Environmental Industrial Regulation

and

the Private Codes Question

Gérard Mondello*

November 1996

International Workshop on **The Economics and Law of Voluntary Approaches in Environmental Policy**, *organised by Fondazione Eni Enrico Mattei and CERNA (Ecole des Mines de Paris)* 18-19 November 1996 Fondazione Levi, Venezia

* ·LATAPSES, CNRS, UMR 42,
250, Avenue Albert Einstein, 06560 Sophia Antipolis, Valbonne, France.
Tel.: +33-04-93954327, Fax : +33-04-93653798.
Email: mondello@naxos.unice.fr.

Abstract

Self-regulation process is essentially based on contractual relationships. Several contract forms are coexisting. This paper is devoted to exemplify some of them specifically in the aim at giving an interpretation to the notion of private codes corresponding to self-commitment contracts, codes of behaviour, etc.. Theses codes are typically self-regulation. Based on contractual foundations, their understanding reveals quite complex. Several factors are at work explaining such a complexity : their origin, the contract process between the agents and the enforcement of the contract itself. This paper is devoted, mainly to understand how the implementation process of the private code may work. To deal with such a problem a matching repeated game have been used and are studied the conditions which led to an equilibrium. It appears that if are respected some conditions as the definition of clear and credible threat, the ascertaining of the application of the private code, then such a regulation means may be proved efficient.

NON TECHNICAL SUMMARY

Since the Association of Consulting Management Engineers has created its own behavioural code in 1933, the private codes (as for example charters) have flourished in the Industrial and Services sectors. Furthermore, it can be noticed that firms mainly concerned with environmental interests and/or risky production have increased their number. As examples, in France, may quoted the TOTAL, ATOCHEM charters, l' « engagement de progrès » of the « Union de l'Industrie Chimique », etc. other examples may be found without difficulty.

Because these codes are not directly initiated by law or the regulatory authorities, they may be considered as a subset of the huge self-regulation process. Nowadays, in the Industry these instruments are more and more often at work[1].

One may wonder what are the causes of such a development. At first sight, their enforcement power could be considered as quite weak. For instance Lawyers speak of 'soft law' or 'green laws' because they are not initiated by Legal Authorities and, consequently, are not directly enforceable. However, this apparent low liability commitment may explain why firms are resorting to them more and more often. Concretely, their features are several. For example, they may initiated by an individual firm (as a charter self-commitment), or may be bound together firms belonging to the same or different sectors.

This paper aims at understanding the nature, the formation and the enforcement capacity of private codes. As a consequence, we may ask, first, why firms are led to use the private codes. Second, being a formal contract, how can they agree about a specific code, third, how could it be enforced ?

The first part of this paper, will analyse these codes the specificity[2]. The main issue is to consider their existence as a consequences of the lack of organised markets because self-regulation is understood as « a collective action of firms which is aimed at remedying to a market failure », (F. Leveque, (1996)). Furthermore, we show that these codes allow to take into account the consequences of a property rights allocation.

In the second part, considering that the concerned agents have reached a mutual contractual agreement we will attach in the understanding of how could be enforced these codes. However, private code formulation is efficient when the markets are flimsy, environmental risk or pollution depending. The whole profession collectively wins binding itself into some credible self-commitments. Nevertheless, conditions to reach such a goal are numerous.

- First, an agreement has to be found between the members of the potential coalition. Such an agreement has costly implications and stowaways behaviours are quite tempting. We did not focus our attention to capture the main features of such formulation, but our developments are based on the existence of an equilibrium solution -i.e. the existence of a contract between the charter members.

---

1 For Much more information see G.Mondello (1996).

2 See for different contracts M.Glachant (1995).

- Second, if the equilibrium existence may be proved, the implementation of such an equilibrium needs more conditions. The main conclusion reached here is that generalised defection cannot be prevented if some conditions are not respected. The simpler ones are a low number of members and a quite clear and credible threat upon the deviant peers. Kandori (1992) has shown that some ascertaining clauses should be added in the aim at increasing the equilibrium condition.

Introduction

Since the early thirties, Industrial sectors have seen private codes, charters, self-commitments etc.[3] emitted by private sources spring up. Because they are not generated by law or the Authorities but by private sources, they belong to some subsets of the self-regulation processes which are, today, more and more often at work in the Industry. One may wonder about their effective enforcement power which could appear, at first sight, quite weak. Hence, lawyers speak of 'soft law' or 'green laws'. Concretely, the private codes nature is multiple. For example, they may be limited to a self-commitment, (firm's individual charter), or may bind together firms from the same sector of activity or different ones[4].

A full understanding of the phenomena needs that the codes conceptual origin, their formation and their enforcement capacity be studied. As mentioned above, this regulation is new compared to the traditional regulatory frameworks. As a consequence, we may ask, first, why firms are led to conceive and use private codes. Second, because these codes work as some formal contract, how can be reached an agreement on the specific terms of a contract, third, how could these terms be enforced ? Gathering these three points is an important task and would require too much space.

In this paper, the codes specificity will be analysed[5] quite quickly. Stemming from the juridical analysis of private codes, it is shown in the first part, that the need of private codes springs from the difficulty to achieve a full property rights allocation. Hence, new « emerging » rights - i.e. access to landscape, Health, Environmental quality, etc.- are recognised progressively by private codes. The community fails to precise such an allocation by legal means or through organised markets. Thus, the private codes formation process helps in this recognising task.

In the aim at controlling the consequences of this attribution, the private codes will tend to define the frontier of those rights. Because of evident advantages in acting first, (and quite alone or without direct control), this allocation is quite unilaterally achieved by the profession, the firms, the polluters, etc.. Formally this study is inspired by the Greif-Milgrom-Weinsgast(1995) work on Guildes. However, our concern is quite different because private codes have specific their target compared to the Guildes organisation.

However, more specifically, we will devote this paper to understand how efficient is the enforcement power of private codes. We are led to consider that such codes correspond to an organisation built on the definition of a contract between agents with same features and interests - that will be called 'peers'. The building of such a contract will not be studied here. This study will be limited to the understanding of the relationships between the coalition of

---

[3] For example, en 1933 has been crated the Association of Consulting Management Engineers- in the United States. The Publicity Code is published in 1937 and has been revisited in 1973, the movement increased and most of the industrial sectors and firms have published private codes. The phenomena popularized with trans-national companies relatively to the technology transfers.

[4] In the environmental sector, since a few years are increasing the number of private codes coming from isolated firms of groups of firms - for example, in France, one may quote TOTAL, ATOCHEM, l' « engagement de progrès » of the « Union de l'Industrie Chimique ».

[5] See for different contracts forms M.Glachant (1995).

agents who define on private basis the behavioural code and the whole Community. It is shown, using existing works on reputation effect and theory of social norms, how may be enforced a private code, or put another way, what are the minima conditions needed to get a credible self-regulation process.

1. Private Codes : Definition

What is a Charter or a private code ? Is it a specific type of professional self-organisation or a simple marketing product ? One may consider that every time an agent or a Community makes some ethical claims about quality, services, etc. to potential buyers or customers is created a private code. This self-commitment allows concerned people to start proceedings against any defecting charter member. Professional courts or legal courts are the main retaliation instruments against deviant members. This could work as a 'Third Party sanctions' according Bendor-Moolkherjee (1990) definition. Therefore, once publicly claimed, the private code may be considered as an implicit agreed contract between the firms and the Community as a whole.

1.1 Property Rights Allocation

Our intuition is that a Charter allows property rights allocation. Historical references plead for such an interpretation. In feudal times, cities get their freedom because of their struggle against the lord ; and, generally, these conflicts issued on a Charter proposal. Freedom was relative and consisted in the allocation of specific rights about exchanges, roads, mills, etc.. Indeed, nowadays, things have changed between citizen and lords. However, this conception about the role of property right allocation, may be extended to the industrial sector. Hence, a private code may be read as a way to recognise the Community some new emerging rights.

At first sight, this position may seem quite amazing and we have to explain it now. We know that market failures may induce the organisation of some self-regulation process. Self-regulation is a substitute to markets, and its status is similar to the traditional regulation one that consists in the use of well-known tools as taxes, permits, norms, etc.. When property rights are well allocated and identified, compensation schemes between polluters and polluted people may be specified quite easily, (as in the Coasian tradition for example). Generally, the choice between regulation (traditional) and self-regulation induces efficiency questioning. Self-regulation seems to be more efficiently enforced and implemented because of its intrinsic flexibility when dealing with non-point sources pollution for example

Self-regulation is understood as « a collective action of firms which is aimed at remedying to a market failure », F. Lévêque, (1996). Furthermore, we will show that these codes allow to take into account the consequences of a property rights allocation. Negotiation between polluters (firms) and polluted (or the regulator), achieves pollution internalization in the well known Coasian tradition. In the Coasian scheme, property rights are given, this is the negotiation first condition. When transaction costs are null, the issue may be proved pareto-optimal, meanwhile when they are positive such a result cannot be guaranteed any more. By the fact, negotiation and self-regulation became an alternative regulation tool compared with taxation, permits, standards, etc.. As Glachant (1995), Lévêque (1996) show it, these contracts bind together administration and firms. The novelty is that firms are several and cannot be represented by a single agent. Then, the question is how can these different partners conclude an agreement? Transaction costs are involved by the quite large number of partners, and the difficulty to define the consequences and the amount of pollution. The situation is quite conflicting.

The private code formation is achieved on a contractual relationship basis and its constitution does not involve the whole community. Are mainly concerned the set of agents belonging to the profession, that is, mainly, the producers. These agents may speak in the name of the Community but they are mainly concerned by the limitation of the property rights they give to it. This, because the adjustments process, linked to the application of the codes, means supplementary costs for the firm. We have to notice that property rights are receiving, here, a quite huge interpretation, its roots may be found in Furubotn et Pejovich (1972) works. The rules set includes enforcement and rights; Dales (1968) distinguishes four types of property rights:

- The exclusive property rights, which are the total disposal of the goods in the limits of the Community right. These are the traditional juridical property rights on field, houses, goods, cattle, etc..

- The Status or functional property, (licences).

- The right to use a public good, (even if rental charges are due),

- The right to benefit of an unchangeable scarce resource.

The more precise the property rights are, the more binding they are for the polluters. And, as a consequence, the more often their own liability is liable to be engaged when accidents or structural pollution occur. Their self-interest, then, is to define the whole set of property rights, and their associated attribute, that they are ready to recognise effectively. Acting this way they put under control the property rights recognition process. Our interpretation is quite close Barzel’s (1992) one[6].

We should study how the contractual relationship between agents issues on a private code. This process borrows some features to the theory of clubs[7], this because actors have common interest to reveal preferences and, necessarily, this led to incur some costs. However, in this paper we let this work undone : we are considering that the formal and contractual agreement between partners is achieved.

1.2. The Private Codes Dynamics

The charter is a set of propositions summed by a value h among a set H of potential propositions. The charter are ranked such that each h is associated to a number between 0 and 1. By convention, the more restricting - i.e. in associated costs terms - the Charter is, the nearer to 1 it will be. Hence, the whole set of potential charters is ordered on an interval, $H \subseteq [0,1]$.

6 For a complete treatment see Mondello, (1996).

7 We may refer to the theory of clubs as a first explanation of the contractual agreement between partners of equal status. Buchanan,J(1965).

The game is played for a given previously determined value of the Charter ($h = h°, h° \in H$). This process is a static repeated game between the N players. The issue of the game will show the agreement enforceability. The general defection means that the process will stop. The regulation will have to change features. Either a more stringent charter will be proposed, or will be required a new regulatory instrument. Every rejected charter $h°$, *in fine*, may be replaced by a more stringent one, h_1, $(h_1 > h_0, h_1, h_0 \in H)$. The private code succession $(h_0, h_1, .., h_T)$, will represent its working out dynamics. If the game main result is a general defection, (no equilibrium value is reached), then the private code will not be enforceable. The private code adoption process may be considered as a dynamic sequential process. Its dynamics rises from a succession of static defecting repeated games -i.e. non-equilibrating repeated games and, as a consequence, from the re-negotiation of the peers' agreement.

2. Matching Repeated Games and Private Codes

The methodology used is inspired from the sociology works of Macaulay (1963) on the formation process of social norms. Here, the social norms are associated to the private code process enforcement. Technically, repeated games inspired from Axelrod (1981), are at the very roots of this problematic. However, in order to get a general interpretation, they have been extended from the genuine two players game to a game with a set of players, members of a community, which are making bilateral meeting at random. For instance, the global working of such a process has been described by Bendor-Mookherjee (1990):

« (.), norms are typically backed by third-party sanctions: if Smith reneges on a deal with Jones, the latter may spread the word about the former, and other members of the same community may punish Smith in a variety of ways, despite being unsolved in the original agreement. » Bendor-Mookherjee (1990, p.34).

The meeting between 'peers' and 'outsiders' is the sole way to check if the of the private code are effective. As a consequence, at every step, (encounter between players), the level of everybody's payoff is checked and are decided the consequences for the following game.

2.1. Description of the Game

The game is a matching game such as described by Rosenthal (1979) and Kandori (1992). In such a game, as it has been said previously, the players meet each other on a random basis. They are supposed to play an identical two players payoff matrix. At every step of the game, all player has met another and unique player, at the following step another encounter is made. At every step, the agents meet each other once and at random. Agents have the choice between co-operative and non co-operative strategies and any defecting agents, (non co-operative players) have to be punished by the new players. If the co-operative solution (Folk theorem) is reached, then the agreement may be considered as stable and the code is adopted among the 'peers'.

2.1.1 The Players

Adapted from generic approaches, the players set is considered as compounded of two kinds of agents:

- The K set of the ‘internal players’ or ‘peers’. They are agents which have initiated the charter. We will suppose, to make things simpler, that K is the cardinal of this set indexed by *i*, $i \in K$.

-The *M* set of the outsiders the cardinal of which is *M* also, indexed by *j*, $j \in M$.

Assumption 1 : K<M.

K<M signification is that a single agent from K may encounter, simultaneously, several agents from M. For example, a producer alone is selling its production to a lot of customers, at every step, each of them will buy something among the K-sellers. Because of assumption 1, we have to notice that they are several K-customers playing simultaneously with an agent from M. Then, we may consider that the matches number is M. Every M-customer plays with an agent from K. As a result the number of players is 2M. Let be 2M=N; N is the players total number.

Let be $\eta(i,t)$ the match of agent *i* to the step, *t*, $t \in [0, T]$ of the game, (where *T* may tend to infinity), it is possible to define the probabilities of meeting for both groups by:

$$\forall i, i \in \mathrm{K},\ \ prob\{\eta(i,t) = j\} = 1/K$$

$$\forall j, j \in \mathrm{M},\ \ prob\{\eta(j,t) = i\} = 1/M \ .$$

More precisely, representative agents from K and M meet at random in a repeated game framework.

2.1.2. The Strategies Space and Game Tree Analysis

The strategy choice fits with the ‘peers’ joining principle. The outsiders strategy is to co-operate - i.e. to adopt the expected behaviour by the ‘peers’- or to choose non co-operative strategies. Customers co-operate when they accept the chart propositions and when they meet co-operative ‘peers’. Let us explain this point.

It may happen that the outsiders judge insufficient the announced Charter level *h* supplied by the ‘peers’. We have to recall that this level is the result of a contract negotiation between the ‘peers’, excluding the ‘outsiders’. Consequently, the ‘outsiders’ are induced to adopt defecting strategies if they consider that their property rights have not been recognised fully. The non co-operative choice may be induced, too, by some retaliation considerations - i.e. when they are faced with deviant coalition members.

In this case ‘outsiders’ use the **minimax** strategies. Let be *a* the index of such an acceptation and $\bar{a}$ the opposite. A priori, ‘peers’ agents do not know the nature of the game. On the decision trees (figure 1 and 2), the ‘outsiders’ strategies are represented by letter (b), meanwhile the ‘peers’ one by (d). Bars upon letters means that are used non co-operative strategies. In this context, (charter accepted by the ‘outsiders’), the inefficiency cause, if checked, will be originated by the ‘peers’ failure. In figure 1, such a meeting is achieved between representative agents.

Let us stop a moment and let us have a look to the situation. From the ‘peers’ side the question becomes : do or do not ‘outsiders’ accept the charter ? At this stage, the game could be considered as an incomplete information repeated matching game. Indeed, the states of nature bear upon the type of the 'outsider', i.e. does or does not the 'outsider' accept the Charter ? Figure 1 shows such a situation, in which the incomplete repeated information game, according Harsanyii process, is transformed into an imperfection information repeated game. Any sub-game of the game is the game itself. At this stage, formal complications may be considered at their higher level when looking for solutions[8].

Fortunately, here, we do not need a complete representation. Let us give an explanation. Let us suppose that 'peers' feel with some high probability that 'outsiders' will not accept the charter terms and, consequently, will not be induced to co-operate. Then, they may think that charter will never be enforced. Let us suppose, furthermore, that in spite of this feeling, the outsiders accept the charter and play co-operatively. They will be faced, nevertheless, with great a number of defecting 'peers' and the game will not converge towards a stable equilibrium. This, because the outsiders will use punishment strategies against the defecting 'peers'. As a conclusion, the incomplete information structure does not add too much to the main features of the fundamental game. It only reinforces the defecting process. This game is specific and belongs to a normative interpretation case. Our concern is more general and we can focus upon the assumption of an 'a-priori' accepted charter.

Let us, then, consider the game when the M-agents accept the charter. Thus, when dealing with private code acceptation, a perfect information game will be used as shown in figure 2, (dashed lines are suppressed at the second node). We can focus on the sub-game which initial node begins with the accepted charter, (*a*).

Assumption 2**:** Once the charter accepted by the 'outsiders', the first defection move never comes from the 'outsiders' side but from the 'peers' one.

When the outsiders decide to co-operate, they play co-operative strategies every time they have met a co-operative 'peer'. If not, that is, if they meet defecting 'peers', the next step, they will adopt a non co-operative strategy which consists in a punishment choice. They play a perfect information game, i.e. they know that they are faced with failing or co-operative player. We may examine the tree game in figure 2 when the 'outsiders' decide not to play the charter. In this case, the 'outsiders' adopt systematically a non co-operative strategy. We have implicitly admitted that the 'peers' could punish the 'outsiders' when playing non co-operatively. Nevertheless, they could go on playing non-deviating strategies without convincing the 'outsiders' and the process will never converge. One may suppose that the 'peers' do not know *a priori* the 'outsiders' decisions when they act in an incomplete information game. We can then define the strategy space for every kind of agent.

[8] See Forges, F.(1988) for the cases of two players. We do not think that incomplete information game have been extended to a Community as in the complete information case.

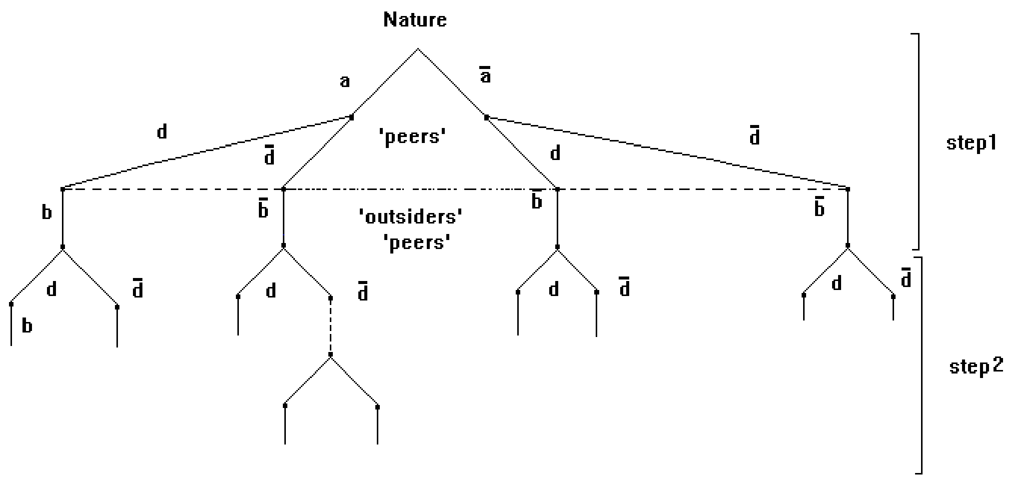

Figure 1

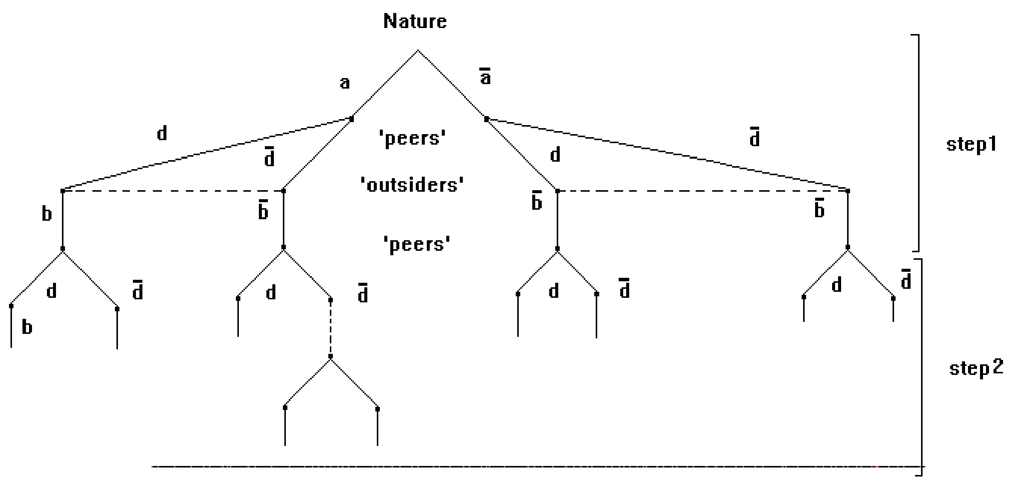

Figure 2

2.1.3. Strategy Space and Payoff Functions

Now, the outsiders payoff function may be specified more precisely. As a simplification, let us notice first that the consumption of a product involves both its quantity and quality (respectively y and s). The higher s is, the better its quality. Agents are waiting for a minimum quality $s°$. Whatever their supplied quantity is, products out of this scope (s<s°), will not find any demand. Then, is defined a quality/quantity index as $x(s,y)$. In the aim at defining the strategy set of agents and their payoff functions, we have to make some assumptions and definitions. Let $U(.)$ be an utility index depending on these values, such that :

$$\begin{aligned} &U_i(.): Y \otimes S \longrightarrow R \\ &(y \in Y, s \in S), \end{aligned}$$

and,

$$x(s,y) = \begin{cases} \leq 0, & (\forall y \leq 0, s \leq s°) \\ > 0, & (\forall y > 0, s > s°) \end{cases}$$

We are associating the quality notion (s) to the charter joining process. As an example, for firm j, the quality level is linked to the level of the charter ($h°$) and joining a private code means that the product quality will be equivalent to its requirement at the $h°$ level. Consequently, the firm will spend a sufficient cost to get the quality $s°$ associated to $h°$. Hence, the higher h is, the higher the expected quality will be. In order to make things easier, we will assimilate s and h, such that :

$$s(h) = h$$

Consequently, the satisfaction function may be written as :

$$U_i(x(h,y)) \begin{cases} \geq 0, & (x(.) \geq 0), \\ = 0, & (x(.) < 0). \end{cases}$$

Let be $h°$ the charter level adopted by firm j and $\tilde{h}, (\tilde{h} \geq 0)$, (with $h°, \tilde{h} \in [0,1], j = 1, \ldots K.$), the quality degree an outsider may expect. It is supposed that firm j has announced that charter $h°$ will be adopted and its production gives the following satisfaction level to the consumer.

$$U_i(x(h°, \bar{y})) \geq U_i(x(\tilde{h}, \bar{y})) > 0 \quad \text{(a)}$$

or

$$U_i(x(\tilde{h}, \bar{y})) > 0, U_i(x(h°, \bar{y})) < 0 \text{ (b)}$$

For a given $h°$, the consumers can make choices described by (a) and (b) above.

In (a) they will co-operate, (no retaliations) because their expectations are fulfilled, $h° \geq \tilde{h}$.

In (b) because they are deceived compared to their expectations $h° < \tilde{h}$, they will not co-operate and will use some retaliation strategy. For example, in concrete situations, the market will not be open because the potential consumers are not convinced by the charter commitment.

Concerning the 'peers' we give an illustration of their payoff function by developing an example. Hence, their profit function depends upon the quantity sold, and the fraction of the K customers which will buy the product sold by the producers.

The payoff function is the expected average sum at every step of the game. It is discounted by $\delta, \delta \in (0,1)$. Let be $(A_f^i, A_v^j) \in A_i \times A_j$ the K and M-agents strategies sets. The 'outsiders' strategy or action space is the following sequence. From the 'outsiders' point of view, the strategy space is :

a) Single shot strategy

If the charter is accepted, then, the 'outsiders' will always play co-operatively: $A_v^j = \{a, b\}$ and non co-operatively if it does not. However, in a one shot game, the 'peers' have the possibility to defect, such that their strategy set is :

$A_f^i = \{d\}$, with a co-operative strategy or $\overline{A}_f^i = \{\overline{d}\}$, with a non co-operative one.

In a one shot game, it does not make sense, for the 'peers' to accept the charter, and the defecting strategy will be always used. Knowing this, the outsider will never accept any charter, and the equilibrium of the game is :

A*={ $\overline{A}_v^j$, $\overline{A}_f^i$ }={ $\{\overline{a}, \overline{b}\}, \{\overline{d}\}$ }[9]

Things are becoming quite different with a repeated game.

b) the repeated game

Two cases as shown in figure 1 and 2 may be distinguished, the case in which the private code is accepted by 'outsiders' and the case it is not.

i) Accepted Charter :

$$A_v^j(t) = \left\{ \underbrace{a, b, b, \ldots., b, b, \ldots., b}_{T} \right\}, A_{v''}^j(t) = \left\{ \underbrace{a, b, \overline{b}, \ldots., \overline{b}, \overline{b}, \ldots., \overline{b}}_{T} \right\} ,.,$$

$$A_{v'}^j(t) = \left\{ \underbrace{a, b, b, \ldots., \overline{b}, \overline{b}, \ldots., \overline{b}}_{T} \right\}.$$

---

9 To be absolutely exhaustive, we should establish a relationship between the strategy choice and the payoff functions g(.,.) and the level of satisfaction *U*(.) and the expected profit. This relationship is evident if we consider that a fixed amount of quantity is bought and sold for a given price and a given level of commitment (charter). As an illustration, we get : g(A*)= (*U*(x=0), 0) for each player

ii) Refused Charter :

$$A_v^j(t) = \left\{ \underbrace{\bar{a}, \bar{b}, \bar{b}, ..., \bar{b}, \bar{b}, ..., \bar{b}}_{T} \right\}$$

The 'outsiders' go on with defecting strategies. The peers actions from 0 to *t* may be represented by :

$$A_f^i(t) = \left\{ \underbrace{d, d, d, ..., d, \bar{d}, ..., d}_{T} \right\}, ..., A_{f'}^i(t) = \left\{ \underbrace{d, d, d, ..., \bar{d}, \bar{d}, ..., \bar{d}}_{T} \right\}, ..,$$

The payoff functions are represented by the following *g*(.) functions for a given step :

$$g\colon A_i \times A_j \longrightarrow R^2$$

It depends on the agents strategies and the charter level *h*, (*h* is supposed to be given):

$$g(A_f^i, A_v^j \; |h°, t) .$$

Once the charter adopted, any retaliation behaviour from the consumers will be motivated by the meeting of deviant agents (firms or peers).

2.1.4. The Game Matrix

Now, must be made precise the concrete features of the agents' payoff function. Consequently, we will assume that a repeated prisoner dilemma game will be played. To make things simpler, let us write the different strategies.

For the 'outsiders' Non co-operative strategies (defecting or punishing) $\bar{b}$ = nc and co-operative strategies : *b*=C

For the 'peers': Non co-operative strategies $\bar{d}$ = nc and co-operative strategies : *d*=C. We can define then the following given matrix game :

Peers

		C	nc
Outsiders	**C**	1,1	-a,1+v
	nc	0,-h	0,0

Table 1

(with a>0 and v>0).

This asymmetric matrix means that whatever the strategy chosen by the peers, (co-operative C, non co-operative nc), their payoff will be null when the 'outsiders' does not play co-operative strategies. In a one shot game, the defecting 'peers' may expect to win (1+v). In the opposite, they will undergo losses if they play co-operative meanwhile the 'outsiders' have decided to defect, (their loss is equal to h). This situation is paradoxical only apparently : the initiative of failure is due to the 'peers' side and the 'outsiders' plays non co-operative retaliation strategies without undergoing losses, (that could be the case when agents decide to boycott a product). The condition the 'outsider' play a co-operative strategy is that if p is the probability to play the co-operative strategy, its value is:

$$p > \frac{a}{1+a} \qquad [1]$$

If the 'outsider' supposes this condition fulfilled he will play co-operatively. The payoff matrix is defined for a given level of the Charter. Let us examine the case in which h^* is given, then [1] will be rewritten :

$$p(h^*) > \frac{a(h^*)}{1+a(h^*)} \qquad [2]$$

Let be $g(a_i, a_j, h^*, t)$ the payoff matrix game for the different players payoff functions in which the strategy set of the player j corresponds to :

$$a_j = \{C, nc\}.$$

It is supposed that the value taken by $g(.)$ for the different players are the payoff matrix given above. Let be m the minimax of the matrix (the punishment point), it appears that :

$$m = \arg\min_{a_i} \left\{ \max_{a_j} g(a_i, a_j, h^*, t) \right\} = (nc, nc)$$

In this game, if the game is played infinitely the co-operative strategy is a co-operative Nash Equilibrium. That is the point we study now.

2.2 The Game Equilibrium

When a charter $h°$ is *a priori* accepted by the outsiders equation [1] is prevailing. As a result, the sole players liable to defect are the 'peers' one. The non co-operative strategies can only come from the punishment strategies (minimax) used by 'outsiders' against deviant 'peers'. Therefore a distinction could be provided on the 'peers' type and consider deviant agents (type d) and 'non-deviant', type nd. If X_t is the type d players number, then, one may define a markovian process in which Q is the (S,S) transition matrix the component of which are:

$$Q = (q_{ij}), \text{ where } q_{ij} = \Pr ob\left(X_{t+1} = j \middle| X_t = i\right)$$

This expresses the defection progression, and it may be supposed then that some players return to a co-operative strategy in such a way that the transition matrix is now:

$$B = (b_{ij}),$$
$$b_{ij} = prob\left(X_{t+1} = j \middle| X_t = i, \text{ a defecting type plays sometime a cooperative strategy }\right)$$

The deviant type diffusion matrix is delayed by an unilateral deviation originated by the d-type, $H = B - Q$. Therefore, the probability vector that an 'outsider' meets a deviant 'peer' is:

$$\mu = \frac{1}{M-K-1}\left(M-K-1, M-K-2, \ldots, M\right)'$$

This is, too, the probability that a deviant agent meets a co-operative player. We may define, then, the stability features of a charter a proposition made by Kandori (1992).

Proposition 1 : *A Charter* $h^*,\ h^* \in H,$ *is accepted by the players if it is a contagious equilibrium in the Kandori (1992) sense.* (Proof in annex 1).

This proposition calls for remarks. In this random matching game, every deviation involves, *ipso facto*, from the 'outsiders side', some retaliations measures and a minimax strategy will be played consequently. As Kandori proves it, sustaining a co-operation strategy needs a few number of players. To state the non-existence of a contagious equilibrium leads either to the definition of a new charter, or the choice of an another process. This potential change allows to check that the whole process is dynamic. A code adoption process requires time and its improvements several intervals of time. The succession of periods is linked to the existence of non-convergent equilibria because of too much an important number of deviant 'peers'.

Once reached the contagious equilibrium, the Charter equilibria defined 'in principle' may be considered as adopted 'in the facts' and is reached a stability condition. An equilibrium has to be found between the increased costs involved by some higher degree of commitment such that outsiders are induced to co-operate and too high a level which involves high investment costs.

Proposition 2 *: Considering two strategies levels such that,*

$$\forall h, h' \in H \text{ with } h < h',\ then,\ g(a_i, a_j | h) > g(a_i, a_j | h').$$

This proposition means that a new definition process with more restrictive a code involves that expected payoffs, *caeteris paribus*, will be less important. The whole set of individual payoff give a general diminishing surplus to divide between partners. A point may be reached in which some players may think that player private codes is not any more advantageous and could accept another regulation type.

2.3 Competition and Private Codes: a Short Example

The higher the number of players, the lesser the probabilities to maintain a contagious equilibrium and, evidently, the least stable the charter will be. One may check this point by examining a duopolistic competition. Let us suppose that N consumers expresses the will to pay more for an improved quality. Let us suppose then that they faces two firms, 1 and 2.

Then, under the assumptions that the firms part equally the market and agree on a level of charter, every defection will have the following consequences :

If the defection comes from firm 2, then at the first step, the payoff will be, respectively $\left(\frac{N}{2}.1, \frac{N}{2}(1+v)\right)$.

That is, for the sector, (both firms): $\frac{N}{2}.(2+v)$.

The $\frac{N}{2}$ deceived consumers will adopt, then, a (nc) strategy and the loss the sector will undergo at the second step, will be equal to $\frac{N}{2}$. The expected payoff will be $\frac{N}{2}.(2+v) - \frac{N}{2} = \frac{N}{2}(1+v) < \frac{N}{2}.(2+v)$, with $\frac{N}{2}(1+v) < N$ if v less than 1.

At step three, the firm 1, which has suffered the punishment from the deceived customers, will fail at its turn too. At step four, the defection is generalised. Knowing these vicious consequences, the charter members, in an oligopolistic context, will have to maintain a contagious equilibrium and therefore will take care not to defect. In the opposite, facing a high competition level, respecting the private code may induce some problems. This result is quite conform to the Kandori analysis and, in our context, would deserve much more attention but our space is limited to pursue such an analysis.

Conclusion

Emerging property rights are at the root of the definition of private codes. In well identified regulation situations, (polluters and polluted people identified, knowable extend and measure of pollution, liabilities allocated, etc.), private codes may be formulated but they belong to the competition weapons. One firm aims at differentiating its product and the code is an advertising instrument.

However, when the markets are flimsy, environmental risk or pollution depending private code formulation may be revealed to be some efficient self-regulation tools. The whole profession chooses a winning strategy when the self-commitments are credible. Nevertheless, reaching such a goal needs several constraining conditions. First, an agreement has to be found between the potential coalition members. Such an agreement has costly implications and stowaways behaviours are quite tempting ones. We did not focus our attention to capture the main features of such formulation, but our developments are based on the existence of an equilibrium solution - i.e. the existence of a contract between the charter members. Second, if the equilibrium existence may be proved, the implementation of such an equilibrium needs more conditions. The main conclusion reached here is that generalised defection cannot be prevented if more conditions are not respected. The simpler ones are a low number of members and a quite clear and credible threat upon the deviant peers. Kandori has shown that an ascertaining clause should be added aiming at strengthening the equilibrium conditions.

In this paper, the references to Kandori's (1992) work is rather incomplete because we did not examine the case in which there is a mechanism or an institution which supplies information to the community members. In our representation, we stay in a rather 'pure' or 'rough' model in which the agents discover by themselves the application of the private code. Cheating 'peers' are not labelled and we do not have pushed the analysis in this direction. We have only sketched the enforcing ability of matching repeated games to establish the private codes terms as a self-regulation instrument.

To put in a nutshell, we can notice that the private code formation is far from being a simple marketing product. Nevertheless, its efficiency requires to gather a huge number of conditions which are based on institutional basis, (the credibility of courts, a good information system) and on the will of the potential and on the effective will of its promoters to make of it a useful instrument. Furthermore, the efficiency of private code have to be found too, in their ability to help in the identification of the liability of defecting actors. This may be an interesting link to follow.

ANNEX 1

Proposition 1 (Proof)

The demonstration bears upon two elements:

i) Contagious equilibrium definition

Kandori (1992) shows that only a defection made by a member, (in our model a 'peer') involves a generalised defection among the whole amount of other players. The resulting equilibrium is called 'contagious equilibrium. The condition a contagious equilibrium be maintained, for a given number M of given agents and v fixed is that δ and a be large enough.

ii) The contagious equilibrium is a sequential equilibrium.

The equilibrium maintains and is a sequential equilibrium if are met the following conditions :

$$\frac{1}{1+v} \geq (1-\delta)e_1(I-\delta Q)^{-1}$$
$$and \qquad [3]$$
$$\frac{\left(\frac{M-k}{M-1}\right)v + \left(\frac{k-1}{M-1}\right)l}{1+v} \geq \delta e_k H(I-\delta Q)^{-1}\mu$$

This result is a necessary condition. It is obtain by comparing the non-profitability condition of a deviation in a unique step of the game, it is expressed by, (Abreu (1988)):

$$\frac{1}{1-\delta} \geq \sum_{t=0}^{\infty} \delta^t e_1 Q^t \mu(1+v) \qquad [4]$$

The left hand side of the equation corresponds to the payoff linked to a perpetual co-operation, meanwhile the right hand side discounts the payoffs linked to a deviant behaviour. To show that the deviant agents have interest to go on deviating, it is used, for the 'peers', non-profitability condition opposed to a deviant strategy. This is the same that to calculate the payoff of the carrying on deviating strategy once has been adopted a deviating strategy.

$$\sum_{t=0}^{\infty} \delta^t e_1 Q^t \mu(1+v) \geq \left(\frac{M-k}{M-1}\right)v + \left(\frac{k-1}{M-1}\right)l + \sum_{t=0}^{\infty} \delta^t e_1 B Q^t \mu(1+v) \qquad [5]$$

The right hand side member corresponds to the Co-operative player payoff. The left hand side corresponds to a systematically deviant strategy. Are deducted the relationships from [3]. For a complete demonstration, see Kandori, (1992). The result is done then.

Bibliography

Abreu, D. (1988), « On the Theory of Infinitely repeated Games with Discounting », Econometrica, 56, pp.383-96.
Axelrod,R, (1981), « The Emergence of Cooperation among Egoists »*, American Political Science Review*, 75, pp.306-23.
Adar, Z et **J.M. Griffin** (1976), « Uncertainty and the Choice of Pollution Control Instruments », *Journal of Environment and Management*, 3, oct.,pp.178-88.
Aumann, (1988): *Handbook of Game Theory*- Elsevier, North Holland, Amsterdam
Bendor, J., Mookherjee, D., (1990), « Norms, Third-Party Sanctions, and Cooperation », *Laws, Econmics and Organization,* Vol.6, N°1, pp.33-63.
Barnet, A.H.(1971),The Pigouvian tax rule under Monopoly, *American Economic Review*, Vol.70, N° 3, pp.1037-41.
Barzel, Y.,(1992), *Economic Analysis of Property Rights*, Cambridge University Press. Cambridge.
Bator, F.M. (1958), The Anatomy of Market Failure*,Quartely Journal of Economics*-August- 72-pp.351-79- reprinted in T.COWEN-op.cit.
Baumol W.J., Oates W.E. (1988), *The Theory of Environmental Policy*, Cambridge University Press, Cambridge.
Buchanan,**J**.(1965), An Economic Theory of Clubs, *Economica*, 32, pp.1-14.
Coase, R. (1960), The Problem of Social Cost, *Journal of Law and Economics*, 22, pp.141-62.
Cowen, T. (1992), *Public Goods and Market Failures : A Critical Examination* - Transaction Publishers - New Brunswick - London.
Cropper, M.L., W.E. Oates (1992), Environmental Economics : A Survey*, Journal of Economic Literature*, Vol.XXX, June, pp.675-740.
Demsetz, H. (1964), « The Exchange and Enforcement fo Property Rights », *Jounal of Law and Economics*, 7, oct. pp.11-26 in T. COWEN (1992), pp.127-145.
Demsetz, H. (1967), « Towards a Theory of Property Rights », *American Economic Review*, 57, pp.347-59.
Farjat, G. (1989), « Les Codes de Conduite Privés », In Mélanges Goldmann, Librairie Générale du Droit et de Jurisprudence, Paris.
Forges, F.(1988), « Repeated Games of Incomplete Information : Non-Zero Sum », in Aumann (1988), pp.156-76.
Furubotn, E.B., et S. Pejovich (1972), « Property Rights and Economic Theory : A Survey of Recent Literature », *Journal of Economic Literature*, 10, pp.1137-1162.
Glachant, M., (1995), Les Accords Volontaires dans la Politique Environnementale: Une mise en perspective de leur nature et de leur efficacité, Economie et Prévision, n°117-118/&-2. pp.49-59.
Greif A, Milgrom P., Weinsgast B.R.(1994), Coordination, Commitment, and Enforcement: The Case of the Merchant Guild, in Journal of Political Economy, vol. 102, n°4, pp.745,776.
Kandori, M. (1992): « Social Norms and Community Enforcement », *Review of Economic Studies*, 59, pp.63-80.
Leveque, F, (1996), Is there Room for Environmental Self-Regulation in the Mining Sector, 5th Mineral Economics and Management Society, (MEMS) Conference, Montreal.
Macaulay, S (1963), « Non-Contractual Relations in Business : A preliminary Study », *American Sociological Review*, 28,pp.55-67.
Mondello, G (1996), « Principe de Précaution ou de Prudence, Nouveaux Modes de Régulation et Relations Contractuelles », Rapport Programme Environnement du CNRS, Environnement, Société et Développement à Long Terme. Etude Economique.
Rosenthal, R.W.(1979): Sequence of games with varying Opponents, Econometrica, Vol.47,N°6, Novembre, pp.1353-67.