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# Market-based instruments for biodiversity and ecosystem services: A lexicon

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## ABSTRACT

Although market-based instruments (MBIs) gained prominence in discourses and practice in the field of biodiversity conservation and provision of ecosystem services, their definition and underpinning theory still are unsettled matters. A review of MBIs – including payments for ecosystem services, taxes and subsidies, mitigation or species banking, certification, etc. – clearly shows that this label encompasses an extremely diverse array of instruments. Their only shared characteristic might be the attribution of a price to nature, yet in different ways and not necessarily in conjunction with economic valuations of the benefits/impacts associated with biodiversity and ecosystem services. Their links with markets are often loose, at least contrasted if not questionable in many cases. This pleads for a better lexicon of such a large collection of policy instruments in order to better inform policy making. This lexicon is based on the links between MBIs, economic theory, and markets. It includes six generic categories: regulatory price signals, Coasean-type agreements, reverse auctions, tradable permits, direct markets, and voluntary price signals. As a matter of illustration, “Payments for Ecosystem Services” refer to various instruments in the literature and in practice. Depending on the context they could fit in all of our categories but one, so that we wonder if the term itself is not emptied of any useful meaning at least from an operational perspective. Last, the diversity of MBIs with regard to their functioning and links with markets seems to disqualify any general statement, be it in favour or against their development. In particular, MBIs as a whole cannot be said to be cost-efficient, risky, inequitable, or capable of revealing information to reach a social optimum and better environmental management.

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## 1. Introduction

“Market-based instruments, such as taxes, charges or tradable permits can, if carefully designed and implemented, complement regulations by changing economic incentives, and therefore the behaviour of private actors, when deciding upon resource use. When set at accurate levels, they ensure that the beneficiaries of biodiversity and ecosystem services pay the full cost of service provision. Experience shows that environmental goals may be reached more efficiently by market-based instruments

than by regulation alone. Some market-based instruments have the added advantage of generating public revenues”

This short text is excerpted from an influential report (TEEB, 2009) that was released as part of the TEEB initiative on The Economics of Ecosystems and Biodiversity. The report constitutes an important landmark in the thinking on market-based instruments (MBIs). It contains many key terms and issues that are dealt with in the present article. First, it refers to the theory of incentives, which stands as a critical justification for the emergence of the market rhetoric; second,

it suggests that these modes of intervention can reveal the “right” price; third, it states that these tools ensure enhanced efficiency in environmental management; and fourth, it evokes the question of funding.

There is clearly a terminology issue here. While the use of MBIs for managing biodiversity and ecosystem services (B&ES) is currently booming (Pattanayak et al., 2010), the scope of applicability of these tools is still an unsettled matter (Muradian et al., 2010). The frontier between market-based and other types of instruments remains blurred, and the use of the term “markets” is not unintentional. Interestingly, this terminology may even give the (wrong) impression that the law is forgotten in the process of developing solutions for the environment. According to Ruhl et al. (2007), “the component that is least developed in the literature on ecosystem services is the law”. Yet, cannot a system of taxation be considered as a part of the law? Furthermore, the term “markets” has both positive and negative impacts for the adoption of instruments that, ironically, do not really deserve this name: “After all [environmental service markets] are seldom true markets” (Wunder and Vargas, 2005).

It is therefore necessary to undertake a clearer definition of these instruments, if only to contribute to the debate, given that “policy-makers’ enthusiasm for market development [for ecosystem services] is not matched by practical understanding” (Landell-Mills and Porras, 2002). For instance, Europe is very strong in its support for these instruments as is reflected in key documents: the EU Biodiversity Strategy to 2020 states that “[Europe] will promote the development and use of innovative financing mechanisms, including market-based instruments” (EC, 2011). This statement is reinforced by Europe’s flagship initiative on resource efficiency that prioritizes these instruments. Yet contrasted positions are to be found in other parts of the world, certainly as ideological as those in favour of markets. Negotiations on climate change in the framework of the UNFCCC have experienced great resistance from a group of countries led by Bolivia; by way of illustration, this group fiercely opposed any reference to carbon markets for the implementation of the REDD+<sup>1</sup> mechanism. Wunder and Vargas (2005) also comment on the efforts by donors to promote these MBIs: “there remains much doubt, particularly in the Southern Hemisphere, about the ultimate desirability of markets”.

The main working hypothesis in the present article is that MBIs constitute one particular mode of intervention that differs substantially from other policy instruments. This was identified as a common belief in the field of B&ES. Indeed, it is widely used in institutional documents and various prominent reports that shape discourses and presumably policy making. This working hypothesis will be tested throughout the article, keeping in mind Sartori’s (1991) advice not to compare what is not comparable. We cannot judge by ourselves and a priori whether these MBIs constitute a relevant category; on the other hand, we do aim to verify whether this category includes instruments that are worth putting on the same level within one and the same category. The absence of a clear and consensual definition may be an indicator that there is little point in using this category (or label).

<sup>1</sup> Reducing Emissions from Deforestation and Degradation. This mechanism is supposed to financially support the fight against deforestation in developing countries.

This definitional issue has already been widely addressed, but in different ways. McNeely (1988) has been an important milestone with the IUCN book on economic incentives. As suggested by the term “incentives”, its scope is narrower than ours and evidences a bias in favour of these “insufficiently applied” (p. 38) instruments. The proposed taxonomy remains simple and distinguishes between direct and indirect incentives, the level of application (from community to international), and in cash or in kind (p. 40). A key book by Sterner (2003) addresses policy instruments for the environment at large, while taking care to avoid isolating “economic instruments” from the others as they lack a clear definition and scope. His coverage is thus much broader than ours and takes into account other policy instruments; yet several categories listed in our lexicon are not mentioned in his book, as is often the case in the textbooks.

This article thus aims to provide a new and constructive analysis of MBIs for B&ES and will proceed in several steps. First, the main instruments will be presented to give an overview of what the term encompasses in terms of discourse. Second, the main reasons for their prominence in the field of environmental management will be mentioned with regard to the characteristic(s) common to all of these MBIs. Third, we will discuss to what extent they can be expected to deliver on one fundamental advantage of the “market-based” approach to environmental management, namely the capacity to reveal information. Fourth, we will propose a lexicon of these MBIs based on their economic characteristics and links with markets to gain a better understanding of their scope of application and their strengths and weaknesses.

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## 2. An overview of the main MBIs for biodiversity and ecosystem services

A number of MBIs for B&ES can be briefly described so as to give a sense of the topic addressed in this article. Our selection of instruments does not presume that they are worth classifying as MBIs, since this is part of the analysis we develop further; but they are commonly referred to as MBIs, which justifies including them in this introductory section.

Fiscal policies are designed to change relative prices, and taxation is widely used. Applied to the environment, it follows the principle of the Pigouvian tax – also named eco-tax – according to which the presence of negative environmental externalities of production processes and activities require public authorities to change a course of action through market signals. It can target the damage indirectly, either through a unit of input (tons of fertilizers) or an area (m<sup>2</sup> of land that are developed), or more directly (tons of CO<sub>2</sub>-equivalent emitted). The heavily debated “carbon tax” is an emblematic example of such an MBI, as it would oblige CO<sub>2</sub> emitters to pay for the alleged damage to the climate. Subsidies can be understood as a Pigouvian tax in reverse whereby rewards target positive externalities. Agri-environmental Measures (AEM) within the Common Agricultural Policy (CAP) are representative of this type of instrument: European states distribute payments to farmers based on their national modalities and for different kinds of ecosystem services. Similar schemes are also developed in the US (Claassen et al., 2008).

Payments for ecosystem services (PES) may be understood as a principle – paying for the provision of a service – or as a specific type of instrument, as in Wunder's (2005) widely used definition. In the first case, it is arguable that many policy tools are part of this category; any transaction in favour of the service provider, whether in the form of subsidies or more tailored schemes, could in fact be included. In the second case, the definition is more specific and hardly applies, because it is too burdensome in practice (Pirard and Billé, 2010). Two emblematic PES-labelled schemes are (i) the Vittel case in France, whereby the company has signed contracts with surrounding farmers whereby they undertake either to change their practices or give up their production in exchange for payments in order to maintain the quality of mineral water (Perrot-Maitre, 2006), and (ii) the Costa Rican “*pago por servicios ambientales*”, which was established in 1996 and proposes payments to land owners according to their land uses – forest conservation, reforestation, sustainable management, etc. – with the justification that these land uses generate ecosystem services either locally or globally (Sanchez-Azofeifa et al., 2007).

Existing markets can be used by producers and consumers to promote goods and services with positive environmental externalities, at their own initiative. The rationale is to provide producers with a premium and/or greater visibility and market shares in order to favour virtuous practices. A good example of this is forest certification: FSC and PEFC are two prominent certification schemes in which forest producers engaged in sustainable forestry can sell their raw or processed timber to niche markets. The same principle can be applied to other products and numerous labels have flourished particularly for agricultural products. Cashore et al. (2004) refer to these institutions as “non-state market-driven governance systems”.

Tradable rights or permits can be exchanged among producers or landowners for the use of a given resource, usually after regulations have constrained full potential use. They are justified by the search for an optimal situation where producers and landowners with the best characteristics in terms of ecosystem services provision, production costs and economic profitability prospects are encouraged to take over from other producers and landowners by purchasing their rights. This system can be applied in many ways: cap-and-trade systems for greenhouse gas emissions; Individual Transfer Quotas (ITQ) for fisheries, which allow fishermen to purchase quotas giving them the right to produce; mitigation banking, whereby land developers who degrade biodiversity are required to purchase certificates issued for land restoration elsewhere; or transferable development rights in Brazil, where landowners in rural areas are legally required to set aside a percentage of their lands but can purchase rights to develop more if other landowners accept to develop less (Chomitz, 2004).

### 3. Why are MBIs emerging in the field of ecosystem services?

#### 3.1. A catchall for instruments with a pricing element?

It is not clear whether and how the terms “economic instruments”, “market-based mechanisms”, “incentive-based

instruments”, “environmental markets” and others overlap substantially. But we believe that, for the sake of clarity and usefulness, markets should be referred to for specific reasons rather than being just a substitute term for “monetary” or “economic”.

Yet this is rarely verified in practice. By way of illustration, the *eftec and IEEP (2010)* report reviews the concepts and theoretical background and defines MBIs by their assumed advantages (improve price signals, allow for flexibility for agents' behaviour, etc.) and effect (change in the price of goods and services). And it usefully reminds us that the Rio Declaration on Environment and Development (1992) promoted “*the use of economic instruments*”.

The confusion between MBIs and economic instruments is striking in many documents that seemingly use one or the other indifferently. If we look at the “Green paper on market-based instruments for environment and related policy purposes” released by the EC (2007), the same assimilation is to be found: “*The EU has increasingly favoured economic or market-based instruments – such as indirect taxation, targeted subsidies or tradable emission rights*”. No definition is given. MBIs are approached through their assumed ability to correct market failures in various ways. And we can hardly expect to gain deeper insight through mysterious statements such as “*At the EU level, the most commonly used MBIs are taxes, charges and tradable permit systems. In economic terms these instruments work in similar ways. However, they also differ in notable aspects*”.

Given the insistence on pointing out significant differences between MBIs, one can reasonably wonder whether it is legitimate to have such a broad and vague category and whether some of these instruments do not share more characteristics with instruments outside this category than with other “MBIs”. In the same vein, a prominent academic paper by Salzman (2005) on markets for ecosystem services makes a notable distinction – especially in light of institutional reports – between subsidies and taxes: “*Despite their poor reputation [...] government payment schemes are surprisingly common [and] should be favoured over the more traditional regulatory and tax-based approaches*”. We find here a conceptual distinction between subsidies and taxes from the perspective of MBIs, which is very different from the statements found in OECD reports (2003) for instance. All in all, these elements plead for a better definition and categorization of the various ways of influencing/orienting decisions and managing the environment.

Taking stock of the numerous tentative definitions, it seems that the “markets” referred to by almost all authors is not the perfect and self-expanding market of economics handbooks, or even something approaching this. A first distinction here can be made between markets and “the market”, the latter being a coherent and all-encompassing system that underpins capitalism as a way of structuring society for the sake of maximal human well-being through a multiplicity of transactions between agents, while the former refers more to the capacity for a number of agents to exchange specific goods and services in a competitive manner and in specific places. “The market” has been considered to have emerged hand in hand with modern capitalist societies as a conscious plan to organize relations between agents in a very artificial way and not necessarily in the interest of society as a

whole (Polanyi, 2001). Furthermore, while capitalism is supposedly justified by its reliance on the market, it does not necessarily translate into a myriad of competitive markets. As Braudel (1979) argues, capitalists have very frequently defended monopolistic markets in their obvious interest.

It is clearly beyond the scope of this article to examine the foundations of capitalism and the associated market principle, but at least we should build on these observations in order to make the point that market ideology is different from the existence of multiple competitive markets, and does not necessarily translate into these markets. This observation finds a direct application in the analysis of MBIs for B&ES. Indeed, the very brief description of the main MBIs suggests already that they do not fit with a definition of markets according to which more than three agents are in competition to produce and exchange a good or service, with accessible information on its characteristics.

Actually, what can be found in practice seems more akin to transactions and trade, but these can easily occur outside real markets. This is in line with what Wunder and Vargas (2005) state when referring to PES: “Instead of true markets, what we mostly find in the real world [...] are bilateral, mutually-negotiated agreements between ecosystem service users and providers”. Apparently many of these “markets” do not host any process of commodification through which a good or service becomes replaceable by another with close characteristics. While perfect markets hardly ever exist in the real world, the fact that most “markets” referred to for B&ES are at the other end of the spectrum gives good reason to be cautious about MBI terminology. Is any improvement foreseeable? Maybe not if we agree that “ecosystem services, while clearly of tremendous value, are ecologically, geographically, and economically more complex than any other kind of commodity or service, which has made tapping into their value a challenge that has yet to be made” (Ruhl et al., 2007).

All in all, the only common characteristic for all these “MBIs” seems to be the fact that a price is attributed to nature to different degrees and in different ways. This does not mean that economic valuations are applied to the environment in order to set a price, or that these economic valuations (when performed) actually value the benefits obtained from the environment, as they may also be targeted at production costs (e.g. specific agricultural practices) or opportunity costs (e.g. forest conservation). It simply means that monetary values are associated with nature, whether for market exchange or for direct deals between a limited number of stakeholders, or for whatever other purpose.

### 3.2. Three main justifications for the emergence of MBIs

Against this backdrop of confusion over definitions, how can we account for the emergence of MBIs for B&ES – both in discourses and in practice? Precisely because of this confusion, some of the reasons and arguments that are proposed do not fit with all MBIs, which is a problem if one wishes to advance ideological views on MBIs in terms of either their advantages or disadvantages.

What is clear, however, is that market approaches tend to be complementary or provide an alternative to coercive/prescriptive laws. Certainly, they can constitute a different

way of having agents make decisions, ideally to reach an optimal situation where all costs and benefits of a given course of action are taken into account. This is suggested by the only common characteristic that was identified among all so-called MBIs, namely the attribution of a price to nature, even if the way this is done can vary greatly.

Thus, while acknowledging the sometimes blurred frontier between law and economics – an illustrative example being the following definition by Stavins (2001): “market-based instruments are *regulations* that encourage behaviour through market signals rather than through explicit directives” (emphasis added) – the temptation to move from law (prescriptive) to economics (use of prices) is encouraged by several sound arguments laid out in much of the literature. We recapitulate below the three main ones.

#### 3.2.1. Correction of market failures

The assessment of a sub-optimal provision of ecosystem services or pollution levels usually points to a lack or even absence of markets that would faithfully reflect the economic values of the environment. MBIs are then appreciated as a means of correcting these values. Yet one has to bear in mind that market failures can also be addressed through regulatory instruments. But, as stated by the EC Green Paper (European Commission, 2007): “Public intervention is then justified to correct [market] failures and, unlike regulatory or administrative approaches, MBIs have the advantage of using market signals to address these failures”, which makes the connection with another argument: signals and incentives.

#### 3.2.2. Theory of incentives

In economics, this theory refers to the fact that decision-makers receive price signals and make decisions accordingly. Decisions are not imposed through coercive or prescriptive means, and agents have the opportunity to balance the costs and benefits of going one way or another. As a result, an optimum level is assumed to be easier to achieve as this approach provides more flexibility, potentially leads to the revelation of previously unavailable information, and is cost-efficient. In addition, incentives are considered more effective than coercion in inducing the right decisions by agents – especially in contexts with poor law enforcement. MBIs focus on achieving results through the self-interest of private entities.

#### 3.2.3. Funding gap

The last Conference of the Parties to the CBD in Nagoya in 2010 led to several important decisions including the adoption of a new strategic plan with a set of targets. In view of these, a Strategy for Resource Mobilization (SRM) was also adopted and Parties to the CBD have been invited to apply a set of financial and resources indicators by June 2011 to measure needs and gaps. This “funding gap” between the cost of achieving the biodiversity conservation targets and the funding available has long been identified, although the quantitative figures remain debated. The European Council also points to this gap as an argument in favour of MBIs for the EU Biodiversity Strategy to 2020. In the last SRM it is said that Parties should “substantially increase resources... from all sources, including innovative financial mechanisms”. In other words, public funding

is far from sufficient and new sources must be sought. The same line of thinking, applied to the forestry sector, resonates in a quote from *Koziell and Swingland (2002)*: “It is now widely recognized that, given the lack of public funding, biodiversity conservation must start to pay for itself, otherwise it is most likely doomed [...] Severe cuts in public finance are the root cause of the development of [MBIs]”.

#### 4. The critical role of information: can MBIs deliver?

Another very common argument for the development of MBIs is their assumed ability to help reveal information at a relatively low cost. This can be illustrated by a schematic opposition between on the one hand rigid and centralized state planning, which is hardly a perfect candidate for creating and using information for decision-making, and on the other hand multiple transactions between private agents with a direct interest in decisions. This aspect is well expressed in an article devoted to tradable permits for biodiversity offsetting that links the informational issue to the cost-effectiveness of various approaches: “[Lack of cost-effectiveness results from the fact that] opportunity costs may have changed in a spatially heterogeneous manner over time [and is] difficult to remedy with a top-down approach because the frequent reallocation of land between conservation and economic development requires an agency to have a high-level of information about changes in opportunity costs” (*Wissel and Wätzold, 2010*).

This point makes sense and needs to be given serious consideration. The tradable permits for biodiversity force land developers who will degrade valuable habitat as a side-effect of their activities to submit a permit to a regulatory authority. Issuance of the permit is dependent on habitat restoration elsewhere and, in principle, is delivered if the ecological values of the restored and degraded lands are equivalent. This description does not involve markets, and such a system could be applied in a non-market way with satisfactory outcomes in terms of B&ES. Yet by allowing third parties to restore lands and obtain tradable certificates, the introduction of the market component provides a framework that incentivizes third parties to find the most appropriate and lowest cost locations for restoration. As such, it decentralizes the search for information and creates a business case for land restoration. Anyone can enter the market, which is bound to open up to more buyers and sellers as long as the public authorities issue the right regulations and keep pressing land developers to offset the degradations they cause to the environment. Competition is enhanced, and costs are revealed owing to the incentives provided to third parties, who behave as profit makers.

This type of market *modus operandi* is also followed by the carbon markets derived from the flexibility mechanisms created under the UNFCCC (“Climate Convention”) as part of the Kyoto Protocol for climate change mitigation. The rationale is similar: by enlarging the scope of greenhouse gas (GHG) emissions reductions from industrialized countries with binding commitments to developing countries, and by allowing trade of carbon credits or quotas between countries (or between utilities with GHG emissions objectives and

carbon project developers), reductions should be achieved where the cost is lowest. With the incentive to look for lowest cost sources of emissions reductions and thus to reveal information on the matter, this market-based instrument theoretically generates cost-efficient outcomes.

The question of information creation, availability and use for environmental decisions is not only pertinent in terms of cost-efficiency as illustrated by the above-mentioned examples. It is also crucial for making fair deals and for saving limited public financial resources. This perspective relates to the asymmetry of information, which is a very significant problem for economists and a barrier to optimal outcomes. For instance, think of a government that wants to maintain ecosystem services for the sake of sustainable development and well-being, and thus intends to have a number of landowners setting aside land or changing agricultural practices. It could issue regulations that impose such changes or protect land with given characteristics (e.g. steep slope, or proximity to streams). It could alternatively create a tax or subsidy that incentivizes landowners to move in the right direction, usually following a one-size-fits-all model. These public interventions share weaknesses in terms of information: it falls entirely on the public authorities to determine the actions to promote or avoid, as well as the amount of taxes or subsidies. Assuming that this information can be found with a reasonable degree of accuracy, the costs of collection would certainly be high. *Salzman (2005)* defends a payment approach to solve this problem and trigger an exchange of information on the basis of willingness to pay and willingness to accept.

This payment approach can take at least two forms, as *Salzman* summarizes: direct negotiations between beneficiaries (or intermediaries) and service providers; or reverse auctions. The latter approach is applied in the Conservation Reservation Programme (CRP) in the US and in the BushTender programme in Australia. While the former case shows limitations and operates somewhat like a general subsidy *inter alia* because of collusions between landowners, the BushTender appears attractive to the author and is pointed to as a promising approach. Basically, it relies on:

“a publicized competition among landholders who provide sealed bids to the government of how much they are willing to accept for changes in land use management [and it gets] farmers to weigh the costs and benefits of land use changes. This type of payment scheme most effectively creates a market dynamic, where potential purchasers bid against one another”. (*Salzman, 2005*)

A key point to be grasped in this quote is that the advantages of a genuine MBI are twofold compared to other instruments: first, reverse auctions force landowners to assess and reveal the costs and benefits of the alternatives and, second, the competition between service providers is assumed to lead to lowest cost solutions. From this discussion, we argue that MBIs differ among themselves with respect to their ability to reveal information. Some may be considered more as a way of orienting decisions through a partial internalization of environmental externalities and associated incentives than as a way of forcing agents to reveal information in order to lead to optimal solutions. This difference is arguably very important,

and one may wish to consider these particular instruments as a means of putting a price on nature and commoditizing ecosystem services rather than as a way of using market exchanges in order to reach optimal situations.

## 5. A lexicon for market-based instruments

In light of our analysis so far, there is unquestionably a need to clarify the existing confusion. A lexicon of these various instruments seems useful for distinguishing between groups of instruments with actually little in common. Knowledge about their strengths and weaknesses, their scope of application and other important characteristics can be improved, in our opinion, only if analysis is applied to more homogeneous groups of instruments. In the absence of such distinctions, generalizations would be misleading in one way or the other. Treatment of Agro-Environmental Measures (AEM) in the Common Agricultural Policy (CAP) framework is telling in this respect. According to the EC definition of MBIs in the Green Paper (European Commission, 2007), AEMs are included due to their closeness to “targeted subsidies”. Indeed, AEMs constitute a subsidy in a number of European countries where farmers are given financial support in exchange for incorporating environment-friendly practices into their production systems. This payment is supposed to account for the value of ecosystem services that are either maintained or newly provided. However, in this same document, AEMs are said to be an application of PES because landowners are compensated in exchange for giving up revenue for the sake of the common good and because in many cases AEMs are contracts.

The following lexicon thus aims to distinguish between the various instruments on the basis of their intrinsic economic characteristics and the nature of their relations to markets. We have chosen to keep the vast range of MBIs that are named as such in our review of the literature. Indeed, at this stage, we have preferred not to endorse the responsibility of making decisions about the eligibility of each instrument, as this overarching terminology seems to stem largely from social considerations and the views held by society. Instead, we have focused on making classifications within this large family that are based on an instrument’s characteristics in the realm of economics. Arguably, the instruments could also be categorized according to other parameters such as equity outcomes or the capacity to reveal information. This is not the objective pursued in this article, which seeks rather to clarify how and to what extent there is an application of economic theory.

The lexicon categories therefore have generic names, and they do not refer to the names of existing instruments such as mitigation banking, certification or payments for ecosystem services (see Table 1). For this reason, the lexicon is obviously not as detailed as a list of specific instruments would be.

Two categories refer to instruments that lead to a change in the price of a product (or its production costs) in order to account for the externalities during the production process. These two categories – “regulatory price signals” and “voluntary price signals” – differ substantially in the way they operate. These price signals can be sent through either mandatory or voluntary measures, with important consequences for their links with public policies and regulations. For

this reason, their scope of application is contrasted: regulations are much more likely to be applied than purely voluntary premiums that consumers would agree to pay for. These types of instruments rely on existing markets and, in the case of voluntary price signals, require the existence of both a product that is clearly associated with these positive externalities and a biodiversity component (or ecosystem service) that is easy to communicate to a wide consumer audience. With regulatory price signals, it is possible to identify and target more services for specific fiscal policy components. Furthermore, regulations can modify market prices directly (e.g. consumer-paid taxes on gas) or production costs (e.g. subsidies provided to farmers for virtuous practices). The range of applications is certainly the widest of all categories, and has the longest history in the case of fiscal policies.

The economist Ronald Coase (1960) has advocated an approach to environmental externalities that is totally different to regulations using price signals, and this underpins our “Coasean type agreements” category. According to the Coase theorem, economic agents can more or less spontaneously make deals and exchange rights in order to improve their mutual welfare if transaction costs remain low. In practice, this approach relies on property rights relating to natural resources use and/or ownership that might be frozen or enhanced in order to provide services. As such, it also prolongs the theory of property rights that applies perfectly to environmental externalities (Demsetz, 1967). This approach can be viewed from two opposite angles in terms of its relation to markets. It could be considered that it is not market-based because these transactions are contractual, tailored to each specific case and seldom create new commodities (standard products) that could be exchanged on the marketplace. But it could also be legitimately argued that these numerous transactions re-create the conditions of a market with “prices” (in reality most often “payments”) that are set as the result of these multiple transactions and bargains. We can also observe that these experiments may sometimes lead to more institutionalized markets with more standardized products, as is observed with carbon. This category was illustrated by Wunder’s (2005) widely used definition of Payments for Environmental Services.

“Tradable permits”, as another category, have come to the forefront with the rise of carbon markets, but they have also long been used for fisheries in the form of Individual Transfer Quotas, and more recently with mitigation banking. Their rationale is to create a new market for a particular environmental problem in order to efficiently and sustainably manage a scarce resource, such as fish stocks. They can even create the scarcity artificially, as in the case of greenhouse gases in order to limit emissions once commitments are negotiated. The market is then supposed to lead to more cost-efficient outcomes for a given environmental objective – which is agreed upon at the outset – with all stakeholders being free to exchange allowances (or permits, quotas, credits, certificates, etc.) depending on their costs, benefits, reactivity, or any factor that may impact their decision process. In this sense, it is probably the closest to what economists would expect as “market-based instruments” for the management of B&ES. Yet it is important to note that these markets are usually extremely dependent on political will, because their *raison*

**Table 1 – Market-based instruments for biodiversity and ecosystem services: a lexicon.**

Category	Exclusive characteristics	Specificities	Relation to markets	Examples of application
Direct markets	A market where an environmental product can be directly traded between producers and consumers (or processors)	Can be framed at the international level with specific rules for each country and a great variety of deals (genetic resources), or as a more classical market with more or less processed products (NTFP)	Proximity to the market definition depends on cases and the degree of commodification	Genetic resources, non-timber forest products (NTFP), eco-tourism
Tradable permits	An <i>ad hoc</i> market where users of an environmental resource need to purchase “permits” that can be further exchanged among resource users, thereby creating artificial scarcity	Designed to either serve a clear environmental objective (with bio-physical indicators) or based on acceptable social costs (market price for carbon)	Creation of a specific market for a given environmental objective, information are expected to be revealed	Mitigation banking for biodiversity, emission quotas in the European ETS, Individual Transferable Quotas for fisheries, tradable development rights for land, voluntary carbon markets <sup>a</sup>
Reverse auctions	A mechanism whereby candidates to service provision set the level of payment (if accepted) in response to a call by public authorities to remunerate landholders	Aimed at revealing prices and avoiding free-riding and rent seeking	Creates an auction-based market that favours competition among bidders for achieving cost-efficiency	Payments for ecosystem services (e.g. BushTender in Australia, CRP in the US)
Coasean-type agreements	Ideally spontaneous transactions (free of public intervention) for an exchange of rights in response to a common interest of the beneficiary and the provider	Requires clear allocation of property rights, highly site-specific and difficult to replicate on a large-scale	Usually not following market rules, more of a contractual nature	Payments for ecosystem services ala Wunder, conservation easements, conservation concessions
Regulatory price signals	Consists in regulatory measures that lead to higher or lower relative prices	Part of a fiscal policy (including subsidies) with environmental objectives and complete control by public authorities	Based on an existing market	Eco-tax, agro-environmental measures
Voluntary price signals	Consists in schemes whereby producers send a signal to consumers that environmental impacts are positive (in relative terms) and consequently gain a premium on the market price	Still limited as an incentive for action due to relatively low willingness to pay by consumers	Uses existing markets to identify and promote virtuous activities	Forest certification, labels for organic agriculture, norms (self-produced before certification)

<sup>a</sup> These voluntary carbon markets stand as an exception in this category, as they are of private initiative and are not derived from publicly led commitments (as for fisheries, greenhouse gas under the Kyoto Protocol, etc.).

*d'être* and necessary conditions of existence rest on prior political decisions – and they thus differ substantially from ordinary markets that can arise spontaneously or in response to a social need. Mitigation banking could barely exist without the associated regulations on conservation and the resulting legal framework, and carbon markets would never take off without the Kyoto Protocol. Current difficulties in negotiating further reduction commitments at the international level perfectly illustrate this point, and voluntary carbon markets do not represent a credible substitute.

Another category – “reverse auctions” – refers primarily to a mechanism whereby stakeholders set the price for a given activity that results in the provision of ecosystem services. Its logic is clearly driven by the search for information in order to select the most appropriate candidates for achieving a specific objective. In this sense, and in reference to our previous section on the revelation of information, it is one of the most interesting MBIs from the perspective of economics and what this science can truly contribute to B&ES. The rationale is to first decide on the range of activities appropriate for a given environmental objective (e.g. fallows on agricultural lands) and then organize a call for bids to select the best candidates in terms of their (secret) financial offers. The available financial resources are then distributed among the candidates with the lowest offers. The scheme can be adapted and made more complex, but its capacity to reveal information on costs and avoid free-riding and rent-seeking through genuine competition remains its main characteristic and strength. This approach is developing all over the world, and the Bush-Tender in Australia and Conservation Reserve Programme in the US represent remarkable applications (Salzman, 2005).

A last category is named “direct markets” and includes all markets that are created in view of exchanging environmental products alone, with no external interference and without combining them with other products and characteristics. Yet a “direct market” can take on as many forms as there are environmental products, and it may be challenging to put genetic resources and non-timber forest products, for example, on the same level. Certainly, the modalities for packaging and marketing may differ substantially. Furthermore, the respective abilities of these markets to ensure long-term conservation and provision of B&ES are very different. While ecotourism may result in preserving a given area in a good condition, the over-exploitation of non-timber forest products is not necessarily sustainable.

## 6. Conclusion

The analysis developed in this article leads to the conclusion that the instruments presented in the literature as “market-based instruments” (MBIs) constitute an extremely heterogeneous group with loose and contrasted links to markets as defined by economic theory. These links may even be questioned in several cases. In fact, the market terminology seems to have been adopted by default, as a way of differentiating these instruments from all other approaches that do not have a pricing element.

Indeed, our interpretation is that the term “MBI” serves as a catchall for all instruments with a price component. Their

main (and only?) common characteristic is the use of monetary values in one way or another (change relative prices, use economic incentives) through a commodification process – to be understood here as considering nature from a utilitarian perspective with associated monetary values, not as creating commodities with standard units. Yet in many cases, MBIs rely on monetary values that are not in fact based on economic valuations (and may not even reveal information about these economic values): for example, deals between providers and beneficiaries of ecosystem services relating to production/opportunity costs, or carbon markets where the price of carbon credits is the result of a degree of scarcity that is artificially created at the international level with legally binding commitments to reduce greenhouse gas emissions. Reversely, it is also worth noting that putting a price/value on nature does not imply the use of MBIs, as we see for instance with compulsory cost-benefit analyses in the US prior to the enactment of a law that may include when necessary monetary valuations of nature and ecosystem services (Ruhl et al., 2007).

In view of this heterogeneity, one can hardly expect that environmental management will automatically benefit from the assumed advantages of markets simply using “MBIs”. Information on the economic values associated with the environment is poorly revealed as many of these instruments do not involve sufficiently frequent transactions between buyers and sellers. Some of these instruments do imply that information is revealed but not specifically on the costs of degrading an ecosystem or the benefits of providing new services. As some of these instruments are directly managed and funded by the State and the national budget, it is taxpayers rather than specific beneficiaries who often contribute, which from a market perspective verges on absurdity.

This heterogeneity argues for the elaboration of a lexicon of MBIs based on their economic characteristics and the nature of their relationships with markets. It is important to note, however, that this heterogeneity rules out any judgement as to whether MBIs are good or bad, efficient or not, as well as any assessment applied to the whole range of approaches. Taking stock of this heterogeneity, the lexicon distinguishes six broad categories that are presented in Table 1. These categories possess contrasted characteristics and use markets in various ways: regulations or private initiatives that change relative prices according to the environmental impacts (“externalities”) of production processes or land uses; negotiated contracts between a limited number of stakeholders with no state intervention for the provision of ecosystem services; or the creation of specific markets that limit the use of a given natural resource and organize an exchange of permits for such use.

The poor use of markets (as defined by economic theory) for the design and implementation of MBIs resonates very well with the findings presented in Hahn (1989, 2000). This author investigated the on-the-ground implementation of an array of economic instruments for the environment, such as tradable permits and environmental fiscal regimes. He concluded that actual implementation was far removed from the ideas developed by economists in their offices in line with sound economic theory: “[experience] shows how the actual use of these tools tends to depart from the role which economists have conceived

for them”. Several factors go to explain this state of affairs, and what stands out is the need to adapt to specific contexts and to deal with conflicting political objectives. This is a key reason for the need to remain cautious about the future of MBIs and the risks of having over-ambitious expectations regarding the effectiveness of their outcomes for the preservation of biodiversity and the maintenance of ecosystem services. This is also why we should pay attention not only to statements such as: “Compared to previous approaches to forest conservation, market-based mechanisms promise increased efficiency and increased effectiveness, as well as increased equity in the distribution of costs and benefits” (Pagiola et al., 2002), but also “such policies, if carefully designed and implemented, can achieve environmental goals at significantly less cost than [...]” (ibid, emphasis added). The devil is clearly in the “details”.

To conclude, terms may be misleading when they are interpreted and used in contrasted ways by diverse stakeholders. Payments for ecosystem services give a perfect illustration of terms that gradually become emptied of their meaning. Indeed, this is used in so many different ways and in reference to so many contrasted instruments that the scope of application, institutional requirements and implications, potential replication or other strengths and weaknesses tend to be forgotten in the process. It can be argued that the range of experiments and definitions of PES found in the literature fits with all of the six MBI categories of the proposed lexicon, except for the “direct markets” category. The Costa Rican scheme looks like a one-size-fits-all subsidy to land uses, and fits well into the category “regulatory price signals”. The PES as initially defined are a perfect application of “Coasean type agreements”. The Conservation Reserve programme in the US and the BushTender programme in Australia are viewed by many, including Salzman (2005), as PES but fit into the category “reverse auctions”. The REDD+ (Reducing Emissions from Deforestation and Degradation) mechanism is presented by many as an international PES (Angelsen, 2009), but is expected to be connected to the carbon markets and thus fits into the category “tradable permits”. Last, certification of timber or labels for organic agriculture can be viewed as payments to virtuous producers for their provision of ecosystem services and through higher market prices, and thus fit in the category “voluntary price signals”.

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