Tragedy of Commons versus tragedy of anticommons? An analysis in term of Social Choices and Property Rights.

Alain Herscovici

Abstract

Based on an approach related to the "old institutionalism," and on the analytical tools built by Williamson and Ostrom, this paper aims to analyze the economic implications of the development of different systems of Commons and collective Property Rights.

In the first part, I will show how the economic literature conceives the problem of commons and anticommons. In the second part, after some methodological considerations, I will specify the different elements necessary to build a function of collective welfare. Finally, I will define the concept of viability of a particular mode of governance and show why, when the transaction costs are positive, the governance based on private negotiation is not systematically the most efficient mechanism in terms of social welfare.

Keywords: Property Rights- Commons- Governance- Social Welfare.

JEL Classification: D71- Social Choice; Clubs; Committees; Associations, D23 - Organizational Behavior; Transaction Costs; Property Rights, K11 - Property Law.

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Is Economics still a dismal Science as written by David Ricardo or a tragic one as highlighted by the modern tragedy of commons? Tragedy of commons versus tragedy of anticommons? How can we choose forms of social organization of production, consumption and property rights that correspond to a viable modality of governance?

This paper aims to demonstrate that the institutional approach, more specifically the seminal works of Williamson (2000, 2002) and Ostrom (2000, 2005), enables us to formulate a coherent answer. The former highlights the specificities of the assets and the fact that, intrinsically, the contracts are incomplete; the latter studies more specifically the different forms of social organization based on collective systems of Property Rights (PR). In this sense, this paper aims to propose an alternative to the analyses of the New Law and Economics, which advocate modalities of private negotiation.

The concepts developed in this study may be applied to different social activities: environment, information, knowledge, culture, scientific and technological production, microcredit banks and so on. However, the study will be focused on the digital economy: the economic nature of goods, the new forms of property, the impossibility of implementing a private system of PR, and the development of all kinds of communities online are elements that highlight the importance of the commons in such econnomy. This study will highlight the importance of these collective components in the way markets are concretely working, including the sphere of private reasoning.

The problematics are the following: identifying the different variables that determine a function of Social Welfare; and defining the *viability* of a mode of governance based on the compatibility between the PR system and the economic nature of goods, which will determine the level of transaction costs, the level of the stock available for the community and, consequently, the level of Welfare that characterizes the mode of governance. The Coasian analysis will be studied based on this approach.

In the first part, I will show how the economic literature conceives the problem of the commons and anticommons, and why this directly concerns the digital economy. In the second part, after some methodological observations, I will specify the different elements necessary to construct a collective function of Welfare. In the third part, I will define the viability of a mode of governance and show how this theoretical framework enables choosing a specific mode of governance.

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I) Tragedy of commons, tragedy of anticommons and Intelectual Property Rights (IPR): a primary approach

1) *Commons versus anticommons?*

When there is a common good in a particular community (ecological components, natural resources, etc.), private appropriation may damage the whole collectivity: this process may result in a decrease in the stock available for the other agents.

Hardin (1968, p. 1243) explains the failure produced by a common property by the absence of an institutional system able to preserve the common good. For example, if a lake is this common good, every fisherman will maximize his gain, which will compromise fish reproduction. The solution consists in implementing a *coercion principle*: the private property of the common good will prevent stock depletion. Hardin analyzes the *enclosures* of the 18th century from such perspective.

The limitation of this thesis may be explained by the following elements:

i) There are other means to regulate the social appropriation of the commons. This social appropriation takes place through social convention and rules, and it cannot be associated to open access regimes (Ostrom, 2000, p. 335). This form of collective property results in establishing explicit or implicit rules and conventions that all the community members should respect so as to control and prevent opportunistic behaviors. These rules and conventions allow limiting the level of transaction costs necessary to control opportunistic behaviors. Regarding the end of the systems based on common property of the land, in the 18 and 19th centuries in England, the failure of the collective system comes from the actions of richer farmers (Cox, 1986, p. 60), i.e. from the private appropriation of the common good.

ii) We should distinguish the situations in which the goods are private and divisible from those in which the goods are public. The mechanism described by Hardin only makes sense if the goods are private and totally divisible: "the benefits consumed by one individual subtract from the benefits available to others" (Ostrom, 2000, p. 337).

On the other hand, when the goods are public, the positive externalities depend directly on the number of users/participants. In the case of the communication networks, for example, these network externalities are characterized by the positive correlation between the number of participants and the utility of the service (Katz and Shapiro, 1985). We can observe the same mechanisms in regard to the software industry, more particularly in the free software industry, and in the peer to peer systems where digital archives are shared (Herscovici, 2007).

When the goods are public goods, private PR may cause significant "market failures" for the following reasons: the private appropriation introduces an exclusion process; decreases the number of participants and the indivisible "quality" of the service available for all participants of the community; and limits the positive externalities produced by this system: the privatization of Scientific Commons produces these effects (Nelson, 2003). On other hand, the level of transaction costs necessary to prevent and control the opportunistic behaviors linked to the non-rivalry of these goods is too high (Demsetz, 1964, p. 16). In order to decrease the transaction costs to a level compatible with the production of such good, the solution consists in modifying the nature of PR and, eventually, the mode of governance.

When applied to scientific and technological production, predatory behavior may lead to a decrease in production innovation growth, in which the privatization of the Scientific and Technological

knowledge may produce this result[1]. Concerning the cumulative character of production, the privatization will translate into a decrease in total production growth.

The anticommons (Heller & Eisenberger, 1998) take place when knowledge is fragmented among various IPR holders. We can consider that two complementary segments constitute the technological process: *a* and *b*. If, for example, there are two PR holders, A and B, and if A lowers its price, A and B's demand will increase, even though B has not lowered its price. So, the IPR price necessary to use a particular technological innovation will be higher in this case compared to the situation in which there is only one PR holder. This *externality of demand* [2] will produce coordination failures and result in a decrease in welfare, regarding competitive price. This situation is characterized by *subadditive costs.*

My interpretation will explain these failures based on the incompatibility between individual appropriations linked to a private PR system and the production of non-rival and non-exclusive public goods. The tragedy of the commons may be explained by the contradiction between communal right and private rights. As there is no private appropriation of the common good, there are no opportunistic behaviors (Alchian, Demsetz, 1973, p. 23)[3]. This second interpretation of the tragedy of commons highlights the fact that the *private appropriation creates opportunistic behaviors*, and that the solution to eliminate these opportunistic behaviors is not the systematic privatization of the rights, but on the contrary, a specific form of "social or communal" PR.

Barzel (1997, pp. 4 and 5) defines transaction costs as "(…) the costs associated with the transfer, capture and protection of rights". This means that the PR system should be compatible with a particular level of transaction that enables the effective production and distribution of these goods. Thus, the following contradiction can be seen: if the PR are totally delineated, the transaction costs are nil, and it is not possible to explain the existence of the firm (Coase, 1937). We are in a Walrasian situation, without firm. This definition seems Williamson's: transaction cost may be defined "by safeguards, which include penalties, information disclosure and verification procedures, specialized dispute (such as arbitration) (....)" (Williamson, 2002, p. 183).

The tragedy of the commons and the tragedy of the anticommons are explained by the incompatibility between the economic nature of the good and the PR system: in the first situation, the dissonance between social welfare and private interests is explained by the fact that the collective PR (or the absence of PR) are incompatible with the private economic nature of the goods. The second situation is explained by the fact that the private PR are incompatible with the public nature of the goods. Both situations are socially inefficient.

This approach highlights the fact that the economic dimension of the PR is defined as "socially recognized rights of action" (Alchian, Demsetz, 1973, p. 17) related to a particular asset and to the economic and social results of this action.

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[1] In this sense, Nelson (2003) underlines the danger of such a system, in regard to the Bayle Dole Act, in the United States.

[2] They are close to the externalities of demand defined by the New Keynesians.

[3] If, for example, every fisherman receives the same amount of fish, regardless of his own contribution.

2) *Intellectual Property Rights and new forms of Intellectual Property*

It is in digital economy that the efficiency of the commons is most representative. The systems based upon sharing information and cultural goods may be socially and economically more efficient than the systems based upon private property and individualized supports. In regard to the music industry, for example, the traditional analysis of the cultural industries is based on a private Intellectual Property Rights (IPR) system, directly linked to private (or semi-private) forms of appropriation; to individualized material supports (books, CDs, and so on); and to individualized payments from the consumers. However, the modalities of social appropriation have changed and become collective. As the mode of appropriation has changed, the IPR system and the funding arrangements have to change (Romer, 2002). From a general point of view, digital economy development is characterized by a double movement: *the transformation of the nature of goods and services and the transformation of the IPR forms.*

On the one the hand, most of these goods and services are public goods, whose principal characteristics are their non-exclusion and non-rivalry. The economic dynamics consists in internalizing the network externalities that appear in these markets. In regard to these specificities, it is not possible to maximize microeconomic profit function equaling marginal cost and marginal product (Herscovici, 2008). These markets are not Walrasian, and their dynamics do not consist in selling private goods, but rather in negotiating the access to the networks in order to "capture" the consumers/users and to distinguish the public regarding the different groups' propensity to pay (ibid).

On the other hand, these goods are *experience goods* (Varian, 2003). Therefore, the price system cannot transmit all the necessary qualitative information to the consumer. Other social mechanisms should do this in order to compensate for the system price failure: institutions, online communities concerning the digital economy, etc.

These new strategies consist in developing, at first, free or almost free services for consumers. This mechanism permits creating the network and the corresponding externalities, as well as disclosing the necessary information that the price system hides. There are various examples that illustrate this kind of strategy:

i) Several software producers make some particular software available for a limited period of time;

ii) Some economic studies determine the piracy level in order to maximize the producer's profit;

iii) All free software programs (such as Linux and Google) are other examples;

iv) When it comes to the immateriality of the diffusion support, in the case of peer to peer networks, more particularly in the music sector, it is no longer possible to control and limit piracy (Herscovici, 2007).

v) Finally, new collective IPR forms appear: the various kinds of Copyleft may be interpreted as *collective property forms*. In regard to open-source software, the GPL (General Public License) produces spill-over effects: if a software component protected by such a license is incorporated into another software program, this new software program has to be protected by the same type of license. The creative commons represent another form of collective property. The authors cede some of their private rights to create a public good (Ostrom and Hess, 2007, p. 17).

3) *Typology of different types of rights*

The typology established by Hess and Ostrom (2005) highlights the fact that there are various types of property rights (the concept of bundle of rights) and that these rights apply to different levels. I will partially use this typology to distinguish the following rights:

i) Access: the right to access a stock of goods or services and to use them. Depending on the divisible or indivisible nature goods, the economic implications are different.

ii) Contribution: the right to contribute to the preservation / expansion of common stock: Scientific Commons or free software, for example.

iii) Extraction: the right to obtain units or products from the stock. Here too, the implications in regard to the level of common stock are different depending on the divisible or indivisible nature of goods that make up this stock.

iv) Removal: the right to modify existing rules within the club, which involves changing the nature of the governance.

v) Exclusion: the right to determine who can use the rights defined above. The pricing system is one of these modalities.

vi) Alienation: the rights to sell or rent the rights previously defined. The privatization of the system may be illustrated by the Coasian analysis of pollution rights. The modification of these rights results in modifying the economic nature of goods: for example, the modification of the modalities of access to the stock determines the public or private characteristics of goods.

The transition from a private system of PR to a common system consists in ceding some of these private rights to create a social capital, in the sense defined by Bowles and Ginty (2001). In regard to free software, the construction of commons implies ceding the components linked to access and alienation, and developing the rights linked to contribution. The different scientific communities work in the same way.

The economic nature of goods and services is determined by two variables: the evolution of the technological system and the evolution the PR system. *Intrinsically, goods are not public or private: the choice of the PR system and the technological evolutions determine their economic nature. In this sense, the PR system may be conceived as an institution.*

There is reciprocal determination between the economic nature of goods and the PR system. As these components are incompatible, there are two possible solutions: (a) to adapt the economic nature of the good to the current PR system. This means a privatization, or a "publicization" of goods, or (b) to modify the PR system, to make it compatible with the nature of goods. The choice depends on the transaction costs associated with each solution, i.e. its viability.

II) The function of Social Welfare

1) *Governance, regulation and social optimum: some methodological considerations*

1.1 The traditional (i.e neoclassical) analysis of Welfare presents some internal incoherencies, as showed by Sen (1982):

- In regards to the no transitivity of individual choices, it is not logically possible to construct an aggregated function of Social Welfare based on ordinal utility (Sen, 1982. p. 287).

- The maximization of individual utility is linked to the hypothesis of substantive rationality, that allows to evaluate all the consequences of the microeconomic decisions (Idem., p. 105), and the ex-ante utility (ibid, p. 93).

- The existence of externalities is incompatible with the Pareto´s optimum (Idem., p. 93)

- Finally, the Pareto criterion does not allow to compare different situations and different competitive equilibrium (Ibid., p. 86).

The methodological choices made in this paper are different: in light of these limits, I will adopt hypothesis that allow to consider the different externalities, to compare different situations and to construct a criterion of choice.

1.2 It is necessary to study the nature of uncertainty. Williamson adopts the bounded rationality hypothesis. In this sense, the uncertainty may be accounted for by the agents' limitations concerning their cognitive capacity to organize and collect the available information. In other words, the uncertainty may be explained by the agents' cognitive limitations, but the universe is ergodic and the different states of the world are finite and knowable.

The uncertainty may be explained by the existence of bilateral relations and of free rider behaviors, i.e. behavioral uncertainty (Saussier, Yvrande-Billon, 2007, p. 21). The process of infinite regressions is incompatible with the absence of uncertainty. What is the nature of this uncertainty? There are two possible answers:

i) In the first one, uncertainty is entirely defined by the agents' cognitive limitations, and the universe is ergodic (Slater and Spencer, 2000). In this sense, there is no strong uncertainty in the Post-Keynesian sense (ibid, p. 61).

ii) On the other hand, the second interpretation shows that there is a relation between these two types of uncertainty: when there are opportunistic behaviors, it is not possible to predict the different strategies of the agents. So, it is not possible to know all the states of the universe. The *behavioral uncertainty* implies strong uncertainty, and asset specificity is an endogenous variable (Saussier, Yvrande-Billon, 2007, p. 75). It allows the existence of strategies to benefit from monopoly or oligopoly rents in relation to the IPR system.

Once the existence of uncertainty has been admitted, the contradiction takes this form: the general problematics developed by Williamson consist in choosing the mode of governance which *economizes* the transaction costs for a particular specificity level (2002, p. 179). If we consider that economizing means minimizing, this implies that the agents use substantive rationality in an ergodic universe. If rationality is limited, and the universe is not ergodic, the agents cannot implement this

choice: *it is impossible, on the one hand, to make compatible bounded rationality and no ergodicity hypothesis and, on the other hand, to choose a mode of governance which minimizes the transaction costs*. Ultimately, if we consider that the universe is ergodic, in the long term, the transaction costs are negligible and the markets represent the most efficient social mechanism (Slater & Spencer, 2000, p. 79, Langlois & Robertson, 1995).

From an Old Institutional perspective, I choose the strong uncertainty thesis: the choice does not allow us to minimize the transaction costs, but it leads to an intermediated situation (*a satisfying approach*), between the lowest and the highest transaction cost level (Williamson, 2002, p. 174.). So, *it is possible to establish a comparison between the governance concept and the regulation one* in the sense defined by the French Regulation School, for example. From this perspective, the governance is implemented far from maximization mechanisms and from the long term equilibrium that the system would reach. This interpretation focuses on the *historicity* and the role of institutions in the regulation process.

Finally, the IPR system is not conceived as an instrument which allows us to minimize transaction costs, but as an *institution*, in which the historical and social dimensions are incorporated. The IPR system is a historical commitment between antagonistic social forces, a commitment that enables market regulation. The IPR system is the product of social and political forces that characterize a particular historical period, i.e. the "codification of one or various social relations" (Boyer, 1987, p. 48). The IPR system is not a neutral instrument that allows achieving an optimal situation, but a complex institution that can be modified in terms of social, historical, and economic evolution.

As noted by Bowles and Gintis (2001), in some situations including "social capital", community governance is more suitable for managing opportunistic behaviors and for coordinating the activity of the whole community. When part of the capital is social, i.e. common to a community, the markets and the State cannot obtain all the information necessary to coordinate all the individual activities. We can observe these mechanisms in the cooperative bank system in some developing countries, for example.

Likewise, a number of heterodox analyses consider that the price is a social convention (Hodgson, 1998, p. 175) or the product of a collective belief (Orléan, 2006, p. 3). This means that the market is not understood as a self-regulating and autonomous instance, determined in an exogenous way; the substantive rationality is not a realistic premise; and the economic value cannot be determined in an "objective" mode, because it is the product of these beliefs and institutions [4].

2) *Main components of the Social Welfare function*

The aim of this formalization is to construct a Social Welfare function, i.e. to identify the main determinant variables and ultimately show to what extend the type of governance determines social welfare. According to the epistemological and methodological choices made in this paper, this formalization is linked to the regulation logic, in the sense defined by the "Old Institutionalism": I will study the different social systems concerning the compatibility/incompatibility between institutional and economic variables, regardless of micro or macro maximization mechanisms.

[4] Orléan (2006) speaks of self referential value (*valeur autoréférentielle*)

This function depends on the following variables: the quantities consumed individually (*qi)*, the level of the stock available for the community (*Nj)*, the level of transaction costs that correspond to the mode of governance (*TC)*, and the exclusion mechanisms, *Ex*. These are determined based on the current PR system: a private PR system will implement the exclusion based on the prices conditioning individual consumption, i.e. access to the available stock.

The Social Welfare function may be expressed as:

$$Uw = f1 (qi, Nj, TC, Ex) \quad (1)$$

with the following relations:

$$dUw/dqi > 0 \quad (2)$$

$$dUw/dNj > 0 \quad (3)$$

The components linked to production activities are embedded in this function through the stock level. The relations (2) and (3) show that social welfare increases when the level of the stock and the individual consumption increase.

The effects of intensification in the exclusion mechanisms are more complex, and they depend on the nature of the goods that compose the stock.

The tragedy of the commons may be expressed by the following relation:

$dUw/dEx > 0$, when the good is private. (4.1)

Here, the exclusion allows preserving the future consumption: it is an intertemporal choice of consumption of scarce goods.

When the good is public, in the sense defined by Samuelson (1954), the effects of the exclusion are differentiated. As consumption generated no congestion, we can say that:

$$dUw/dEx < 0 \quad (4.2)$$

In regard to the indivisibility of the good, the exclusion decreases social welfare. This mechanism is broadened when there are network externalities (Katz and Shapiro, 1985): regardless of the consumption level, the exclusion decreases the indivisible quality of the good. The same can be observed in regard to activities showing cumulative features such as the scientific and technological production (Nelson, 2003). This is the case illustrated by the tragedy of the anticommons.

When it comes to experience goods, the relation (4.2) is also verified: as the price system does not transmit the information related to qualitative components, we must share the experience of all the users in order to increase the use of consumption. Thus, the higher the number of users, the greater the utility of each user. This is a specificity of the electronics networks, both hard and software. In this regard, we can observe the fundamental economic role of the different communities online.

$$dUw/dEx > 0 \quad (4.3)$$

When the consumption reaches a critical value, *congestion effects* arise: the indivisible quality decreases for each user. Here, the exclusion, which allows limiting consumption, can be implemented based on the price system or other institutional criteria: rules, coercion principles, and so on.

One of the limitations of Hardin's analysis is that he considers the price system to be the only modality of exclusion (Cox, 1986, p. 60).

The individual utility function is the following:

$Ui = f2 (qi, p)$ (5)

$dUi/dq > 0$ (5.1)

When process of learning by doing exists (like in the digital economy), or when the goods are highly differentiated (Cultural goods, for example), the marginal utility increases.

$dUi/dp < 0$ (5.2)

The level of the common goods stock may be expressed by:

$Nj = f3 (qi)$ (6)

$dNj/dqi < 0$ (6.1)

This is the specific case studied by Hardin.

$dNj/dqi = 0$ (6.2)

When it is an indivisible public good, without congestion effects.

$dNj/dqi > 0$ (6.3)

When there are network externalities, or when the process is cumulative.

Finally, there is a negative correlation between transaction costs and welfare.

$dUw/dTC < 0$ (7).

From such perspective, the tragedy of the commons may be explained by the absence of compatibility between the collective nature of the stock, the divisibility of the goods that constitute this stock, and the private consumption. Likewise, the tragedy of the anticommons may be analyzed as the absence of compatibility between the indivisibility and the cumulative feature of production and private modalities of appropriation. *So, the social welfare depends on the compatibility (or the absence of compatibility) between the economic nature of the goods, the PR system linked to the stock, and the type of consumption.*

For example, the problem of the peer to peer networks concerns the incompatibility between a stock of indivisible goods and logic of supply and demand linked to a private and individualized PR system

(Romer, 2002). The transaction costs necessary to control the opportunistic behaviors are higher than the gains that this kind of mechanism tries to preserve (Herscovici, 2007).

Finally, we must compare the criteria traditionally used to evaluate the welfare with the function built in this paper:

i) In terms of redistributive justice, the Pareto criterion is a relative one, as it corresponds to a process of maximization, for an exogenously determined income distribution.

ii) The Kaldor-Hicks criterion, in a universe in which contracts are complete and rationality is substantive, only considers the total utility in regard to the maximization of the production, regardless of the consequences in terms of social inequalities (Herscovici, 2010).

iii) The function of Social Welfare, the way it was defined in this paper, embeds these two dimensions: the first one concerns the level of production based on the level of stock; and the second one refers to distributive justice based on the PR system that determines the inclusion or exclusion modalities.

3) *The provision of public goods*

The maintenance and increase in stock are directly related to the question of efficient allocation of public goods. In this regard, Nordhauss (2006) distinguishes three technologies in the production of public goods:

i) *Additive technologies*: when the production of public goods is the sum of the production of the different producers (ibid, p. 93). The pollution level illustrates these kinds of technology, due to negative externalities, and the shared files networks due to positive externalities. For Nordhauss, this kind of mechanism results in an underprovision of the public good (Ibid, p. 95).

ii) The *Weakest-link technologies* depend on the weakest producer; the total result depends on the weakest production. The construction of a dam illustrates this kind of situation: efficiency depends on the contribution of the "weakest" producers. In these cases, the opportunistic behaviors are minimized, and the provision of public goods is "satisfactory".

iii) Differently, the third type of technology is characterized by the fact that the global result depends on the best technologies (*Best-shot Technologies*). With respect to research activities, for example, the results of such activities depend on the contribution of the best one; the one whose work results in a discovery and/or an innovation. As the successful producer cannot enjoy all the benefits of his production because of the positive externalities, generally, this kind of technology implies in an underproduction of such goods.

We do not agree with these analyses, for the following reasons:

First, there are implicit or explicit rules that allow controlling the opportunistic behaviors. Regarding peer to peer systems, for example, the total product, i.e. the total stock available for the community, depends on the contribution of each member. However, the technological system is conceived to regulate the relation between down and uploads for each user: the amount of downloads is

proportional to the amount of uploads (Herscovici, 2007). This mechanism introduces a proportional relation between the individual consumption and the individual contribution. This process limits the opportunistic behaviors and increases the provision of these goods. Likewise, regarding the common property of land, specific rules allowed preserving the common stock (Cox, 1986).

Second, the activities of research and technological production are cumulative: it means that the current production depends on the initial stock, which includes all the contributions. This kind of activity is characterized by a strong uncertainty. In this sense, the amount of successful research depends on the whole research, including the ones that failed.

Third, it is no longer possible to separate consumption and production: in the case of free software, the consumption may generate the production of improved or new software programs. This is also valid for the Scientific Commons: the "consumption" of science is necessary for the production of new knowledge. Finally, the different communities online represent consumption and production spaces: they allow "producing" the utility of goods, and the production of new goods.

It is not possible to ignore (as does Nordhauss) these institutional variables. They determine the modalities of access to the stock, the reproduction of this stock and, consequently, the provision of these goods. This institutional mechanism is expressed in the relations (6.1), (6.2), and (6.3).

III) PR system, economic nature of goods, and viability of the mode of governance

1) *The different levels of the PR system*

PR system is simultaneously related to the modalities of access to stock and the modes of consumption[5]. The first level depends directly on the different modalities of exclusion: it is possible to imagine free access for the members of the community and exclusion for the agents who do not belong to the community. Local externalities are limited to some geographical space (Ostrom, 2000, p. 336). Based on a set of rules, it is possible to limit the access to the goods deriving from this common stock; the necessary costs to limit or regulate the private consumption are not prohibitive.

The second level is related to the individual modalities of consumption and to the concept of enforcement, as defined by Alchian and Demsetz (1973, p. 17). In peer to peer networks, there is a fixed relation between download e upload for each consumer. Thus, it is possible to renovate the common stock. In the free software industry, or in scientific production, the consumer may also be the producer. Overall, the users who access a network create social utility and value for the firms that negotiate the modalities of access to such networks. This is the strategy adopted by Google.

In this type of economy, the configuration of the PR system that is compatible with the economic enablement of these activities should allow verifying the following conditions: (a) free access, for the final consumer, to the stock of available information; (b) composition of the stock, it should be made of indivisible of goods; (c) private property, to be able to negotiate the modalities of access to the network from other firms. The conditions (a) and (b) correspond to the creation of social utility necessary for the economic valorization of the network; (c) represents the new form of valorization based on the creation of social utility. Therefore, it is possible to talk about *semicommon property*, in

[5] Heller and Ostrom (2005, p. 10) define these levels as *resource system* and *resource units.*

regard to the stock: there is open access for the final consumer but paid access for the private companies, as the creation of value depends on the previous creation of social utility.

2) *The viability of governance*

The problem of viability appears when there are incompatibilities between the different elements of the system, and when the resolution of such antagonisms cannot be implemented without prohibitive transaction costs. The tragedy of the commons or the present copyright conflicts in the musical industry are consequences of this incompatibility.

It is possible to define the viability of the mode of governance in the following way: *a mode of governance is viable when the transaction costs are compatible with the level of production of goods and services, i.e. when the implementation of the activity does not imply a decrease in welfare.* This concept is defined without any relation with maximization mechanisms or with the concept of "invisible hand".

Table 1 - Governance, Social welfare and Viability

Stock (PR)	Economic nature	Individ. consumption (PR)	Welfare	Viability	TC	
Common	divisible	private appropriation	-	-	+	**1**
Common	indivisible	collective appropriation	+	0	-	**2**
		Contribution	+	+	-	**3**
		Network extern.	+	+	-	**4**
		Congest.	-	-	+	**5**
private	divisible	direct private appropriation	+	+/-	+/- .	**6**
semi commons	indivisible	indirect private appropriation (two sided markets)	+	+/-	+/-	**7**

The first situation in the table above corresponds to Hardin's analysis: the unfeasibility of the governance is expressed by the exhaustion of the available stock, and by prohibitive transaction costs to solve these problems.

On the other hand, situations (2), (3), and (4) correspond to viable modalities of governance: the institutional variables allow maintaining the transaction costs to a level that is compatible with the maintenance of welfare, and also allow maintaining or increasing the stock.

Situation (5) highlights the necessity of a control on the social consumption: these control activities imply an increase in transaction costs and, consequently, a decrease in welfare. The viability will be evaluated based on the comparison between the increase in TC and the decrease in welfare.

Situation (6) corresponds to the private logic. For the neoclassical school, this is the most efficient situation: the welfare is maximized by the Pareto optimum, and there are no transaction costs. This is verified in the pure and perfect competition situation, as defined by Walras, i.e. when the price system provides all the necessary information. When there are no such conditions, the welfare is no longer maximized. For example, in some situations, when there are various PR holders, the price necessary to use the whole technological process is higher than it would be in the case of just one PR holder (Herscovici, 2010). The Economy of Information of Stiglitz and Akerlof shows clearly that the price system is not able to convey the information regarding the qualitative components of the goods, and that the free market is not an efficient mechanism.

Finally, situation (7) corresponds to the mechanisms operating in the digital economy: (a) the access to the stock is semi-private but the goods are indivisible; (b) the consumption is quasi-free, but the modalities of access to the network represent the new modalities of economic valorization of these activities (double-sided markets); the source of the value depends on the social utility created. The results in terms of welfare and viability seem positive: the free access for the final consumer implies an increase in welfare. However, the viability of the governance depends on the PR system adopted: the current system is based on an individual consumption from individualized material supports (books, CDs, DVDs, and so on), while the creation of economic value comes from the social utility created within the network. The transaction costs necessary to implement the current IPR system are prohibitive (Herscovici, 2007). We should then think about how to remunerate the creators in other ways that are compatible with the economic evolutions in this sector.

3) *The choice of a modality of governance*

3.1 *The criterion used to evaluate welfare*

The PR are conceived as the possibility to use one specific production factor, and to produce the negative externalities which result from this use (Coase, 1960, p. 22). The PR are defined in terms of availability and no longer in terms of property in the traditional sense. The efficiency criterion is different from that used by Pigouvian economy. It incorporates the production or utility maximization, and ignores the income distribution implications.

In regard to the negative externalities, Coase maintains that "(…) Pigou is, of course, quite right to describe such actions as 'uncharged disservices'. But he is wrong when he describes these actions as 'anti-social'' (1960, p. 18). This means that welfare corresponds only to the total production and/or utility, according to the Kaldor-Hicks criterion.

If A makes a profit equal to 100, but this activity produces a disutility equal to 30, and if A pays 30 to B, this situation is a Pareto optimal one. On the one hand, neither agent prefers the previous state. On the other hand, the total utility net growth is equal to 70. However, in this situation, there are no transaction costs.

The problem is different when we introduce transaction costs: if the transaction costs in the previous example were equal to 80, for instance, there would be two solutions:

i) If the compensation is achieved, the total utility (or production) reduction is equal to 10.

ii) If the compensation is not achieved, the utility increase is equal to 70. However, the inequalities are more important between polluters and pollutees. Then, the situation is no longer a Pareto's optimum. The Kaldor-Hicks criterion *only considers the PR allocation efficiency and its impact on the production level*.

This kind of allocation of PR is only possible if the different opportunistic behaviors are controlled and they do not result in high transaction costs. Naturally, in this case, the market solution is considered to be the most efficient one. This means that the transaction costs are less high than they would be in an "institutional" or a bureaucratic situation, and that the situation is efficient, in regard to the criterion chosen.

3.2 *Coase's problematic: the Stigler´s interpretation*

The Coasian Theorem, as it was formulated by Stigler (1966), is a neoclassical interpretation of the Coasian problematic: Despite its several limitations, it highlights the fact that the private negotiation between private actors is the most efficient governance mechanism.

We can illustrate this theorem with the following example (Pejovich, 1995): each of two agents, X and Y, has a house. Y's activity consists in testing alarm sirens. This activity translates into an increasing utility evaluated at 500, for Y, and a decrease in X's utility of 200.

Table 2 Coasian and Williamsonian approaches: a comparison

Coasian approach: the private mechanism				
	X utility	Y utility	Total utility	
With negotiation	1200	1300	2500	1
Without negotiation	1000	1500	2500	2
The Williamsonian approach: the institutional mechanism				
Pigouvian regulation	1200	1000	2200	3
Pigouvian tax	1200	1300	2500	4
Institutional regulation	1300	1200	2500	5

Proposition 1: The comparison between 1, 2 and 3 shows that 1 and 2 are socially more efficient. In this respect, we should observe that the transaction costs are zero.

Proposition 2: The comparison between 1, 2, 4, and 5 shows that the four situations are equivalent in terms of total welfare, even though transactions costs are zero.

If, on the contrary, we consider that each solution is characterized by positive transaction costs, the total welfare depends on the level of transaction costs inherent in each mode of governance. Nothing indicates that the private mode of governance corresponds to the lowest level of transaction costs. The hypothesis of positive transaction costs is fully justified: they correspond to the costs that allow implementing and transferring the PR. Nil transaction costs imply that the PR are totally defined, that the implement of PR system works "naturally" without transaction costs, and that contracts are complete. This is a Walrasian situation, not an institutional one (Barzel, 1997, p. 11).

We understand Williamson's analysis in this way: the choice of a mode of governance will be made regarding the total welfare. This total welfare depends on the level of transaction costs of each mode of governance. The Coasian analysis, or more precisely the Stigler´s interpretation, considers, a priori, that the bureaucratic costs are higher than the market costs. *Williamson, on the contrary, demonstrates that the market is not systematically the solution that corresponds to the lowest level of transaction costs*.

In other words, the welfare produced by each mode of governance depends on the specific level of transaction costs. Stigler considers that the transaction costs associated with a private negotiation are lower than the ones associated with public intervention. Differently, I show in this present study that the market, i.e. the private negotiation, is not systematically the most efficient mechanism. *When the transaction costs are positive, the choice of a modality of governance depends on its viability, i.e.* (a) the implications in terms of preservation/enlargement of the stock; and (b) the increase in the Social Welfare that corresponds to each modality of governance.

Conclusion

This analysis implies a redefinition of the object of Economic Science itself: this object is no longer defined as the way a competitive system of prices allows carrying out an efficient allocation of scarce resources:

i) The price system is a noisy signal in regard to the qualitative components of the goods and services (Stiglitz and Grossman,1976, and Akerlof, 1970) and it does not convey the appropriate signal to carry out this efficient allocation of resources.

ii) Some technological advances produced abundance of goods and assets: (a) the increase in labor productivity, in the long run, means a decrease in the unitary value and price of each good. So, it is possible to talk about relative abundance; (b) the digitalization of Information and Knowledge creates an abundance of such goods and services.

Consequently, *the choice of a modality of governance has become a fundamental issue in Economic Science*: it directly concerns the concrete modalities of social appropriation of goods and services and the continuity of such governance, i.e. activity coordination problems, and social and economic viability.

From this perspective, the analysis of transaction costs is essential: it allows choosing a specific modality of governance and ensuring its viability. It is an institutional analysis, as the market is not understood as an autonomous mechanism; socially efficient and deprived of historical dimension. The institutional components play a fundamental role: They allow regulating the whole system based on the compatibility between the accumulation logic and the institutional elements, coordinating the actions of the agents, and keeping the transaction costs at a level that is compatible with the activity considered.

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