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The Choice between Economic Policies to Face Greenhouse Consequences

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Abstract

In the past few years, unstable and extreme weather patterns are increasingly occurring as phenomena of climate change, and the link to greenhouse gas (GHG) emissions is scientifically accepted. From an economic point of view, extreme weather patterns are causing major damage to health, property, and business.

In this chapter, following an economic analysis of law (EAL) approach, the issue of the comparison between the alternative environmental economic policies is analyzed starting from the consideration that the emissions of GHGs originate market failures: the environment appears as a “public good” that may not be appropriated and has no market price; the damage to the environment is a case of “externality,” where it is fully or partly a social cost that is not internalized into the accounts of the parties causing it. In the EAL literature, an environmental policy instrument has been seen as it may play a role in correcting malfunction and subsequent inefficiencies.

In the first part of the chapter, we intend to revise the traditional analysis of the choice of environmental policies. The following part deals with the comparison between tax and tradable permit systems. Then the role that can be played by the insurance sector is considered. The different policy instruments are considered in the framework of climate as an economic global public good. And, finally, some conclusive remarks are presented in relation to the COP 21 conference in Paris in terms of the future policies against GHG effects.

Keywords: climate change, environmental policy choice, insurance, greenhouse gasses, COP 21

1. Introduction

Over the last centuries, climate change has been raised as a very important issue all over the world. The change in climate results from an increase in the earth's average atmospheric temperature, which is usually referred to as global warming. It may be due to both natural and human causes, especially greenhouse gas (GHG) emissions.

In response to increasing scientific evidence that human activities are contributing significantly to global climate change [1], decision makers are devoting considerable attention to public policies to reduce GHG emissions and thereby prevent or reduce such change.

The policies span a range of regulatory approaches. The main alternative is between command and control (CAC) and market-based (MB) instruments, and a relevant role can also be played by the insurance sector.

This chapter aims to describe the traditional theory on the choice of environmental policies following an economic analysis of law (EAL) approach (Section 2) to analyze the comparison between tax and tradable permit systems (Section 3), to outline the role of the insurance sector (Section 4), and to consider the different policy instruments in a context of economic global public goods. The final objective is to take into account the future COP 21 conference in Paris in terms of the choice of policy instruments against GHG effects.

2. The traditional issue of the choice of environmental policies

The problem of the choice of environmental policy instruments has been an issue since Pigou [2] analyzed the need for state intervention when private costs diverge from social costs and suggested that the solution would be to internalize the externalities through taxation.¹ Coase [4] criticized the proposed state intervention and affirmed that there is no reason to suppose that governmental regulation is called for simply because the problem is not very well handled by the market or the firm.

The ensuing debate has been conducted along these two opposite views: on the one hand, the supporters of the idea that the choice of policy instruments is to be applied as a public matter and the state, as policy designer, should select the optimal instruments and take responsibility for their imposition in the public interest, but, on the other, the supporters of MB instruments are trying to fight a battle against a sort of "anti-market" mentality based on a reluctance to apply MB instruments [5].

So the problem would be to compare the instruments that can be considered public oriented and those that can be considered market oriented, where the former is characterized by a public agency that defines a conduct rule and provides an enforcement system and the latter is characterized by instruments based on market mechanisms stimulating the conduct of the firm indirectly and by a private administration and enforcement system.

¹ See the documents of the "Pigou club" [3].

Following an EAL approach, traditionally regulatory systems originate from the presence of market failure: in our specific case, the environment appears as a “public good” that may not be appropriated and has no market price; the damage to the environment is a case of “externality,” in that it is fully or partly a social cost that is not internalized into the accounts of the parties causing it.² So the comparison of different instruments can consider how they may play a role in correcting malfunction and subsequent inefficiencies [7].

In this way, we can move from the theoretical definition of the efficiency of different instruments to their practical, and so direct, potential to achieve concrete objectives. In particular, the objectives that emerge as relevant in judging the practical efficiency of environmental policies are the following: first is the prevention in the sense of providing incentives for firms to improve safety standards, and second is the connection with technological change in the sense of encouraging firms to adopt lower risk technologies.

The first kind of environmental instrument is the so-called CAC that is characterized by a public agency that provides a definition of conduct rules and enforcement system. Thus, they could be defined as public-oriented instruments, which require the use of a particular technology or the observation of a performance standard, authorizing for the maximum amount that a source can emit.

CAC is divided into two phases as follows: “command”, which sets a standard based on the maximum level of permissible emissions, and “control”, which monitors and enforces the standard.

Regarding standards, they can be classified into two: ambient standards, which fix a minimum desired level of air or water quality or a maximum level of emissions that must be maintained, and emission standards, which fix a maximum level of permitted emissions that can be performance based, setting emission limits that each firm is allowed, or technology based, specifying the best technology to be used.³

As to the US experience with this kind of regulation, the activity of the Environmental Protection Agency (EPA) provides a clear example of regulation by an independent environmental authority. This agency performs its tasks through the setting of preventive standards, the enforcement of polluting emission thresholds, and the performance of inspections and, possibly, of actions brought to the federal courts. We cannot mention the European Community experience given that a standard setting system has not been established at a European level (but at national level) and that the European Environmental Agency (EEA) has only a very limited role.⁴

2 Economists consider environmental policies within the framework of the category of externalities, as evidenced by Cropper and Oates [6]: “The source of basic economic principles of environmental policy is to be found in the theory of externality.”

3 As Cropper and Oates [6] explain “...The determination of environmental policy is taken to be a two-step process: first, standards or targets for environmental quality are set, and, second, a regulatory system is designed and put in place to achieve these standards. This is often the environmental decision making proceeds. Under the Clean Air Act, for example, the first task of the EPA was to set standards in the form of maximum permissible concentration of the major air pollutants. The next step was to design a regulatory plan to attain these standards air quality.”

The choice to develop a CAC regulatory system is based on the advantage of centralized agencies to assure a cost-effectiveness calculation on the base of the expected damage and of the marginal cost of different level of preventive care. The centralized structure presents the advantage to provide a continual oversight of problems and a broad array of regulatory tools.

Following the traditional EAL approach, well-defined standards generate the correct incentive for the firm to act with caution and make the best production and prevention decisions [8, 9].

CAC instruments use to be compared with MB instruments that are characterized by a private administration and enforcement system and stimulate indirectly the behavior of the firm. There are essentially two different types of those instruments: taxes that are fees imposed on emitters proportionate to the total amount of emissions released into the environment (they could be divided into emission charges, product charges, and user charges) and marketable (or tradable) permit systems that provide a fixed number of permits equal to the allowed total emissions, distributing them among polluting firms in a specific area.

The two types of MBI instruments can be seen in the following two different approaches: on one side, taxes follow a price approach because producers adjust the quantity, given a fixed price put on emissions; on the other side, a tradable permit system follows a quantity approach because the price is adjusted according to supply and demand, given a maximum quantity of emissions allowed.

3. Carbon tax versus tradable permit system

A carbon tax is a particular tax based on GHG emissions generated by burning fuels and biofuels, such as coal, oil, and natural gas. It has been introduced with the main goal to level the gap between carbon intensive (firms based on fossil fuels) and low carbon intensive (firms that adopt renewable energies) sectors. Due to the introduction of that form of taxation, the relative prices of goods and services will change; the emissions of intensive goods will be more expensive, whereas the emissions of less intensive goods will be lower. Thus, carbon tax provides a strong incentive for individuals and firms to adjust their conduct, resulting in a reduction of the emissions themselves. Hence, by reducing fuel emissions and adopting new technologies, both consumers and businesses can reduce the entire amount they pay in carbon tax.

A tradable permit system is defined as quantity-based environmental policy instrument. The regulatory authority stipulates the allowable total amount of emissions (cap) and the right to emit becomes a tradable commodity. Under a cap-and-trade system, prices are allowed to fluctuate according to market forces. Thus, the price of emissions is established indirectly. Permits could be allocated to firms through auction or free allocation.

⁴ The EEA was set up as a legally independent community body under council regulation (EEC) 1210/90. The EEA's core task is to provide decisionmakers with the information needed for making sound and effective policies to protect the environment and support sustainable development.

Similarly to other environmental taxes, carbon taxes are defined as priced-based policy instruments for the correlated effects to increase the price of certain goods and services, thereby decreasing the quantity demanded. On the other side, tradable permits are defined as quantity-based environmental policy instrument. Although both policy instruments are MB, their implementation is different: carbon taxes fix the marginal cost for carbon emissions and allow quantities emitted to adjust, whereas tradable permits fix the total amount of carbon emitted and allow price levels to change according to market forces.

Which is better? There is no simple yes or no answer, and the policies are not necessarily mutually exclusive. Several important advantages and drawbacks of the respective policies are outlined later.

A well-functioning emission trading system allows emission reductions to take place wherever abatement costs are lowest, regardless of international borders. As costs associated with climate change have no correlation with the origin of carbon emissions, the rationale for this policy approach is that an emission trading system allows to fix a certain environmental outcome and the companies are called to pay a market price for the rights to pollute. This is the reason why an emission trading system is suitable for international environmental agreements, such as the Kyoto Protocol, specifically for the characteristic that a defined emission reduction level can be easily agreed between states.

Emission trading is more appealing to private industry because, by decreasing emissions, firms can actually profit by selling their excess GHG allowances. Creating such a market for pollution could potentially drive emission reductions below targets.

A carbon tax would offer a broader scope for emission reductions [10]. A system of tradable permits entails significant transaction costs, which include search costs, such as fees paid to brokers or exchange institutions to find trading partners; negotiating costs; approval costs; and insurance costs. Conversely, taxes involve little transaction cost over all stages of their lifetime.

Carbon taxes are dynamic economic instruments that offer a continuum incentive to reduce emissions. In fact, technological and procedural improvements and their subsequent efficient diffusion lead to reductions in tax payment. In addition, trading systems are able to self-adjust because emission goals will be easier to meet; there will be a decrease in permits' demand and in their price but not as rapidly as taxes.

The implementation of an emission trading system is very complicated and requires technical steps, including treatment of sinks, monitoring, and enforcement. On the other hand, taxation is a very well-known instrument by policy makers, not very costly because it does not require monitoring and enforcement organization.

The revenue from carbon taxes can be used into the economy to reduce income taxes or levies on labor or capital investment. This may be part of a national or international reform of the taxation systems with the effects to shift the tax burden from "goods" like labor to "bads" like pollution.

In Table 1, we have summarized the main differences among CAC, carbon tax, and tradable permit system.

	Command and control	Carbon tax	Tradable permit system
Certainty over CO ₂ price or cost?	No	Yes. The tax establishes a well-defined price	No. But price volatility can be limited by design features, such as a safety valve (price cap) or borrowing
Certainty over emissions?	No. Regulating the rate of emissions, the level uncertain leaves	No. Emissions vary with prevailing energy demand and fuel prices	Yes, in its traditional form. No, with the use of additional cost containment mechanisms
Efficiently encourages least-cost emission reductions?	No, but tradable standard is more efficient than non-tradable standard	Yes	Yes
Ability to raise revenue?	No	Yes. Results in maximum revenue generation compared with other options	Traditionally no
Incentives for R&D in clean technologies?	Yes and no. Standards encourage specific technologies but not Broad innovation	Yes. Stable CO ₂ price is needed to induce innovation	Yes. However, uncertainty over permits' prices could weaken innovation incentives
Harm to competitiveness?	Somewhat. Regulations increase the cost of manufacturing, but, unlike taxes of tradable permits, do not raise the price of fossil energy	Yes, though if other taxes are reduced through revenue recycling, competitiveness of the broader economy can be improved	Yes (as with a tax), but giving firms free allowances offsets potentially harmful effects on profitability
Practical or political obstacles to implementation?	Yes. Setting the level of standards is difficult	Yes. New taxes have been very unpopular	Yes. Identifying a reasonable allocation and target is difficult
New institutional requirements?	Minimal (unless tradable)	Minimal	Yes, but experience with existing trading programs suggests that markets arise quickly and relatively inexpensively

Source: Parry and Pizer [11].

Table 1. Command and control versus carbon tax versus tradable permit system

4. Insurance as an environmental policy instrument

A relevant role could be played by the insurance sector in the choice of political economic instruments for climate change.

As mentioned in Section 1, following the EAL approach, the emitters of GHGs externalize the true costs of their contribution to climate change, and this implies the need to recover these costs, which manifest through both the costs of impacts and the costs to prevent impacts. Because the insurance sector is the world's largest industry, the response of insurers to the broader climate change challenge will no doubt be the key to, at least partially, solve this internalization problem.

Generally, insurers can indirectly stimulate prevention behavior in their customers. In the case of climate change, they can play two primary roles through their insurance products. The first role is played in supplying and pricing traditional insurance coverage for damage deriving from climate change by the promotion of actions of businesses and individuals to align policy holders with climate-positive behaviors. The second is played in providing capital to new ventures and reducing the financial risk to investors by facilitate the creation of new markets and services that will help to solve the climate change problems.

In both the roles, insurance companies deal with the management of risk activities. In fact, climate change risk is managed by the insurers through the risks they accept from clients, given that climate change causes an increase in intensity and spreading the distribution of extreme weather events with resultant effects on property claims that could be catastrophic.⁵

Traditionally, insurance is the main mechanisms available to individuals and business to manage the financial consequences of risky events, such as natural hazards like windstorms and floods. Insurance companies used to work making each individual or business pay a premium to protect themselves against an uncertain loss. The premium is calculated by pooling risks across a large and diverse population considering the pool's expected losses.

In this way, the insurance industry provides a coverage for climate change consequences because climate experts predict changes in the intensity and the distribution of extreme weather events and of the resulting risk of catastrophic property claims.

But specifically, for what concerns the consequences of climate change, many problems arise to provide insurance coverage [13].

First, climate change is connected to global weather patterns that may increase the potential for losses so large. As more severe weather becomes more common and overall variability of conditions increases, there is a threat for the solvency of insurance companies.

Second, because uncertainties in assessing climate change's impacts are high and affect property, casualty, business interruption, and health; as a result, risk has significant ambiguous components and insurers are both likely to charge a significantly higher premium or avoid insuring the risk entirely.

Third, climate change-related risks may be correlated and create a skewed risk pool that could increase the probability of extremely large losses and also risks not well-distributed across existing insurers.

⁵ Insurance coverage can be also connected with the liability system. But, for what concerns the consequences of climate change, such as impacts of property damage from extreme weather events, the assignment of liability is a very complex topic. See Reference [12].

Finally, as a result of insurers' uncertainty aversion and need to protect against extremely large losses from single or related events, it is not clear that insurers will be willing to insure against some climate change-related risks at a price that policy holders are willing to pay.

Climate change will affect, and in some cases is already affecting, most major types of insurance products. Insurers will feel the impact of climate change on property and casualty insurance, where the insurer bears the risk of a loss suffered directly by the policy holder. These property and casualty claims include not only damage to insured property as a direct result of weather but also claims for business interruptions and other consequences of weather-induced events. Also, health and life insurers are going to face increasing costs.

Sometimes, insurance companies are involved in the systems of compensation fund that have been established in some countries. This is the case of special government disaster funds within the target to promote framework of contingency measures to cover the economic costs of natural disasters [14].

Other insurance products are the so-called "financial responsibility" products. This term includes the tools that require companies to demonstrate to have sufficient financial resources for eventual future environmental damage that may arise through their activities. In its common implementation, financial responsibility implies that a production activity is authorized only if companies can prove that they will be able to financially cover economic claims, for example, using surety bonds, cash accounts, deposit certificates, self-insurances, and corporate guarantees.

In the past few years, the insurance industry has developed financial products suitable for dealing with climate change-related risks in the direction to play a role far beyond simply compensating climate change's victims for their losses *ex post*. The activity of the insurance has become relevant as a political economic instruments within an *ex ante* strategy to financially manage large-scale catastrophes, as a complement of *ex post* instruments for the compensation of disaster losses.

Insurance industry is also developing alternative risk transfer products, given that conventional reinsurance arrangements may in future cover a smaller proportion of total losses, and there may be insufficient capital available to insurance markets to cover these losses [15].

A first kind of these insurance products are called "catastrophe bonds" and consist in securitizing environmental risks in bonds, which could be sold to high-yield investors. The catastrophe bonds are able to transfer risk to investors that receive coupons that are normally a reference rate plus an appropriate risk premium. By these products, insurance companies limit risk exposure transferring natural catastrophe risk into the capital markets. In this way, with the involvement of the financial markets, their global size offers enormous potential for insurers to diversify risks.

Weather derivatives are another kind of financial instrument used by companies to hedge against the risk of weather-related losses. Weather derivatives pay out on a specified trigger, for example, temperature over a specified period rather than proof of loss. The investor providing a weather derivative charges the buyer a premium for access to capital. If nothing happens, then the investor makes a profit.

With this kind of financial products, the insurance industry tries to reach two goals. First, there is the need for extra capital and to spread risks beyond the insurance sector. Particularly, cat bonds are used to spread insurance risk in the financial sector. The second goal is to improve the accuracy and the resolution of hazard data and the likely impacts on climate change with the involvement of financial market forecast ability.

The insurance industry can act to tackle the consequences of climate change by playing its part in climate change mitigation, through the promotion of ways to reduce GHG emissions. Insurers are also well placed to help society to adapt to the impacts of climate change, by promoting the effective limitation and management of risks from extreme weather-related hazards.

Individuals and companies that buy insurance products could be stimulated to address climate change-seeking mechanism to facilitate mitigation of GHG emissions and adaptation to the inevitable impacts of climate change [16]. In addition, the insurance companies themselves are motivated to take significant actions to mitigate GHG emissions and increase adaptive capacity to reduce overall uncertainty and other barriers to insurability and are also motivated to limit the insurers' potential exposure to catastrophic risks in excess of their capacity to avoid the potential for property and liability claims in excess.

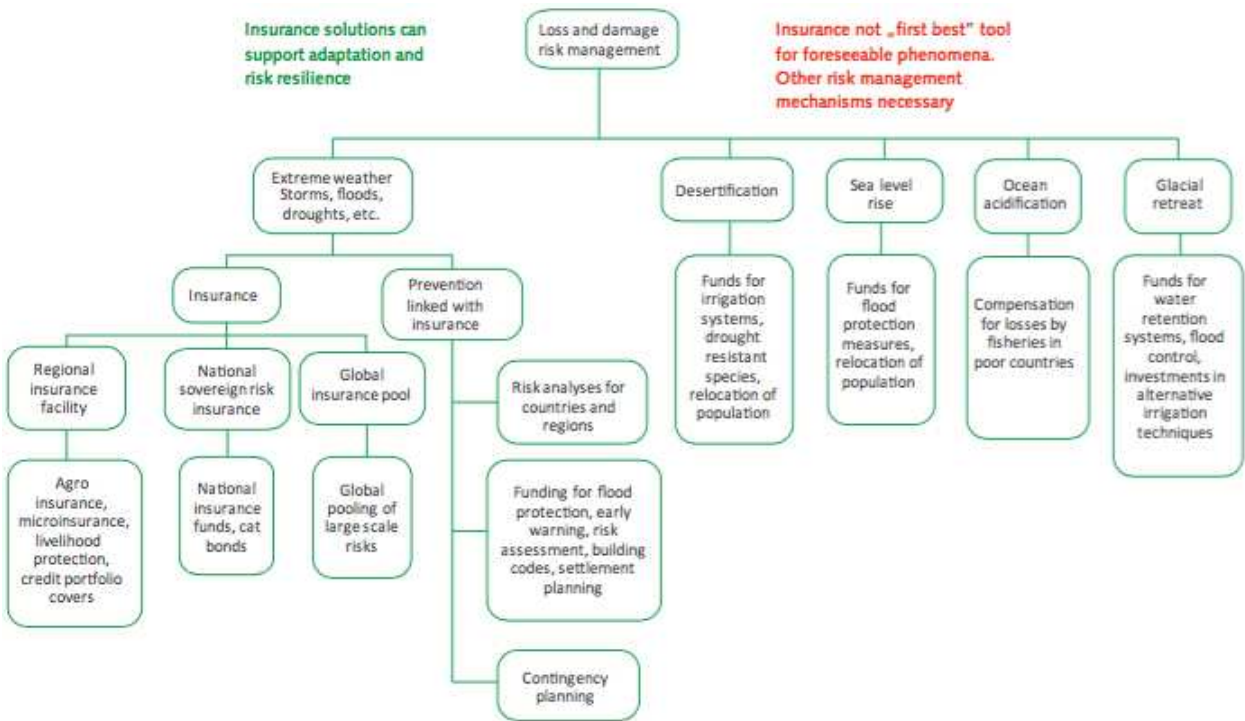
The insurance industry is also developing new products that would have the consequences to stimulate the adaptation to climate change. On the one hand, products help to create the conditions for active adaptation to build physically resilient communities; on the other hand, products provide capital and liquidity to help communities to cope with losses caused by climate change catastrophes.

Insurance products can be designed in a way for which simply their price reflects the level of climate change-related risk assumed by the insurer. These products, rewarding behavior that reduces risk of financial losses, encourage adaptive behavior. For example, insurance products that incorporate these features provide a premium discounts on property insurance for climate-resilient commercial or residential buildings.

The recent tendency to supply coverage with differential premiums to customers depending on their level of protection from losses caused by weather-related disasters can be seen as a clear opportunity for insurers to reduce their own overall and maximum possible loss exposure while promoting communities overall resilience in the face of climate change's impacts. So, more often, policies include discounts for businesses or homeowners that have taken specific steps to ensure their buildings resistant to floods or other hazards. Moreover, insurance companies also condition their policies on compliance with laws such as building codes, thus playing a role in enforcing laws that promote climate change resilience.

The second kind of insurance products that stimulate adaptation is based on the availability of capital to cope with catastrophes. These are financial arrangements intended to bring needed capital that will reduce the risk that could derive from future climate-related hazards for those who are most likely to be in peril. These products can be defined as adaptation oriented because they help to build the capacity of nations, communities, and businesses to cope with climate change impacts.

Figure 1 shows the different roles that can be played by insurance sector as a form of environmental policy instruments.



Source: MCII [17].

Figure 1. The different roles of the insurance sector in the framework of climate change consequences

5. Policies choice in the case of climate change and the concept of “economic global public goods”

Dealing with the consequences of GHG emissions in terms of climate change implies a definition of “economic global public goods” that can be defined as goods with economic benefits that extend to all countries, people, and generations [18]. Following the EAL approach, they are special case of externalities with a global dimension.

Climate is clearly “global” in both causes and consequences; moreover, the emissions of GHG have effects on global warming independently of their location, and local climatic changes are completely linked with the world climate system.

In addition, global warming is characterized by other important features that imply some difficulties in the implementation of the instruments provided by the standard economic theory of policy choice. First, we cannot determine with certainty both the dimension and the timing of climate change and the costs of the abatement of emissions. Second, the effects of GHG concentration in the atmosphere on climate are intergenerational and persistent across

time. Finally, it emerges a relevant equity issue among countries because industrialized countries have produced the majority of GHG emissions, but the effects of global warming will be much more severe on developing countries. In other words, the countries that have more responsibilities will face less consequence in the future and vice versa.

There are major governance issues involved in dealing with global public goods because global coordination is required [19]. With economic public goods, it is difficult to determine and reach agreement on efficient policies because they involve estimating and balancing costs and benefits where neither is easy to measure and both involve major distributional concerns. When dealing with economic public goods like global warming, it is necessary to reach through governments to the multitude of firms and consumers who make the vast number of decisions that affect the ultimate outcomes.

Because global warming is a global public good, the key environmental issue is global emissions, and the key economic issue is how to balance costs and benefits of global emission reductions. Climate change depends only on total GHG emissions and the time path of emissions not on the geographic location of emissions. Moreover, the impacts depend primarily on cumulative emissions that remain in the atmosphere not on the annual flow of emissions.

It is a global issue to decide what the distribution of emission reductions among countries should be and how the costs should be allocated, together with the need for differences among high- and low-income countries, high- and low-emitting countries, and high- and low-vulnerability countries.

Given the global nature of climate change, it is easy to understand the necessity of an action at international level, in order to efficiently implement the different policy instruments that we have analyzed earlier in this chapter.

First, the instruments based on tax mechanism need a method of coordinating policies among countries. In the international environment, it could assume the form of either an international tax or a harmonized domestic tax system. In the case of an international tax, the nations (and not the firms) pay the tax to an international agency, which receives and redistributes the tax revenues. On the other hand, in the case of harmonized domestic tax, the international community should negotiate an agreed level of a domestic emission tax, establishing adequate compensation for the losing countries from the gaining countries.⁶

Second, it is possible to establish an agreement that sets quantitative limits of emissions and allocates emission permits to firms (or States) but allows to trade among countries, in order to minimize abatement costs. The starting allocation of permits can be set through either an auction or a grandfather allocation. Under an auction, government (or the international community) sells the emission permits, whereas under the grandfather rule, the allocation of emission permits is based on historical records.

⁶ Nordhaus [20] hypothesizes the institution of an harmonized carbon tax (HCM), essentially equivalent to a “dynamic Pigouvian pollution tax for a global public good” and points out 10 different reasons to prefer it to a quantitative approach.

In the global-warming context, quantitative limits set targets on the time path of GHG emissions of different countries. Countries then can administer these limits in their own fashion, and the mechanism may allow transfer of emission allowances among countries, as is the case under the Kyoto Protocol.

The European Union Emissions Trading Scheme (EU-ETS) – the world’s most extensive carbon pricing market – has now been in operation for 10 years. The EU-ETS was developed as a way of meeting the EU’s GHG emission reduction targets in the most efficient and cost-effective manner. To do so, the EU-ETS sets a limit (a cap) on the total emissions; certain EU sectors (mostly heavy industry and aviation) are allowed to use during predefined trading periods. Permits are then distributed among polluters where one permit equals one ton of carbon dioxide equivalent. These permits can then be traded between market participants. As such, the total amount of pollution is set by an external authority, but market participants determine the permit allocation, thereby optimizing efficiency.

In addition, the involvement of the insurance sector as an efficient policy instruments needs a global approach.

Insurance sector can contribute to develop risk management strategy to minimize climate change consequences on an urgent basis to prevent further escalation of global warming. However, insurance needs to be a part of the overall policy of mitigation and adaptation that aims at reducing the severity of many impacts that could result from climate change if current adverse conditions prevail.

In order to organize their own operations to the new challenge, the insurance industry should include climate change risk in its internal governance procedures, in line with the existing financial corporate risk identification. To enable insurance companies to play a responsible role in tackling climate change consequences, they require a reliable, transparent, and international coordinated policy framework as well as long-term, appropriated GHG emission reduction goals coordinated at an international level.

6. Final remarks: COP 21 and the issue of the linkage of different national policies

In the COP 21 meeting in Paris at the end of the 2015, global climate policy has faced the tension between the efficiency benefits of uniform global policy and national and regional variation in tastes for differing policies. Although climate negotiations, going back to the framework convention, have had a coordinated global policy as their goal, it could be that we will head toward a less coordinated system of local, national, or regional policies.

In reality, as we have analyzed in the chapter, different countries are undertaking different policies ranging from CAC to MB approaches, such as carbon tax and tradable permit systems.

Variations in policies, although catering to local tastes and preferences, can lead to substantial inefficiencies, and the target will be to reach an optimal degree of policy homogenization.

There is a large literature on the importance of linking economic policies to face GHG consequences [21].

Some authors argue that the basic approach underlying emission reduction credit systems like the Kyoto Clean Development Mechanism (CDM) can be extended to create linkage opportunities in diverse emission control systems in ways that do not necessarily suffer from the shortfalls of the current CDM. Moreover, while emission reduction credit systems are designed to work with MB systems like tradable permits, they describe ways in which it can interact with tax systems as well as certain regulatory systems [22].

By clarifying the opportunities and challenges of insurance as an instrument for adaptation and outlining a practical way forward, it is hoped that this discussion contributes to the opportunities in adopting a comprehensive adaptation strategy that enables risk management and insurance through the funding of a global adaptation strategy [17].

In the near future, the challenge for COP 21 to reduce GHG emissions is to try to link heterogeneous climate policy instruments as a way to reach the solution of climate change issue in the long term.

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