Emissions Trading under the Kyoto Protocol

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Historically, numerous negotiations have been conducted in order to achieve a consensus on policies to contain environmental degradation. The first worldwide agreement was finally reached in Kyoto, thus providing the name for the Kyoto Protocol. Further elicitations of the protocol were obtained after thorough discussions, which however did not significantly alter its basic components (see den Elzen and de Moor, 2002).

It is well known that the Protocol aims at a reduction of Green House Gases' (GHG) emissions at 95% of the base year emissions, the standard base year being 1990. Compliance to emissions reductions must be accomplished at national level, thus each country's targets have been clearly designated. The protocol has been essentially rejected by the current US administration (or at least is not expected to be ratified in the near future), along with other countries like Australia. Nonetheless, and following a long period of uncertainty, the protocol has come into force after Russia's decision for ratification early this year (2005).

The main aspect of the protocol that motivates our discussion is the set of so-called "flexible mechanisms" for emissions reduction, one of which is trading of emissions allowances. Before describing this mechanism more analytically, it is worthwhile to notice that, despite the US administration's denial to ratify the Protocol, the US Environmental Protection Agency (EPA) has already implemented an emissions trading mechanism for SO2 emission allowances, while analogous markets have been operating in other countries, irrespectively of their attitude towards the Kyoto protocol (e.g. Australia, Canada, China, Japan). Most importantly, the US market is the one exhibiting the more mature characteristics in terms of price signalling and competition (Svendsen and Christensen, 1999). Moreover, it has become a common belief that emitting will soon become an extremely expensive "activity" Grobbel et al., 2004), thus justifying the inclusion of environmental risk in financial reporting.

Trading of emissions allowances (or carbon permits) is based on the fact that each organisation emitting GHG must possess certificates in the form of emission allowances. Large polluters include the energy, aluminium, cement and car industries. The allowances are initially allocated by a state-controlled authority, which handles each country's emissions repository. Although the exact way to allocate these permits remains debatable, it is expected that most allowances will be allocated for free, based on historical emission levels of each industry. This approach, called "grandfathering", is mostly encouraged by industrial lobbying and state protectionism towards certain sectors. Nevertheless, after initial allocation, emission allowances become tradable assets, thus implying that each organisation and/or facility must reach environmental compliance via the market. Failure to do so results in penalties per metric tone of CO2 exceeding the level justified by the available allowances. These penalties have been set by the EU at € 40 / tCO2 for the preliminary period 2005-2007 and at € 100 / tCO2 for the first commitment period of the Protocol (2008-2012).

In general, risk exposure arising from non-compliance to emission targets has not been sufficiently recognised and estimated (de Leyva and Lekander, 2003). The most characteristic example of an immensely exposed sector is the electricity producers that use carbon (e.g. lignite). Apart from state-originated initiatives, like England's encouragement of wind farms or Germany's intention to transfer its emission permits to new gas-powered plants in order to finance their building, most facilities in this sector run the risk of being severely penalised.

This risk exposure has provided strong motive for the development of "carbon funds", i.e. funds dedicated to environmental products like emissions permits. These funds(1) have recently become very popular, since both governments and industrial actors are seeking hedging against environmental risk. On the other hand, existing markets illustrate that emissions trading could lead to emission reductions at a lower marginal cost. As an example, although the marginal abatement cost per tone of SO2 was estimated between $700 and $1700 in the US, the price discovery process in the SO2 market led to an average price of $350.

At the moment, there exist 47 systems for trading and transferring GHG emissions (see Hasselknippe 2003), at various stages of preparation or operation. Although these systems present a large diversity, market liquidity could be accomplished only if they could be integrated via a kind of common currency, like the metric tone of CO2. A subset of those systems is highly dependent on EU's provision to create a European-wide trading scheme, which could serve as a platform for the unification of several parallel markets.

Figure 1

Figure 1 (Hasselknippe, 2003)

The European Trading Scheme

The main political document for emissions trading in the EU is the directive 2002/353/EC, which anticipates the establishment of a European-wide market for CO2 emission allowances, called the "European Trading Scheme", or ETS for short. The aim is to reduce the emission levels by 8% with respect to 1990 levels, i.e. the EU adopts a more aggressive environmental policy than the Kyoto protocol.

The directive imposes that at least 85% of allowances will be initially allocated for free by each member-state, whereas any remaining allowances could be auctioned. The ETS includes more than 5,000 facilities, which emit approximately 46% of total CO2 emissions. In order to initially allocate emission permits to each facility, each member-state should submit a National Allocation Plan (NAP) until the end of 2004 for approval by the Commission.

It is expected that initial allocation will leave numerous facilities exposed and therefore in need for further permits, which could be acquired via the market and specifically through the ETS. Given that price discovery in such a market should encourage the facilities to reveal their marginal abatement costs, it is expected that the total reduction cost will be more fairly allocated among the industrial actors and/or sectors.

From an inverse viewpoint, the ETS will encourage environmentally friendly technologies like natural gas, since facilities achieving emissions reduction via technological means could favourably convert their allowances into cash flows. For most electricity producers, this arises as the obvious choice because of their exposure, except for the case where a Russian entry into the ETS would significantly lower the price of permits.

Forecasts anticipate price fluctuations between €15 and €30/tCO2 for the period 2005-2007, which will eventually converge at an equilibrium price around €25/tCO2 in 2008. Liquidity in this market is expected to increase further, since even a mild GDP increase in the EU implies a significant financial burden, according even to prudent forecasts (de Leyva and Lekander, 2003).

Evidently, increased cost of emissions will influence the European energy market and the price of energy itself. Part of this increase will be counteracted by more efficient production and distribution, while the remaining part will be transferred to consumers. For industrial consumers, the increase varies among sectors, although a minimum increase of 15-20% is

widely foreseen. The good news is that electricity producers are expected to receive a large amount of initially allocated allowances, thus obtaining a financial lead since the allowances are acquired at zero cost.

According to de Leyva and Lekander (2003), a price of €25/tCO2 makes the construction of electricity plants powered by natural gas the only viable option in the energy sector. Most importantly, increased demand for natural gas will increase its price, thus encouraging further its use for electricity production. In the same study, it is estimated that electricity production by wind farms becomes competitive at a price of €50/tCO2.

Auctioning emission allowances

In any auction, it is crucial to define the items being auctioned. With carbon permits this becomes a simple matter, since we may safely assume that each permit is for one metric ton of carbon usage. To increase liquidity in this market, all permits are considered the same after their date of issue. Also, permits can be considered as bankable, e.g. a permit issued for the year 2000 can be used in any later year. There is no environmental loss in making permits bankable, a fact also captured by the Marrakesh Accords where the negotiations on the actual implementation of the Kyoto Protocol were completed (den Elzen and de Moor, 2002). Current carbon emissions are reduced to the extent that permits are banked. Given the long lifetime of CO2 in the atmosphere, short-term voluntary banking is unlikely to have significant impacts on CO2 concentrations. Most importantly, allowing banking further increases liquidity in secondary markets, since all permits are the same after their date of issue.

Under the Kyoto targets, permits can be used at any time within a five-year commitment period. This essentially allows borrowing of up to five years worth of permits in the first year of the program and reducing amounts in later years. In addition, permits can and should be auctioned not only for the current years but also for future issue years. This allows the regulator to better control market functionality by adjusting the availability of permits. Thus, some permits for 2005 could be auctioned in 2000 even though they cannot be used against CO2 emissions until January 1, 2005. Overall, early auctions could facilitate the development of an active futures market, thus improving risk allocation.

Our last remark is that at a European-wide level it is safe to assume an absence of market power. Together with the aforementioned characteristics, this implies that there are no impediments to creating a fully efficient auction for emission allowances, especially since auctions have performed efficiently in much more complex settings like spectrum auctions and electricity auctions. Secondary markets for permits are likely to be highly efficient as well. These markets can complement an efficient auction, allowing firms to make adjustments to their permit inventory based on production and/or weather fluctuations (see Markellos et al., 2005).

Footnotes

(1)
- **http://www.environmental-finance.com/2002/0207july/carbon.htm**
- **http://www.pointcarbon.com/**
- **http://www.natsource.com**

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