

## **CHAPTER 7**

### **CONCLUSIONS**

Economists have pointed out the suitability of economic instruments like taxes and tradeable emission permits for reducing CO<sub>2</sub> emission because with these instruments emissions are abated at minimum costs. Less attention has been paid to the practical design of instruments, in particular to the design of a system of tradeable carbon permits. One of the aims of this study has been to fill this gap, describing in detail the requirements of a feasible system of tradeable carbon permits for the European Union. In addition to the design of a system of TCP's, the consequences of implementing such a system have been studied, concentrating on the effect which TCP's might have on entry into industries, a subject which so far has received little attention in the literature.

The enhanced greenhouse effect occurs worldwide, therefore the problem arises of coordination of policies. As a third subject it has been analyzed whether and how countries can cooperate in reducing emissions and what the role of taxes and TCP's can be in an international setting, taking into account the complication that fossil fuels are already taxed in most countries. Moreover, it has been studied how this might affect the optimal design of a system of TCP's.

Two themes are recurrent in this study. The first theme is the choice between grandfathering and auction of the permits. This choice is important in designing a feasible system of TCP's, it can affect entry barriers and it has consequences for the revenue which governments raise when they use tradeable permits. The other theme is the comparison between on the one hand TCP's and on the other hand carbon taxes and command-and-control type of regulation like emission standards.

A main conclusion is that it is possible to design a feasible system of TCP's. An important element of such a system is the distribution of the permits. From a political economy point of view it is attractive to grandfather permits to sources of CO<sub>2</sub> because the negative impacts on the cash flow of firms will be considerably

smaller with grandfathering than with auction of the permits or with emission charges. With grandfathering firms as a group will only have to make expenditures for the abatement costs. Especially for the energy intensive sectors of industry, permit expenditure will be several times larger than the abatement costs. Therefore, tradeable carbon permits will be politically more acceptable than a tax or auction of permits, making a system more feasible. However, a distinction is made between industrial and other sources. The permits for the other sources are auctioned by the government. In order not to trouble households and other small fuel users with the necessity to buy permits these can be sold instead to suppliers of fossil fuels, who can subsequently mark up their fossil fuel prices with the price of the permits.

A system of tradeable permits, and indeed any other instrument, is only feasible when there is adequate monitoring and enforcement. Our system of TCP's can be monitored and enforced by obliging importers and producers of fossil fuels to hand over carbon permits to the authorities for the carbon contained in the fossil fuels which they bring onto the market. This considerably limits the number of firms which have to be monitored and makes it possible to use existing procedures for levying excise taxes on fossil fuels.

Within the context of the EU, the question arises whether TCP's can be implemented in one MS of the EU or whether it should be implemented at the European level. Introducing the TCP-system at the European level poses no problems. It also seems to be possible to implement a system in one MS because so far there is no European CO<sub>2</sub> reduction policy. TCP's will probably fall under the 'rule of reason' which allows exemptions to article 30 EG which deals with free movement of goods.

The second question dealt with in this study is whether tradeable permits will create entry barriers. The conclusion is that entry barriers can occur when tradeable permits are introduced. Three types of entry barriers have been identified which in theory are affected by tradeable permits. First, transaction costs on the permit market can have consequences for entry in the limit pricing model. Second, capital markets might not work perfect, in which case grandfathering puts incumbent firms at an advantage. Third, firms can try to make it more expensive for entrants to

acquire permits by driving up the price of the permits, thereby reducing entry.

It should be noted that grandfathering permits to the established firms does not necessarily create entry barriers in the sense of creating a cost advantage for the firms. Grandfathered permits have an opportunity cost when they are used. These opportunity costs are equal to the price for which they can be sold and therefore established firms do not have a cost advantage over entrants just because they received permits for free.

Transaction costs, which can occur on the permit market (born by either the buyer or the seller of permits or both), can affect entry barriers in the limit pricing model. The limit pricing model is a two-period (Stackelberg) game in which the incumbent firm invests in the first period, taking into account how the potential entrant will react in the second period. In this way he influences the output of the entrant in the second period. It might also be profitable for the incumbent to deter entry completely. The occurrence of transaction costs on the permit market can make it more attractive for the established firm to deter entry or it can reduce the size at which the entrant will enter.

An extreme form of entry barrier can occur when a firm or group of firms controls a vital input and excludes other firms from the use of this input. This will force these firms to use less optimal and more expensive substitutes and reduce their competition, or even exclude them completely from the market. Exclusionary manipulation can also occur on the permit market when one or a small group of established firms can control the price of permits and thereby drive up the costs of potential entrants.

Neither the transaction cost barrier nor exclusionary manipulation do seem to be very relevant for our system of TCP's. The main reason for this is that the market for carbon permits is a large market with many potential actors from most sectors of industry. It is therefore probable that a well-functioning market will develop with low transaction costs, reducing the effect transaction costs might have on entry barriers. Moreover, it will be very costly for a firm to use the permit market to drive up the costs of rivals because of the large size of the market.

The most relevant type of entry barrier with respect to our system of TCP's occurs when capital markets do not work perfectly and established firms receive

their permits through grandfathering. According to the long purse theory, an incumbent firm can drive a potential entrant out of the market by means of a price war if its financial resources are larger. *Ceteris paribus*, grandfathering permits to established firms and selling them to newcomers means that the incumbent has larger financial resources because grandfathering permits is in effect equal to making a capital gift. Therefore an incumbent firm can outlast the entrant in a price war. Given imperfect capital markets, grandfathering can effectively reduce entry.

In empirical studies it is found that capital requirements are a significant determinant of entry barriers. It has been estimated for the Dutch economy by how much a system of tradeable carbon permits will increase the capital requirements of new firms, assuming that entrants acquire at least one year's stock of permits before they enter a market. As is to be expected, energy intensive industries are most affected although the increase in their capital requirements is modest, at most 1.7 percent (in the petroleum industries). Entry might be reduced when capital markets do not work perfect and permits are grandfathered, but probably only to a small extent.

The last question posed at the start of this study was how countries can cooperate in reducing transboundary pollution like CO<sub>2</sub>-emissions and how cooperation of environmental policies will influence the optimal design of instruments like taxes and TCP's. A two country model has been used which takes into account the complicating problem that countries already tax fossil fuels for other reasons than reducing CO<sub>2</sub> emissions. The simple economy modelled consists of one consumer who can consume two goods, one of which causes pollution when it is consumed. In addition the consumer chooses how much time he will work (and earn income) and how much leisure he will enjoy. The government has to raise an exogenously determined amount of revenue and reduce pollution by means of taxes (or tradeable permits) on the two goods. This second-best model is used to establish which combinations of instruments will maximise welfare in the two countries.

Two variants of the model have been used. In the first variant a damage function is included and therefore the optimal emission reduction level, the optimal level of CO<sub>2</sub>-abatement, is determined endogenously. The two countries can

increase their welfare when they cooperate in reducing emissions. Cooperation can be extended further when they use sidepayments: one country pays the other country and reduces its emissions less. The other country diminishes its emissions further. An interesting conclusion is that including sidepayments in agreements on emission abatement can actually increase pollution compared with agreements which do not include sidepayments.

In the second variant it has been assumed that emission ceilings are set exogenously. In this variant countries can only cooperate when they use sidepayments. This form of cooperation, where one country pays another country for reducing its emissions, is also called Joint Implementation. The model with exogenously determined emission ceilings has been used to establish which institutions are necessary to realise the optima and to determine the role of taxes and tradeable permits. This analysis yields several insights.

First, in the second-best model used here, there is no difference between grandfathering or auctioning of the permits in either national or international systems of tradeable emission permits. In the case of grandfathering the optimal tax on the polluting good equals the tax plus the price of the permits when they are sold. To put it in a different way, the rent obtained by the gift of the permits is fully taxed away and the permit price is zero under grandfathering. Therefore, the welfare effects of either grandfathering or auctioning are similar in this second-best model.

Second, it suffices to specify the sidepayment and emission targets in a cooperative agreement; it is not necessary to specify the taxes which each country has to levy. It can be left to the countries themselves to set taxes or use a national system of tradeable permits. Given the emission targets and the sidepayment agreed upon, each government will set the optimal tax rates and the national permit markets will be in equilibrium at the optimal permit price.

Third, instead of taxes an international permit system can be used which allows trade in permits between the two countries. Given agreed upon emission ceilings and sidepayments, countries can be left free to set revenue raising taxes. Although tax competition is allowed, both countries will set (welfare) optimal taxes. In this case in each country the number of permits used is equal to that country's emission

ceiling.

Fourth, it is not welfare optimal to allow trade in permits between the two countries without first agreeing on emission limits and sidepayments. Simulations show that, as might be expected, this will increase welfare in both countries compared with the situation in which countries do neither coordinate their emission reduction policies nor allow trade in permits. However, in neither country does it achieve the welfare levels which are realised when countries explicitly cooperate. In the second-best model studied here an international system of tradeable emission permits without initial coordination might therefore be termed a second-best policy: second-best to explicit coordination of emission reduction policies.

In all chapters the choice between grandfathering and auction of the permits was part of the analysis. Overlooking the results, is it possible to give a final verdict on this choice, given our central question of how to design a feasible system of TCP's? Our conclusion in the institutional chapter 2 is that grandfathering should be preferred for industrial sources, or at least for the energy intensive sectors of industry, while the permits for the other sources should be sold. The main reason is that this makes a carbon reduction policy more acceptable to these sources than would be the case when permits are auctioned or when a tax is levied. The choice between grandfathering or auction does not affect relocation decisions of industries, therefore from this point of view there is no preference for either of the two methods. Grandfathering could increase barriers to entry but even for the energy intensive sectors the increase in entry barriers appears to be small. In contrast with the conclusion that a policy of grandfathering should be applied when the government's aim is to increase political acceptability of tradeable carbon permits stands the conclusion from our second-best analysis which indicates that in case welfare maximisation is the aim grandfathering is not useful because the authorities would completely tax this capital gift away. Therefore different criteria lead to different policy advice. next to that it should be realised that the second-best model used is a very simple one which only focuses on the revenue aspect of taxes and permits.

The second recurrent issue in this study is the comparison between TCP's and other instruments like taxes and direct regulation. A system of TCP's seems to be just as feasible as a carbon tax. Monitoring and enforcement will not pose larger problems than a tax, although in a European-wide system insufficient enforcing might lead to larger excess emission when TCP's are used compared with a tax (or standards). Tradeable permits have the advantage over a tax that permits can be grandfathered to (part of) the sources of CO<sub>2</sub> emissions which will reduce their expenditures. Furthermore the emission reduction level is set, which is not the case with a tax or with standards.

Tradeable permits can increase entry barriers through imperfect capital markets. This problem does not arise with taxes or standards, however the problem is relatively small and seems to be more theoretical than practical. Both taxes and tradeable permits can be used in international agreements on emission reduction. Whichever instrument is used, cooperating countries should first agree on emission reduction ceilings and monetary compensations in order to realise maximal welfare gains. In this respect there is no difference between the two instruments.

Our final conclusion is that a system of TCP's is an attractive and feasible instrument for reducing CO<sub>2</sub> emissions, both at national and international levels. The system described in this study can be implemented in the European Union at the Union level and it might also be possible to introduce it in one Member State. Entry barriers might be affected by TCP's when capital markets do not work perfect, but the effect is small and limited to a few sectors of industry.