As Williamson (1991a, p. 294) asserts, "further

¹² The co-existence of different governance structures differs somewhat from Williamson's predictions (1991) on alternative and substitutable governance structures rather than complementary ones in order to achieve a given transaction.

developments of conceptual, theoretical and empirical kinds are needed”. The definition of environmental-related transactions, the identification of their key attributes and the implied agents should be identified and analyzed more thoroughly. The correspondence between governance structures and categories of policy instruments, their dimensionalization and dynamics require further examination. Equally, the categorization of policy instruments employed in the paper is underdeveloped and deserves more attention. The transaction costs tied to each category of policy instrument may be refined by considering each category as including three constitutive stages, i.e. *design, implementation and enforcement* that are very similar to contract analysis (Williamson, 1985). Such analysis may help policy makers to predict the responses of regulated entities under different scenarios and legitimate their instrument choice. The simultaneous use of several categories of policy instruments, considered as the combination of substitutable modes of private and public ordering to regulate environmental-related transactions needs to be explored. The precise alignment of transactions to alternative modes of ordering, principally free markets and *laissez faire*, contractual approaches, market-based instruments and command-and-control, is still non-existent (see Delmas and Marcus, 2004 for a first attempt). Lastly, our discussion has not taken into account the historical and social context of instrument choice, which obviously plays an important role in explaining instrument choice and their combination. The empirical testing of the theoretical propositions deriving from this extension – including the expected effects of transactions attributes on governance costs under different governance structures—constitutes a challenging issue and merits future research.

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Table 1: Distinguishing attributes of free market, hybrid approaches, market-based instruments and command-and-control

Attributes	Governance structure			
	Free market	Hybrid approaches	Hierarchical approaches	
			Market based instruments	Command-and-control
Instruments				
- Incentive intensity	+++	++	+	0
- Administrative controls	0	+	++	+++
Performance attributes				
- Adaptation (A)	+++	++	+	0
- Adaptation (C)	0	+	++	+++
Contract law	++	+	0	0
+++ = very strong; ++ = strong; + = semi-strong; 0 = weak				

Figure 1: The simple contractual scheme adapted to the choice of environmental policy instrument (Modified from Williamson, 2005b p. 12)

