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Aviation and the EU Emissions Trading Scheme—Lessons learned from previous emissions trading schemes

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ABSTRACT

Designing an emissions trading scheme requires in-depth knowledge regarding several aspects. This paper attempts to clarify some important design points of the forthcoming emissions trading scheme for aviation under the EU ETS. Five general key points of system design are acknowledged and comparisons are made to previous and current emission trading schemes. While it is not meant to be exhaustive it helps to create an understanding of what design elements should be handled with caution. Discussion is provided in regard to the recent implementation of aviation in the EU ETS. Above all, it is argued that initial allocations of emission permits and the trade barrier between the aviation sector and EU ETS need to be carefully examined.

1. Introduction

In accordance with the goals set up by the Kyoto Protocol, carbon dioxide (CO_2) emissions from the members of the European Union decreased by roughly 5% between 1990 and 2003. During the same time period the total contribution of CO_2 emissions from international aviation increased by an astonishing 73% (Wit et al., 2005). According to the Intergovernmental Panel on Climate Control (IPCC, 2007) aviation is responsible for approximately 2% of global CO_2 emissions. As passenger quantities grow at a rate of roughly 5% per year (Lee et al., 2009), depending on improvements in fuel efficiency and flight frequencies, this might potentially lead to an increase in emissions of greenhouse gases in the range 3–4% annually given that no effort is put into limiting and reducing the global environmental impact from the sector (IPCC, 2007). Thus, it was deemed crucial to implement some control on emissions stemming from aviation. Starting on January 1, 2012 all emissions from civil international aviation, arriving and departing within the European Union, are monitored and controlled through issuance of emission permits.

Some key design points can be distinguished regarding implementation of an emissions trading scheme, these also apply to the case where a new sector is included in an already existing one. In order to bring some clarification to the issues at hand one can study already existing emission trading schemes to see how these issues have been handled in the past.

2. Key design points of an emissions trading scheme

2.1. Allocation

Allowances can either be distributed for free (*grandfathering*) or by charging emitters a price for each allowance they demand (for example by *auctioning*). Let us consider these two options. *Grandfathering* implies that permits are distributed free of charge based on historical emissions. It is the most common choice of allocation mechanism from a policy perspective as it is easier to gain political acceptance from the trading sectors (Anderson, 2001). Applying grandfathering as the method of allocation caution should be taken when estimating baselines of emissions. It is possible that historical emissions were unusually high (or low) due to some exogenous force in the economy. For example, the 9/11 terrorist attacks on the United States in 2001 led to a huge decrease in demand for air transport reaching into 2004 (Ito and Lee, 2004; Morell, 2007). Using baselines of historical emissions can also create competitive advantages for firms with relatively high historical emissions while generating high costs to, for example, low price carriers who have shown a large growth during the past decennium (Morell, 2007). It is also possible that grandfathering based on historical emissions lead to perverse incentives for firms to emit more today as they expect to receive more permits in the future by doing so (Hepburn et al., 2006). On the other hand, *auctioning* allowances has greater support in scientific literature. Hepburn et al. (2006) promote auctioning

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particularly for the EU ETS as it would reduce the problem of competitive advantages for some firms as well as increasing the over-all efficiency. Auctioning would also eliminate the perverse incentives such as delaying fleet renewal to keep emissions at a high level for future calculations of historical levels.

2.2. Liability

Liability can either be places in a *downstream* (where the source of emissions is held liable) or *upstream* (place liability on some agent prior to the emitting source) approach. Bohm (1999) argues that a *downstream* approach might lead to some potential problems, in particular, (i) high transaction costs and (ii) exclusion of smaller actors for the trading scheme. If we consider these two criteria the most efficient choice should be obtained. This might mean that an *upstream* approach is more efficient. A crucial criterion is that the liable source directly or indirectly can influence fuel consumption (Andersen, 2001). This gives a number of options to consider including *Fuel suppliers*, *aircraft operators*, *airports* and *air traffic controllers*.

2.3. Inter-temporal trade

Inter-temporal trade refers to both banking and borrowing allowances and is considered one design point that potentially leads to a more efficient system. Banking allows agents to use allowances in the future in order to achieve lowest possible present value of the cost of emissions reduction (Kling and Rubin, 1997; Tietenberg, 1999). Borrowing allowances from future trading periods is a more risky venture. If firms are allowed to borrow from future allocations and then leave the scheme these allowances will not be accounted for. Rubin (1995) argues that the lowest possible cost of abatement is achieved when the system allows for full inter-temporal flexibility.

2.4. Trade barriers

Including new sectors or linking several systems can be done in several ways. An *open trading scheme* would treat all parts the same and allow trade between all involved actors. however, there is a belief that heterogeneous damage from the emitting sources[2] one emitting sector could be cut off from the others, a so-called *closed trading scheme*. A third option, *semi-open trading scheme*, can also be considered. This will effectively introduce a trading barrier, called the gateway, where a net flow of permits is only allowed one way.[3]

2.5. Hot spots

Damage from some types of emissions can have a local effect. While this is not the case for CO_2, other greenhouse gases such as O_3 and NO_x yield different damages depending on the altitude where they are emitted. Allowing free trade between all agents could thus possibly create local "hot spots" of emissions.

3. Experience from previous emissions trading schemes

The *EU Emissions Trading Scheme (EU ETS)* was introduced in an attempt to reduce the levels of emitted greenhouse gases in accordance with the goals expressed in the Kyoto Protocol. It was intended to cover roughly 45% of total CO_2 emissions within the area, thus making the EU ETS the largest emissions trading scheme to date. During phase I (2005–2007) the focus of emissions reduction was put solely on CO_2 although leaving the door open for implementation of other greenhouse gases in phase II. Each member has their own emission reduction targets and they are allowed to distribute allowances to energy intense sectors within their borders. Allocation is primarily done by grandfathering although a growing part of allowances are available for auctioning. In phase I however, only four member countries chose to put up allowances for auction (Betz and Sato, 2006). Phase III of the EU ETS will start in January 2013 and end in 2020, the current goal is that emissions will be 20% lower than 1990 levels at the end of phase III. In 2006, when data was available on actual verified emissions, this showed an excess of allowances, prices plummeted. There were a number of contributing factors to the "over-allocation" of allowances seen in phase I (Rogge et al., 2006). For example, the information on which baseline emissions were calculated could have been uncertain thus leading to miscalculations. Another important aspect was that when calculating future reductions of emissions an optimistic view of growth rates was used.

The *US Acid Rain Program* was the first large scale emissions trading scheme in the world and primarily aimed towards reducing emissions of sulfur dioxide (SO_2) and also nitrogen dioxides (NO_x). Prior to Title IV (known as the US Acid Rain Program) the Environmental Protection Agency (EPA) initiated "command-and-control" programs aimed at reducing air pollutants. When these proved costly, tradable emission reduction credits were introduced. These were earned by abating more than set up targets and could be traded or banked for future periods (Tietenberg, 1998).

The initial allocation of permits to Table A listed units were 8.7 million t of SO_2. This was based on total emissions in 1985, a total of 10.68 million t. However, due to unforeseen changes in input prices due to the deregulation of rail transport prior to 1995 effectively lowered the price for low sulfur coal (Ellerman et al., 1997). Earlier attempts to meet emissions targets resulted in total emission from Table A listed of 5.30 t in 1995. The excess supply of permits resulted in lower prices than anticipated. Prior to the start of the program in 1995 expectations of the price of permits were as high as $1500 according to Bohi and Burtraw (1997). Instead, auction prices in 1995 cleared at around $130 (Bohi and Burtraw, 1997; Conrad and Kohn, 1996) Market volume was also a lot smaller than expected with only 9% of the affected units reporting that they relied on trading permits to fulfill their commitments regarding emissions (Rico, 1995).

Although not limited to small geographical areas, emitters of SO_2 and NO_x contribute to acid rain on a regional, not global, level. Therefore there is some risk of local "hot spots" to form when a national emissions trading scheme is implemented to control a regional problem of this sort. At an early stage of the US Acid Rain program two separate trading zones were considered, one for the western states and one for the eastern (Rico, 1995). However, emissions were already somewhat regulated through local health standards, included in these standards were both levels of NO_x and SO_2 (Rico, 1995).

The *UK emissions trading scheme* (UK ETS), a voluntary emissions trading program, was initiated in 2002 by the UK government as part of the UK Climate Change Program. Reduction goals were compared to a baseline of average historical emissions between 1997 and 2000. It was an economy wide program with two types of participants, referred to as Direct Participants and Agreement Participants. An initial descending clock auction[4]

[2] There is evidence that this might be the case for aviation (IPCC, 1999; Lee and Sausen, 2000; Wit et al., 2005).

[3] This system is currently used for aviation where actors on the aviation market are allowed to use allowances issued to stationary sources, but not vice versa.

[4] The descending clock auction for the UK ETS was set up such that Direct Participants offered the amount of emission reduction that they were willing to