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The impact of banking on permits prices and compliance costs

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The impact of banking on permits prices and compliance costs

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VI. The impact of banking on permits prices and compliance costs

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1 INTRODUCTION

The flexible mechanisms of the Kyoto Protocol, namely Emissions Trading (Art. 17), Joint Implementation (Art.6) and the Clean Development Mechanism (Art. 12), give to the Parties the opportunity to reduce their compliance costs by allocating emission reductions where they are cheapest. Recent studies (see in particular Eyckmans, Van Regemorter and van Steenberghe (2005, Chapter 5, this volume) and the references cited therein), have shown that the use of these mechanisms reduces total compliance costs by a factor of two.

The same studies have also pointed out the low levels of the international permits price, and consequently, of the absolute level of compliance costs in 2008-2012. This result reflects mainly the weakening of the world emission reduction objective following the US withdrawal from the Protocol.

However, these analyses do not account for Art. 3.13 of the Kyoto Protocol which allows Parties to bank unused emission permits.[1] If post-Kyoto targets are assigned before 2012, the parties will make use of such an intertemporal flexible mechanism since Kyoto permits prices are predicted to be very low. This would allow them to decrease substantially their overall compliance costs through an increase in the Kyoto permits prices.

The purpose of this chapter is twofold. In Section 2, we illustrate the functioning of the banking mechanism, as well as its impact on compliance costs and permits prices. Then, in Section 3, these effects of the banking provision are quantitatively assessed by means of the MacBank model. Concluding remarks are presented in Section 4.

[1] Indeed, "*If the emissions of a Party included in Annex I in a commitment period are less than its assigned amount under this Article, this difference shall, on request of that Party, be added to the assigned amount of that Party for subsequent commitment periods*" (see UNFCCC (1998), Art. 3).

2 HOW DOES BANKING AFFECT PERMITS PRICES AND ABATEMENT COSTS ?

The purpose of this section is to illustrate graphically how allowing for banking of emission permits may decrease countries' compliance costs, through a change in the permits prices. We proceed in three steps. First, we explain how a country decides on the amount of emission permits to buy or to sell. Then we turn to the analysis of the 'static' gains from trading the permits. Finally, we account for two compliance periods and illustrate the "intertemporal" gains from banking emission permits.

2.1 Amount of permits traded by a country

In order to show how a country determines the amount of permits to be supplied or demanded on the market, we make use of the concept of "marginal abatement costs curve" (MAC curve hereafter). As represented in Figure 1, the MAC curve associates, to every level of emissions by a country i (Ei), the costs of reducing its emissions by one additional unit.[2] At the "business-as-usual" (BAU hereafter) level of emissions, corresponding to point **a** in Figure 1, the country does not reduce its emissions and, accordingly, does not incur any costs. If the country decides or is compelled to reduce its emissions up to **e** (that is, to reduce its emissions by the distance **ea**), it bears abatement costs equal to the area defined by triangle **abe**. The costs of reducing the emissions by one more unit (the marginal abatement costs) are then equal to the distance **be**.

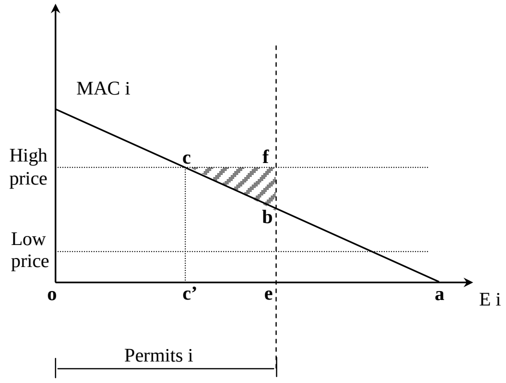

Figure 1.

Consider now that country i has received an amount **oe** of tradable emission permits.[3] If it does not trade any permits, its abatement costs are equal to **abe**. Depending on whether the permits price is higher or lower than the marginal abatement cost **be**, the country will gain by emitting a lower amount of

[2] For convenience, the MAC curve represented in Figure 1 is linear.

[3] We adopt the standard assumption that each country must hold one permit for one unit of emissions.

pollutants in order to sell permits or by emitting a higher amount of pollutants and purchasing additional permits.

Consider the case of a ‘high price’ for emission permits. In this situation, the country gains by reducing further its emissions, up to the point where its marginal abatement costs equal the permits price, that is, up to **c’**. Indeed, the additional abatement costs amount to area **bcc’e** while the additional benefits from the sales of permits amount to area **cc’ef**. The net gains equal the area of the shaded triangle **bcf**. A similar reasoning can be performed with the “low price” of permits. The country then gains by purchasing emission permits instead of emitting according the amount of its allocated permits.

2.2 The “static” gains from trading permits

For the purpose of illustrating the gains from trading permits, consider two (representative) countries, namely country i and country j. By measuring the emissions of i from left to right and those of j from right to left, and by plotting their MAC curves, one is able to represent the gains from trading permits between these two countries.

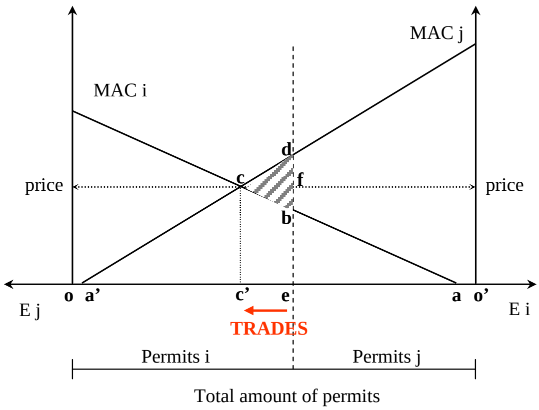

Figure 2. Gains from “static” trades

The BAU level of emissions of i amounts to **oa** while those of j amount to **o’a’** as depicted in Figure 2. Assume that the countries receive, respectively, **oe** and **o’e** emission permits. In Figure 2, the total amount of permits allocated to the countries corresponds to **oo’**, which is strictly lower than the total amount of BAU emissions.

Given the initial allocation of permits, it is easy to see that the marginal abatement costs differ across countries: they correspond to distance **eb** for country i and to distance **ed** for country j. Applying the analysis of the above section, we observe that country i gains by selling emission permits as long as the permits price is higher than its marginal abatement costs, while country j gains by purchasing permits as long as the price is lower than its marginal abatement costs. Hence, there is some room for permits trading between the two parties, as long as the marginal abatement costs differ. Countries will therefore trade the amount **ec'**. The price of the permits will in this case be equal to distance **cc'**.[4]

Such trades are therefore benefical to both countries (and would in fact not take place otherwise). The net gains of country i correspond to area **bcf** while those of country j equal area **cdf**. The total gains from these "static" (as opposed to "intertemporal", see below) trades correspond to the shaded area depicted in Figure 2, that is, area **bcd**. This area represents the total abatements costs saved through a "better" allocation[5] of emissions across countries.

2.3 The "intertemporal" gains from banking permits

In addition to the "static" gains from trading permits, "intertemporal" gains can be obtained via the banking of emission permits.[6] [7] To illustrate such gains, one obviously needs (at least) two commitment periods. As depicted in Figure 3, we consider that the total amount of permits allocated to both countries in period 1 (distance $\mathbf{o_1o_1'}$) is larger than the total amount allocated in period 2 (distance $\mathbf{o_2o_2'}$). If the possibility of banking emission permits is ignored, "static" trades of permits among the countries at each period lead to permits prices such that the first period price ("price1") is lower than the second period one ("price2"). Such a configuration fits the recent state of affairs particularly well, if one considers the Kyoto Protocol commitment period (2008-2012) as the first period.[8]

[4] Depending on the assumptions about the market mechanism, distance **cc'** is either the price of the last permit traded by the countries, or the price of all permits traded.

[5] Such an allocation would be "better" than an allocation of emissions corresponding to the initial allocation of emission permits.

[6] On this topic, see especially Cronshaw and Kruse (1996), Kling and Rubin (1997), Hagem and Westskog (1998) and Yates and Cronshaw (2001).

[7] Borrowing of emission permits could also be analysed along the same lines. However, no existing market for emission permits has ever allowed for such a provision.

[8] Indeed, forcasted permits prices for that period are very low (see the preceding chapter) and future commitments are expected to be more ambitious, so that the permits price is likely to be higher in the second period than in the first one.

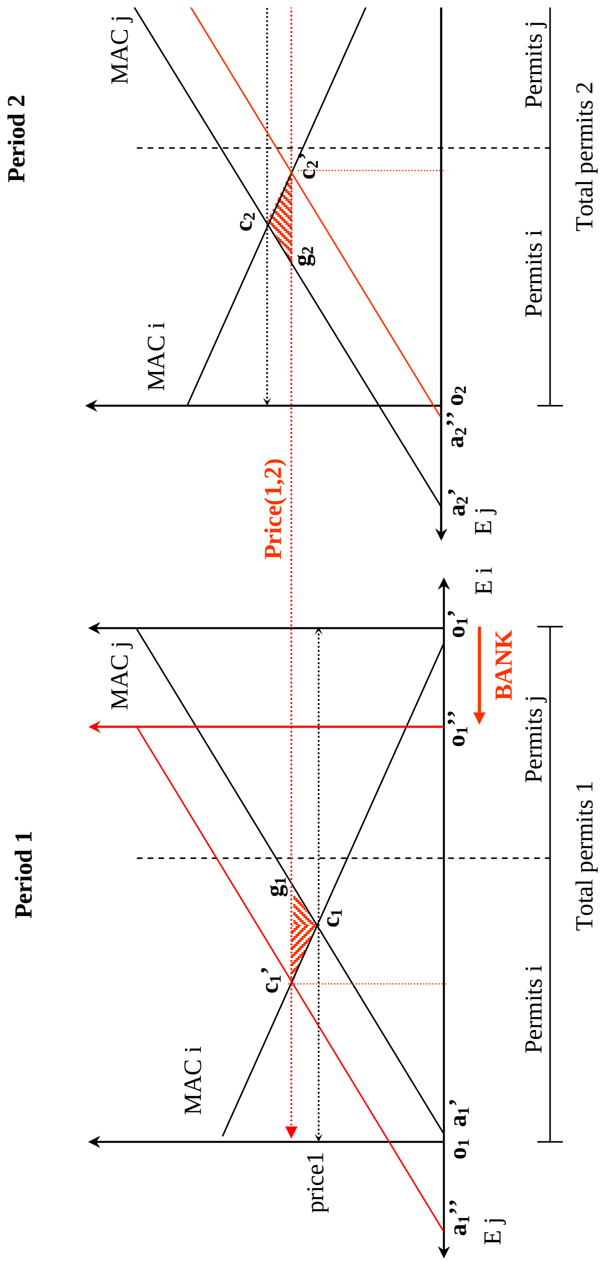

Figure 3.

Given that the permits price and hence the marginal abatement costs are lower in the first period than in the second, countries gain by making additional reductions in period 1 (when they are cheaper) in order to make smaller abatement efforts in period 2 (when such reductions are more expensive). The banking provision renders such intertemporal trades of permits possible. In fact, countries will gain by banking emission permits as long as marginal abatement costs (or permits prices) differ across periods. The argument is similar, then, to the one used in the previous section on the "static" gains from trade.

The fact that permits are banked can be represented by a decrease in the total amount of permits available in period 1 (from $\mathbf{o_1o_1'}$ to $\mathbf{o_1o_1''}$ in Figure 3) and a corresponding increase in period 2 (from $\mathbf{o_2o_2'}$ to $\mathbf{o_2o_2''}$). Such changes imply a rise of the first period price and, simultaneously, a decrease of the second period price. Permits will be banked until the two prices become equal.[9]

Again, the gains from such intertemporal trades can easily be represented. In period 1, the additional total abatement costs incured in order to bank the permits are represented by area $\mathbf{a_1'a_1''\ c_1c_1'}$. At the same time, the total abatement costs saved in period 2 correspond to area $\mathbf{a_2'a_2''\ c_2c_2'}$. The difference, a net gain, is given by the sum of the two shaded triangles ($\mathbf{c_1c_1'\ g_1}$ and $\mathbf{c_2c_2'\ g_2}$).

3 AN ASSESSEMENT OF THE POTENTIAL IMPACT OF THE KYOTO PROTOCOL BANKING PROVISION

Since the Kyoto Protocol allows for the banking of unused emission permits, it is important to quantify its possible impacts described above in Section 2, namely (i) the rise in the first period (i.e., the Kyoto commitment period) permits price and (ii) the gains from such intertemporal trades.

The MacBank model, developed by van Steenberghe (2005), suits that purpose. It extends to several commitement periods the MacGEM model presented in the previous chapter. The basic mechanics of the model, based on MAC curves, is illustrated by the analysis given in Section 2.3 above.[10]

MacBank requires, therefore, the definition of a (or several) post-Kyoto scenario(s). We describe one such possible scenario below and give the associated permits prices, amount of banking and compliance costs. The results under alternative scenarios, as well as sensitivity analyses, are then briefly presented and discussed.

3.1 Description of a possible post-Kyoto scenario

The model allows for the introduction of 5 commitment periods (of 5 years each), 2008-2012 being the first one. In the first commitment period, it is assumed that USA does not commit to its Kyoto target. The other Annex-B countries commit to their targets by making use of the flexible mechanisms and also, possibly, by banking emission permits. Non-Annex-B countries engage in CDM activities.

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[9] In this analysis, nothing is said about the amount of permits banked by each country. In fact, there is an indeterminacy that rises from the fact that only the aggregate amount of permits banked matters. For more insights on this issue, see van Steenberghe (2005).

[10] The analysis of Section 2.3 did not include any discount rate. In MacBank, we introduce such discount rates. We run our base case scenario under the assumption of a 5% annual discount rate for all countries.

In our central scenario, we assume that the USA starts committing to emission reductions from 2013 onwards, while non-Annex-B countries join the participating countries only in the third period, that is, from 2018 onwards.

In the fifth commitment period (around 2030), the world CO_2 emissions objective is chosen to be 35.0 Gt CO_2 (which corresponds to the "weak emission reductions objective" in van Steenberghe (2005), that is, to an increase of world emissions by more than 60% compared with 1990).[11] [12] At each commitment period, the emissions objective is shared among the participating countries according to a certain formula which gives, at the beginning, an important weight to the implicit sharing rule defined in the Kyoto Protocol, and then progressively moves towards a sharing rule based on the population of each country.[13]

3.2 Results

3.2.1 Permits prices and amount of banking

Under the scenario defined just above, MacBank shows that countries will significantly rely on the banking provision. A first part of the results are reported in Figures 4.a and 4.b. Figure 4.a shows the level of discounted permits prices at each of the five commitment periods (2010 to 2030)[14] under two alternative situations: (i) when countries do not make use of the banking provision and (ii) when countries do take into account the possibility of banking emission permits.

In the first case, when no permits are banked, the permits price in the first commitment period (2010) is fairly low, as predicted by many other analysts.[15] Moreover, although the emission reduction objectives do not appear to be very ambitious, discounted permits prices increase significantly through time. As explained in Section 2.3, countries will therefore benefit from banking a certain amount of permits, such that discounted prices become equal at each period. Hence, the first period's permits prices increase, while the last period's prices tend to decrease due to banking.

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[11] As in MacGEM, we consider here only CO_2 emissions.

[12] The emissions objectives of the second, third and fourth periods lie between those of the first and fifth ones.

[13] See van Steenberghe (2005), pp. 16-17, for a more precise description of the formula.

[14] 2010 stands for the 2008-2012 period, 2015 stands for 2013-2017, and so on.

[15] This is due to the US withdrawal and to the relatively large amount of hot air allocated to some countries, as explained in the preceding chapter. One may notice that the first period permits price is different from the one given in the previous chapter, as well as in Chapter 7. This discrepancy is mainly due to slightly different assumptions on the levels of baseline emissions.

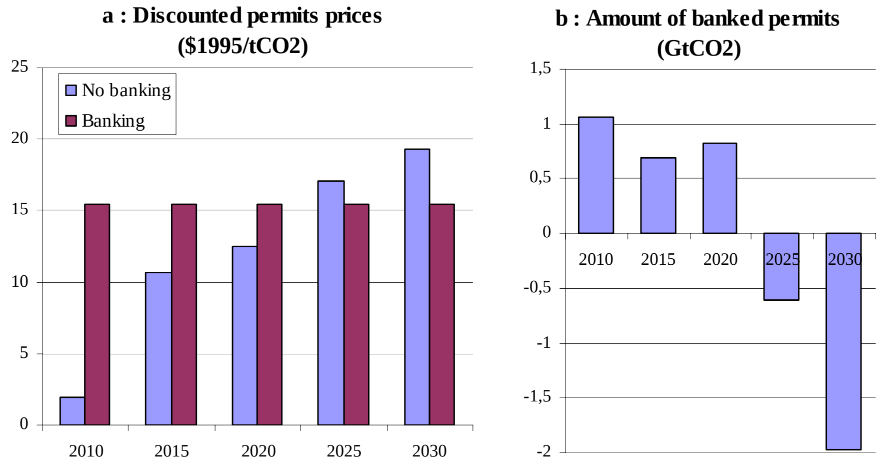

Figure 4: Permits prices and banked permits

In the first commitment period (2010), the price, taking the banking possibility into account, is much larger than the non-banking price, by a factor of 8. This result suggests that, in the perspective of future (post-Kyoto) commitments, countries (economics agents within countries) will engage in significant carbon abatement activities as early as 2008-2012, although the emission reduction targets in that period have become unambitious due the US withdrawal and the large amount of hot air.

As far as the amount of banking is concerned, Figure 4.b shows that countries bank permits during the first three periods and use those permits in the following two periods.

3.2.2 Impact of banking on compliance costs

The world "gains from intertemporal trades" –i.e., the gains obtained by making use of the banking provision--are computed by substracting the discounted sum (over all countries and over the five periods) of compliance costs when no permits are banked from the same sum when countries do bank emission permits. This difference amounts to 10.5%, meaning that the banking mechanism leads to a substantial decrease in world compliance costs.

However, the gains from intertemporal trades are not equally distributed. In fact, we observe that the use of the banking mechanism increases the compliance costs of all participating Annex-B countries, except the countries of Central and Eastern Europe (mainly Russia and Ukraine, CEU hereafter). This increase is substantial (+21% for EU countries (EU15)). The main beneficiaries of the banking mechanism are CEU and non-Annex-B countries. Indeed, as a consequence of the banking mechanism, the permits price rises when these countries are net sellers of permits (or CDM credits), i.e. in the first commitment periods, while the price decreases when many of them become sellers of permits, i.e. in the last commitment periods.

3.3 Alternative scenarios and sensitivity analyses

Under more ambitious post-Kyoto commitments, the gains from intertemporal trading become even more important. For instance, a world objective of 24.5 $GtCO_2$ in 2030 (i.e., an increase by 14% in world emissions compared to 1990) leads the banking mechanism to save 12% of total compliance costs. The first period permits price is augmented by a factor of 20.

Numerous alternative scenarios that deal with the participation structure and the allocation rules have been considered; sensitivity analyses on the key parameters have been performed. But the qualitative results do not change: banking leads to a significant increase in the first period permits price and to significant cost savings. However, these analyses reveal that the order of magnitudes (of changes in permits prices and gains from banking) are particularly sensitive to baseline emissions and to the discount factor.

4 CONCLUSION

The banking provision of the Kyoto Protocol can be interpreted as an intertemporal flexible mechanism. Just like the international emissions trading mechanism, joint implementation and the clean development mechanism, banking can bring gains from trade. The MacBank simulation model shows that these gains are significant at the world level, even if post-Kyoto commitments are not particularly ambitious. However, in order to be able to capture these gains, post-Kyoto allocations need to be agreed upon as early as possible. Indeed, abatement strategies often require investment decisions, and these require planning.

Moreover, because the implementation of the banking provision would cause a large increase in the first period permits price, countries which are net importers of permits in the Kyoto commitment period, such as EU15, would bear larger compliance costs. On the contrary, countries like Russia, Ukraine and the non-Annex-B countries would gain much from the use of the banking provision since it substantially increases their revenue from permit sales. This should be accounted for when bargaining on future (post-Kyoto) commitments.

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