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Abstract

The question of how to share the costs of the measures to be taken against global warming is one of the most controversial questions in the international climate policy debate, and is, as yet, unsettled. The burden sharing agreement (BSA) reached by EU Member States is a rare example of a successful (regional) burden sharing scheme. The agreement was reached in two stages in March 1997 (pre-Kyoto) and in the Spring of 1998 (post-Kyoto). This paper analyses, from a political economy perspective, the factors which facilitated burden sharing within the EU and which determined the particular sharing rule adopted. Three "stylised facts" emerge from the study. First, countries with high national targets, which were assigned relatively large shares in the pre-Kyoto BSA, had their shares reduced significantly in the post-Kyoto BSA. Second, the country presiding over the negotiations was assigned a disproportionate large share. Third, attempts were made to relax political constraints by singling out the abatement requirements of specific sectors. We propose a simple game-theoretical model to explain these facts. We show how the share of the total burden that a country has to shoulder in equilibrium depends on what national targets it adopts, the fall-back positions of the other countries, and on who chairs the negotiations

Zusammenfassung

Zu den am heftigsten umstrittenen Themenfeldern in der internationalen Klimapolitik zählt die Frage, wie die aus Klimaschutzmaßnahmen resultierenden Lasten zu verteilen sind. Ein seltenes Beispiel für eine erfolgreiche und nachvollziehbare Aufteilung von Reduktionsverpflichtungen stellt das zwischen den EU-Staaten ausgehandelte Lastenverteilungsabkommen dar. Dieses wurde in zwei Stufen, im März 1997 und im Frühjahr 1998 erreicht. Während das erste Abkommen im Vorfeld der internationalen Klimaverhandlungen von Kyoto zustande kam und einen nicht rechtsverbindlichen Charakter aufweist, wurde im zweiten, bindenden Abkommen das in Kyoto akzeptierte Gemeinschaftsziel zwischen den EU-Mitgliedsstaaten aufgeteilt. Dieser Beitrag analysiert die Faktoren, die eine Einigung innerhalb der EU ermöglicht haben und das Verhandlungsergebnis beeinflussten. Aus der Analyse des Verhandlungsprozesses ergeben sich drei stilisierte Fakten: Staaten, die ein ehrgeiziges nationales Emissionsziel aufweisen, erhielten ein hohes Reduktionsziel in der ersten Verhandlungsrunde, konnten sich in der zweiten Runde aber signifikant verbessern. Das Land, das in der jeweiligen Verhandlungsrunde die Ratspräsidentschaft innehatte, wurde mit einem höheren

Lastenanteil bestraft. Über Ausnahmeregelungen für bestimmte Sektoren konnten Widerstände einflussreicher Gruppen gegen die geplante Verteilung gemildert werden. Diese Beobachtungen lassen sich anhand eines einfachen Verhandlungsspiels rationalisieren. Wir zeigen, wie der Lastenanteil, den ein Land im Gleichgewicht trägt, von seinem nationalen Ziel, der Rückfallposition anderer Länder sowie von der Frage, wer die Verhandlungen präsidiert, abhängig ist.

1 Introduction

Over the last decade scientific evidence on anthropogenic influence on global climate due to emissions of greenhouse gases has accumulated. At the same time, projections of what has to be expected in a business-as-usual-scenario have become more worrisome. In its third Assessment Report, the International Panel on Climate Change (IPCC) serving as scientific authority in the field of climate policy now estimates world temperature to rise between 1.4°C and 5.8°C by the end of this century, correcting its former estimations to an even higher value (IPCC, 2001). Today, the problem of climate change is generally acknowledged by most scientists and politicians but mitigation measures are only starting slowly.

A convincing explanation for this "implementation-lag" has been given in the economic literature where protection of the earth's climate has often been described as a global public good (Cline 1992, Nordhaus 1994, Sandler 1997). While the reduction of greenhouse gas emissions is a costly affair for those countries that undertake it, the benefits of climate protection are shared by all countries. Thus, there is little incentive for individual countries to provide for the common good. "Let others do the job" is the individually dominant but collectively problematic strategy that will be pursued by rational and self-interested actors. This holds true just as much for individuals as it does for representatives of sovereign states.

One way forward, suggested by economic theory, is to look for stable international environmental agreements that commit the affected parties to take appropriate action and limit the scope for free riding (see, for example, Barrett 1990, 1997). In practice, it has, however, proved difficult to sustain international environmental agreements that go much beyond codifying what the countries would have done anyway. These problems are particularly apparent in the international climate negotiations. Here, the disposition of national representatives to adopt binding and effective reduction targets for greenhouse gas emissions is very weak and the emission targets that have been agreed upon at Kyoto in 1997 have ever since been challenged openly or secretly through the introduction of distorting accounting methodologies. Also, the average emission reduction of 5.2% over all industrialised countries agreed in the Kyoto Protocol is only a first small step towards what scientists consider a safe minimum reduction level. In the case of global warming, the difficulties of achieving far-reaching agreements are enhanced further by the fact that the costs and benefits of climate policy are not

distributed evenly but differ tremendously across countries. While some countries are particularly vulnerable to the adverse effects of climate change (e.g. small island states) others do not expect to suffer much or will even gain from climatic change. Developing countries expecting to experience significant economic growth in the future are reluctant to commit to strict targets and argue that the lion's share of the adjustment cost should be borne by the developed countries. It is therefore clear that even if here are significant aggregate gains to be won by taking joint action against climate change,[1] the distribution of these gains is a crucial factor determining which actions can actually be taken. An instrumental factor for the success of international agreements thus appears to be that proper attention is paid to burden sharing.

While at the international level, many of the problems associated with the distribution of the burden of a proactive climate policy are still unsolved, the European Union (EU) has successfully worked out a Burden Sharing Agreement (BSA) among its Member States that in a sophisticated manner takes account of national differences. The background for the BSA among the EU Member States is the so-called "Bubble" agreement laid down in Article 4 of the Kyoto Protocol and pushed for at Kyoto by the EU. It allows groups of countries to accept a common emission target and to redistribute it internally.

The negotiations that led to the final adoption of a burden sharing agreement within the EU in the Spring of 1998 took place in two stages. An initial agreement was reached in March of 1997 in the preliminary stages of the Kyoto negotiations, i.e., before the EU had committed to the Kyoto reduction target. At this junction, the Member States agreed to a burden sharing scheme that allocated a 10% reduction of EU-wide emission of greenhouse gases among them. After the Kyoto-Protocol had been signed in late 1997 and the EU had committed itself to an overall emission reduction target of 8%, the Member States entered into a second round of negotiations which led to the adoption of the official BSA in the Spring of 1998. During the second round, the initial agreement was not only adjusted to reflect the (lower) Kyoto target but a significant redistribution of the burden among Members also took place.

1 Note, however, that neither costs nor benefits are known with any degree of certainty.

Although the two agreements are not fully comparable as the first one only encompasses three greenhouse gases whilst the second one includes all six gases that are listed under the Kyoto Protocol, they still make for an interesting comparison, and almost serve as a "natural" experiment to investigate the impact of international commitments on regional burden sharing agreements. In addition, the conflict of interest between developing and developed countries that renders a global burden sharing agreement so difficult has a counterpart within the EU. In the EU, the group of countries with low per capita income and emission levels but with high growth expectations (the cohesion countries) stood opposite to the group of richer member states (the non-cohesion countries) accounting for most of the total emission of greenhouse gases from the region in the burden sharing negotiations.[1] The fact that it was possible to reach an agreement, suggests that there are ways of overcoming these difficulties.

This paper has two purposes. First and foremost, it offers a detailed description of the process that led to the adoption of a burden sharing agreement within the EU. We characterise the allocation rules embodied in the BSA reached before and after Kyoto using a number of normatively motivated distribution rules – such as the equity and sovereignty rule – as benchmarks. We pay particular attention to the differences between the initial and the final agreement in order to identify the impact of the Kyoto commitment on the BSA. We also highlight the role of national emission reduction targets and political leadership in reaching agreement. From this part of the study three stylised facts emerge. First, countries who had adopted high national targets prior to the negotiations were assigned relatively large shares in the initial, pre-Kyoto BSA. More interestingly perhaps, the same countries had their shares reduced significantly in the post-Kyoto BSA, while those countries who got off more lightly in the initial agreement saw their share of the burden increase. Second, it seems that the country presiding over the negotiations was assigned a disproportionately large share. Third, attempts were made to relax political constraints by singling out the abatement requirements of specific factors

Second, we propose an analytic framework to make sense of these facts. In particular, we argue that the facts can best be understood by taking into account explicitly the political constraints that bind the hands of the national representatives that participate in

1 The term "cohesion countries" refers to the group of low-income countries that receive financial support from the European cohesion fund directed at promoting the European integration. The group of cohesion countries encompasses Spain, Portugal, Ireland and Greece.

the negotiation process. We use the theory of two-level games, which acknowledges the interplay between domestic politics and international relations (Putnam, 1988), as the starting point for our formal analysis. We develop a game-theoretical bargaining model that, despite its simplicity, can account for several of the stylised facts by relating the outcome of the bargaining process to the national targets adopted by the countries, to common international commitments approved collectively by the countries, and to the self-seeking interests of the chairman of the negotiations.

The rest of the paper is organised as follows. In section 2, we discuss some burden allocation rules often proposed in the literature. In section, 3, we present the analytical framework. In section 4, we describe the process that paved the way for the two agreements and identify three stylised facts. In section 5, we develop a simple game-theoretical bargaining model, using the notion of two-level games, to explain these facts. In section 6, we conclude with a discussion of the findings and highlight the policy implications.

2 Competing emission target allocation rules

The problem of how the burden of climate policy should be allocated across countries is one of the most challenging issues in international climate negotiations and similarly, also in climate talks within the EU. How the constraints on emissions are distributed will largely determine the allocation of abatement costs.

A common understanding in international negotiations is that developing countries should not be burdened to the same degree as industrialised countries due to their poor economic situation and lower per capita emission levels. This understanding is expressed in the normative principle of “common but differentiated responsibilities” laid down in the United Nations Framework Convention on Climate Change (UNFCCC). In the EU, Member States generally agree that for similar reasons, cohesion countries should be most favoured in an EU burden sharing scheme.

However, as it stands, the principle of “common but differentiated responsibilities” still leaves much scope for interpretation. Until now, there is no universally accepted rule that spells out implications of this principle in detail. Rather, competing target allocation rules suggested by different actors continue to shape the negotiating process. In the

following, the most relevant allocation rules in climate negotiations will be introduced and applied to the EU burden sharing problem.

The simplest form of burden sharing which Schmidt and Koschel (1998) term the sovereignty rule is the assignment of equal percentage reductions to all countries. Each Member State would have to reduce emissions by a uniform rate representing the common reduction target. The rule can be rationalised as being the result of sovereign states bargaining over the issue with equal bargaining power. As it builds on status quo emissions it has also been characterised as "squatter's rights" (Grubb 1995). In terms of legitimacy, there is no real argument supporting the rule other than protection of rights that have been established by past usage or custom. Based on John Locke's and Robert Nozick's theories on the inital appropriation of unowned goods Helm and Simonis (2001) characterise the past usage as a morally acceptable distribution rule in cases in which "enough and as good" is left in common for others. However, with respect to climate change the problem is that not enough is left, meaning that others cannot appropriate an equal right to emit as nature's capacity to absorb emissions is clearly limited (Helm, Simonis 2001, p.9). The allocation of emission rights based on the status quo also violates the principal of "common but differentiated responsibilities" unless the very heroic interpretation is chosen that the principle would refer to absolute instead of relative reductions. Being out of the morally acceptable propositions' range does not say, however, that the rule would not be favoured by some Member States.

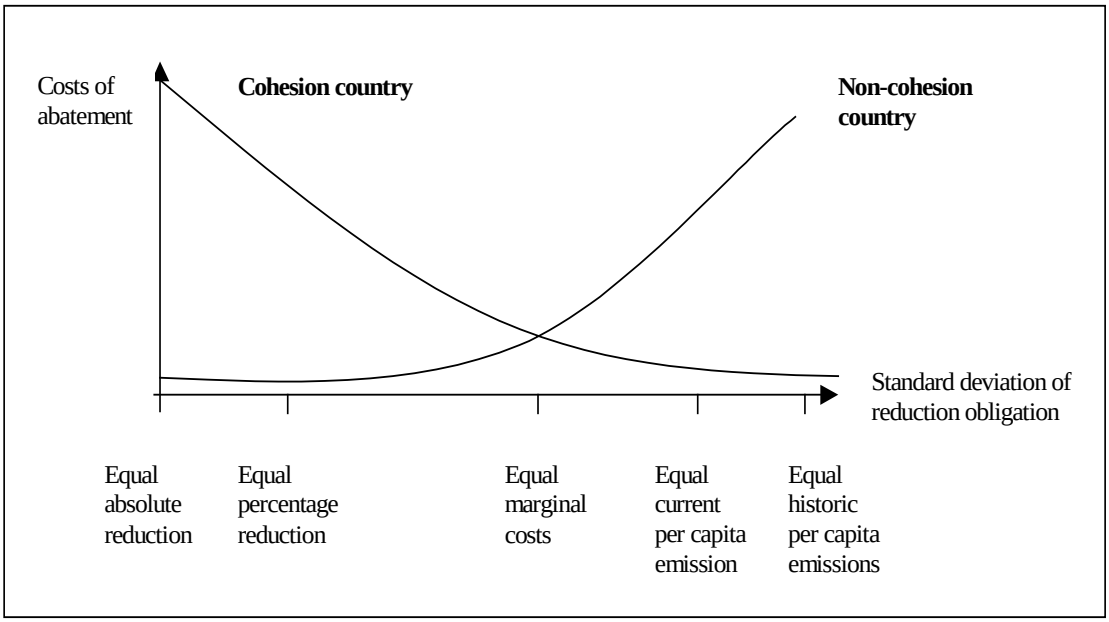
On the opposite end of the spectrum stands the equity rule which assigns equal per capita entitlements to all human beings. From the beginning of climate negotiations until now it has been kept up especially by the developing countries. With the underlying assumption that nature consumption is a human right that must not be granted differently the equity rule is morally convincing. Generally, it is formulated either with respect to current or historic emission levels, the latter being the more comprehensive and thus the more disputed one. As a reference point it takes a country's cumulated historic emissions since, for example, the beginning of industrialisation (den Elyzen et al. 1993). The equity rule could also be used looking at projected future emissions during the commitment period. While the sovereignty rule is objected on moral grounds, the equity rule faces serious implementation difficulties as it requires fundamental structural changes within high-emitting countries and leads to strong redistribution. Taking account of the heavy burden that this would place on some

countries proposals have been made to use the equity rule as a long-term target. Per capita emissions should contract and converge until, for instance 2045 (Meyer 2000).

Economic approaches to the problem of burden sharing concentrate on the level of abatement costs in different countries. Fairness-oriented approaches would call for a distribution of emission targets so that each country faces equal abatement costs either in terms of the absolute value or relative to the country's GDP. Efficiency-oriented approaches focus on the equalisation of marginal abatement costs through the allocation of emission targets. To the extent that the EU countries will be allowed to trade emission permits with each other at a EU-wide market, as suggested by the European Commission (see CEU, 2001), and to the extent that such a market will be competitive and transaction costs are limited, least (abatement) cost allocations can be reached independently of the initial allocation of the burden among the countries (see, e.g., Baumol and Oates, 1988, chapters 11-12) and so, the initial allocation is not a predominant issue.

Figure 1 illustrates the cost-effects of different allocation rules for a cohesion and a non-cohesion Member State. It shows their competing interests in the choice of the distribution rule. As the allocation of a given target is a zero-sum game a distribution rule that benefits the rich, high emission Member states always discriminates –although not to the same extent – against the poor, low emission Member States and vice versa.

Figure 1 Cost effects of different allocation rules



Besides this basic conflict of interest between the cohesion and non-cohesion countries with respect to the allocation rule, countries also argue on the more complex floor of individual circumstances. There is a long list of arguments countries put forward in order to be awarded special exemptions from reduction obligations. For example, northern countries argue that because of unfavourable climatic conditions they need to consume more than average energy for heating thus forcing them to emit more than average greenhouse gases. Also, attempts have been made to shift the burden on another country: for example, it has often been claimed that Germany benefited largely from reunification and the collapse of heavy industry in East Germany ("wall-fall-profits") and should consequently take over a larger portion of the obligation. As the need for adjustment from these claims cannot be estimated easily the individual circumstances further complicate negotiations.

From the menu of potential burden sharing rules illustrated in Figure 1, it would not be unreasonable to restrict attention to the rules that fall between the polar cases of the sovereignty and the equity rule. [1]

3 An analytical framework

Without any doubt, numerous political and economic factors played a role in determining the characteristics of the particular burden sharing rule adopted by the EU Member States. To structure the discussion, it is therefore useful to outline a general analytical framework that can serve as a guideline for interpreting events.

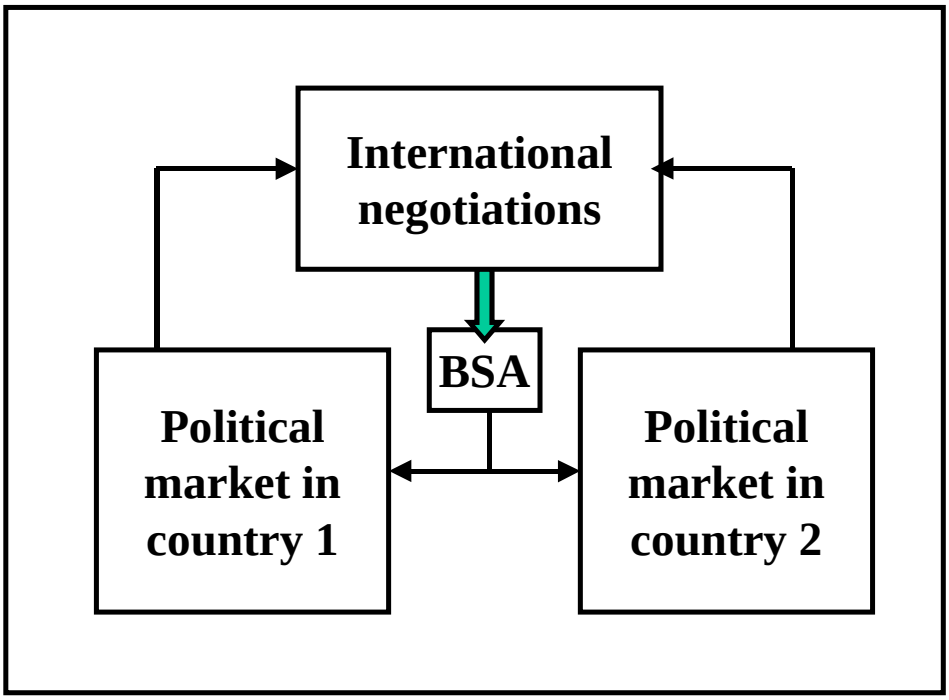
The economic literature on international environmental agreements tend to treat the participants in international negotiations as monolithic and benevolent governments that sincerely represent the common interest of their country (see, e.g., Barrett, 1997). While this approach has yielded many important insights, it appears somewhat incomplete and inappropriate for analysing the burden sharing agreements reached by the EU in 1997 and 1998. In particular, it leaves out the fact that government officials (elected politicians or bureaucrats) often have interests that partly or wholly conflict with their constituencies, and that it is the incentives embodied in elections and other political control systems that ultimately determine what these government officials can and will do at the negotiations table. These ideas have, of course, long be recognised by political scientists and public choice scholars, and have been formalised in the theory of two-level games (see Putnam, 1988).

The theory of two-level games explicitly acknowledges that international relations and domestic politics are entangled and that the political constraints and pressures that the representatives face at home shape the outcome of international agreements. The general structure of a two-level game is illustrated in Figure 2. As the name of the theory suggests, the game is played at two levels: the international level, where the representatives for the relevant countries meet to negotiate the terms of an international agreement, here a burden sharing agreement, and the national level, where a political

1 Presumably no cohesion country would accept a higher emission target than a non-cohesion country and no non-cohesion country would allow per capita emissions in cohesion countries to increase even beyond the level of non-cohesion countries. Note also, that the outer left distribution rule, equal absolute reduction, in many cases is not feasible due to differences in size of the countries.

market constrains the set of politically acceptable actions available to the national representative during the negotiations at the international level.

Figure 2: The two-level game



The national political markets impose constraints on the representatives in many ways. Politicians, whose main motivation is to win elections, would obviously not be willing to scarify political office in order to reach agreement at the international level. While voters are concerned about many different policy issues, opinion polls suggest that they, in all EU Member States, take a basic interest in the issue of climate change, although priority placed on it differs from country to country (CEU, 1999). Successfully reaching a burden sharing agreement at the international level is therefore important for national politicians who want to demonstrate progress in the implementation of climate policy, and ultimately for winning elections. Adoption of emission targets is of high symbolic value in itself and will thus be watched and honoured by voters interested in climate policy. That is, voters may well reward politicians for reaching international agreements, even though the "real" benefits of action against climate change are highly

uncertain and would, in any case, not materialise until far into the future. The perceived benefits as well as the symbolic value of action may therefore play a key role in determining the voting behaviour of environmentally motivated voters. On the other hand, reducing greenhouse gas emissions is costly, and the costs are borne by firms and households immediately. When politicians seek to implement climate policies, they therefore risk losing votes from voters facing high abatement costs. Also, some policy measures prove to be of high public sensitivity such as raising taxes on gasoline. Lost votes as a result of costly and/or ill-designed policies are the opportunity costs politicians have to face when taking measures against climate change (Michaelowa, 1998).

The constraints imposed by elections are by no means the only ones. Special interest groups – in particular business associations and environmental NGOs – also play an important role, and are typically able to affect the behaviour of politicians by providing information, by financing election campaigns, or by bringing climate change policies to the forefront of the minds of voters (see Grossman and Helpman, 2001). It is interesting to note that the two main groups have very different interests regarding burden sharing. To international NGOs, the distribution of the burden is not that important as long as the overall EU-wide commitment remains significant. To them, it is especially important that the EU is taking the lead in climate policy and is convincing the international community of doing likewise. National business associations, on the other hand, will be keenly interest in the distribution of the burden and will resolutely lobby against high national targets.[1] Conversely, national environmental NGOs take an interest first in national obligations and only second in the overall EU target.

All these political factors are taken into account when the representatives of the countries meet at the international level to share the burden of abatement, and define the sharing rules that individual representatives would consider politically acceptable. Representatives of countries with a high percentage of voters interested in climate policy and/or strong environmental NGO engagement in this field will be more willing to make concessions in order to achieve progress than others. Those, whose constituencies are primarily concerned with the costs of climate policy measures, would be more reluctant to accept significant international commitments. As pointed out by Olson (1965), agents with strong interests in a collective good can be exploited by those

1 An exception needs to be made with respect to those businesses profiting from GHG emission reductions such as the nuclear and the renewable energy industry.

with only minor interests. This suggests that representatives whose constituencies weigh the issue of climate protection highly will be inclined to accept more than an average share of the burden.

4 The negotiation process

With this framework in mind, we now turn to the discussion of the two burden sharing agreements. We make a distinction between the agreement reached in March 1997 before the Kyoto agreement of December 1997 (the pre-Kyoto case) and the burden sharing agreement reached in the aftermath of Kyoto in the Spring of 1998 (the post-Kyoto case).

4.1 The first agreement on commitment distribution (the pre-Kyoto case)

Ever since the early 1990s EU governmental delegates had been trying to work out an agreement on differentiated reduction commitments but it was not until March of 1997 that a first deal was struck.[1] Clearly, the date of the agreement can be seen in connection with the third Conference of the Parties that were scheduled to convene in December of 1997 at Kyoto. According to the Berlin Mandate of 1995 a protocol containing binding emission targets and timetables for industrialised countries should be adopted during the conference. In the preliminary stages to the Kyoto conference it had become obvious that other OECD countries such as the US, Japan, Canada and Australia were quite disengaged with the issue of climate protection. In order to put political pressure on these countries and to convince them to accept meaningful emission targets at Kyoto the EU ministers were in need of demonstrable progress. Only if the EU itself could credibly commit to an ambitious target it could take the lead in international climate negotiations. The fact, that the EU ministers were only able to reach an agreement shortly before Kyoto shows the paramount effect of political pressure from outside.

Another factor stakeholders unanimously describe as facilitating the agreement was an expert proposal commissioned and instructed by the Dutch presidency. The so-called triptych approach calculates national emission targets bottom-up, based on three different sectors: The domestic sector, the heavy-industry and the electricity generation sector. For each sector, a different allocation rule is chosen.

1 For a detailed description and analysis of the negotiation steps see Ringius 1999

As for the domestic sector, consisting of households, services, light industry, agriculture and transportation, the equity rule applies. It is acknowledged that per capita emissions will and should converge in future, possibly by the year 2030. Emission entitlements in the domestic sector during the commitment period can be calculated by linear interpolation. As a special grant to northern countries, per capita emission entitlements are corrected for adverse climatic conditions.

In the energy-intensive heavy industry sector an equal growth rate and the same energy improvement rate is assumed for all countries, taking the existing industry structure as given. In addition, a correction for German "wall-fall-profits" is suggested. Ringius observes that the heavy industry had been singled out partly for political reasons: In earlier years, these industries had strongly opposed the energy/carbon tax proposed by the Commission and had been granted exemptions from the tax. In the triptych proposal emission entitlements allocated to the heavy industry sector correspond with business-as-usual forecasts (Ringius 1999, p.143-144). It is noteworthy that with respect to the heavy industry sector equity considerations are not relevant. The price of granting more lenient targets to cohesion countries is paid predominantly by the light and domestic sector. This is assuming that the triptych approach is not only used for the initial allocation of the burden between countries but will also be relevant for future burden sharing between sectors. In the light of Political Economy the outcome can be explained by the representation asymmetries between the well-organised large emitters and loose groups of other firms and the general public in the negotiation process.

For the electricity sector a tailor-made approach is adopted. The triptych approach requires some minimum share for renewable energy and CHP and limits the use of oil and gas as well as annual growth of electricity consumption. Cohesion countries are granted extra allowances of energy consumption. With the liberalisation of the European energy market this provision does not discriminate against utilities of non-cohesion countries, but again, the burden rests on the general public of non-cohesion countries.

The appeal of the triptych approach is that it accommodates national circumstances without being overly complicated thus lending transparency to the negotiation process. As it was designed by neutral experts it is also not suspicious in terms of serving particular interests. However, the triptych approach is not identical with the final outcome of the agreement (table 1). Rather than prescribing an outcome to Member

States it served as a starting point for discussion. In the negotiating process that followed, two other aspects seem to have influenced the final distribution agreement.

Table 1: EU burden sharing schemes and national targets in the pre-Kyoto case

Member State	Agreement 1997	Sovereignty rule	Equity rule	Original triptych	National Targets (target year)
Austria	-25	-10	-8.1	-4.8	-20 (2005)
Belgium	-10	-10	-33.5	-15.1	5 (2000)
Denmark	-25	-10	-41.4	-14	-20 (2005)
Germany	-25	-10	-33.0	-19.6	-25 (2005)
Finland	0	-10	5.4	-7	0 (2000)
France	0	-10	-2.6	-12.3	13 (2000)
Greece	30	-10	84.6	-1.8	25 (2000)
Ireland	15	-10	15.9	-4.9	20 (2000)
Italy	-7	-10	10.7	-8.8	0
Luxembourg	-30	-10	n.a.	-19.8	-20 (2005)
Netherlands	-10	-10	24.8	-8.9	3-5 (2000)
Portugal	40	-10	345.8	15.5	40 (2000)
Sweden	5	-10	-25.1	21.5	0
Spain	17	-10	48.9	6.2	25 (2000)
UK	-10	-10	-33.4	-19.5	0
EU-15	**-10**	**-10**	**-10.0**	**-12.6**	**0**

Source: Koschel, Schmidt (1998); Dessai, Michaelowa (2001), Blok, Phylipsen, Bode (1997)

It is interesting to note that Member States that had adopted high national targets prior to burden sharing negotiations have been assigned the highest targets in the 1997 agreement. There is a significant discrepancy between Austria, Denmark, Germany and Luxembourg that with the adoption of a high national target had revealed strong interests in climate protection and the rest of the high emitting countries UK, the Netherlands and Belgium. These have been assigned much lighter burdens. Neither the equity rule nor the triptych approach however suggests a difference in treatment between them. On the contrary, Austria, for example, would have been treated more lenient than the UK if the latter rules had been applied. This result is in line with Olson's principle that revelation of strong interests leads to exploitation. Also, it can be interpreted as first-mover-disadvantage.

Finally, the figures for the Netherlands suggest that holding the presidency during negotiations has a negative impact on national interests. With the exception of Luxembourg and Austria, the Netherlands is the only Member State whose emission target in the agreement coincides with the highest of all proposed schemes. As stated

above, one would expect the final target to lie somewhere in between the value of the equity and the sovereignty rule. If it is higher this could be due to selective incentives of the ministers in charge. In case of the Dutch minister it is quite intuitive to assume personal satisfaction from brokering the deal. If agreement was only slightly away the Dutch presidential might have been willing to fill the gap. The country holding the presidency thus can serve as a pivotal player in the negotiations.

4.2 Revision of the burden sharing after Kyoto (the post-Kyoto case)

Although internally, only 10% reduction had been allocated among Member States at Kyoto, the EU offered to reduce its emissions by 15% hoping for other OECD-countries to follow suit. As foreseeable, this target could not be established as a common target for all industrialised countries. Instead, the EU reduction obligation was considerably lowered to 8% whereas the rest of heavy-weight OECD countries accepted slightly lower targets. Besides the adjustment to six greenhouse gases and the change of the target year from 2010 to the period of 2008-2012 a more fundamental change occurred: While the first distribution agreement could be characterised as finger exercise the EU now had a binding target. The differences between the first and the second agreement on burden sharing reflect this change in nature (**table 2**).

Table 2: Differences between the pre- and the post –Kyoto burden sharing scheme

Member State	Pre-Kyoto BSA	Post-Kyoto BSA	Difference
Austria	-25	-13	+12
Belgium	-10	-7.5	+2.5
Denmark	-25	-21	+4
Germany	-25	-21	+4
Finland	0	0	0
France	0	0	0
Greece	30	25	-5
Ireland	15	13	-2
Italy	-7	-6.5	+0.5
Luxembourg	-30	-28	+2
Netherlands	-10	-6	+4
Portugal	40	27	-13
Sweden	5	4	-1
Spain	17	15	-2
UK	-10	-12.5	-2.5
EU-15	**-10**	**-8**	**+2**

The most outstanding difference between the first and the second agreement is that non-cohesion countries are better-off while all cohesion country targets have been tightened. Distribution has clearly turned in the direction of the sovereignty rule. The greatest winner is Austria whose emission target had been unreasonably high in the former agreement.

Once emission targets become binding, equity considerations obviously turn more costly and equity provisions tend to be diluted. Also, the bargaining position of cohesion countries has considerably weakened: Before the Kyoto-target was approved, failing negotiations in the EU were of no consequence. After its adoption, however, cohesion countries would be left with the common target of -8% if no co-operative solution could be found. In this hold-up situation they are forced to accept less favourable burden distributions.

In spring of 1998, the official EU Burden Sharing Agreement was reached under UK presidency. As in the case of the Dutch presidency, chairing negotiations tends to go along with negative impacts on national interests as highlighted in the following anecdote: Drawing upon the humiliation for the whole EU if it was unable to distribute even -8% after pushing for a -15% target at Kyoto Michael Meacher, Junior UK environment minister at that time exclaimed: “As far as I’m concerned I will not leave the room until we’ve got an agreement. ” (Anonymous 1998, p.2)

4.3 Summary of findings

The analysis of the two burden sharing agreements reveals a number of “stylised facts” which we may summarise as follows:

1. The countries with the highest national targets were assigned relatively large shares in the pre-Kyoto BSA, but had their shares reduced significantly in the post-Kyoto BSA.
2. The country holding the presidency (chairing the negotiations) was assigned a relatively large share in both BSAs.
3. Attempts were made to relax political constraints by singling out the abatement requirements of specific sectors using the triptych approach.

To guide our understanding of these facts, we develop a simple bargaining model in the next section. The model combines insights from the theory of two-level games (Putnam,

1988) and the theory of sequential bargaining (Rubinstein, 1982). As discussed above, the theory of two-level games shows how international relations and domestic politics are entangled, and how the outcome of international negotiations can best be understood by taking into account that the players at the international level are subject to political constraints and pressures at the domestic level. The theory of sequential bargaining provides a powerful tool for analysing how an agreement at the international level might be reached – subject to domestic politics. Accordingly, a combination of the two seems an appropriate starting point for theorising about what happened during the pre- and post-Kyoto burden sharing negotiations in the EU.

5 A simple bargaining model

5.1 Outline of the model

We consider a region with I countries, indexed by i=1,2,...,I. The region has an aggregate abatement target, denoted N^A, which specifies the total amount of abatement to be undertaken by the I countries. We treat the target as given.[1] The countries have to decide on how to share the burden of abatement among them. The negotiations, which may lead to a burden sharing agreement, take place at the international level in a (finite) sequence of meetings, indexed t=1,2..,T. During these meetings, each country is represented by a government official, which we shall refer to as the country representative. The country representatives take turns chairing the meetings. The representative holding the chair in round t controls the agenda, and makes take-it-or-leave-it offers to the representatives from the other countries. An offer is a particular burden sharing scheme, $\{n_{1,t},....,n_{I,t}\}$, with $\sum_i n_{it} = N^A$, where n_{it} is the abatement to be undertaken by country i at time t. The representatives from the other countries can either accept the offer (S_t =A) or reject it (S_t =R). If all accept the offer, then the negotiations are concluded successfully, and the agreement is implemented; if not, the negotiations continue to the next round under the leadership of a new chairman, and no abatement is undertaken in the meantime. After T-1 rounds, the negotiations terminate by default and the countries implement $\bar{n}_i$, where $\bar{N} = \sum_i \bar{n}_i$. We can think of $\bar{n}_i$ as the fall back options, i.e., what the countries would implement either unilaterally or as part

1 A more complete theory of burden sharing agreements would explain the joint determination of the target and the way it is being shared. In particular, it is possible that the target is affected by the particular burden-sharing scheme that goes with it.

of a larger international agreement in case a burden sharing agreement cannot be reached[1]. All this is common knowledge.

At the national level, a political market holds the country representatives accountable for what they do in the negotiations. For example, elected representatives take into account how a particular agreement might affect reelection prospects, and to the extent that the government is captured by special interests (Stigler, 1971), the impact on specific groups might also constrain what the representative is willing to agree on in the negotiations. To capture these ideas in a simple way, we assume that each representative enters the negotiations with the view to maximising a political support function.[2] The political support function M_i of country i trades off the political benefit of abatement, $B(.)$, against the cost, $c(.)$:

$$M_i[B(\sum_i n_i; Q), c(n_i)] = \beta_i B(\sum_i n_i; Q) - \alpha n_i \quad (1)$$

We assume that political support is increasing in the benefits and decreasing in the costs. The benefits, B(.), themselves are an increasing, concave function of total abatement undertaken in the region, $N = \sum_i n_i$, and abatement undertaken elsewhere in the world, Q. The benefit function is meant to capture the benefits that voters and environmental NGOs in the relevant country attach to the actions taken by their government. Since the benefits depend on total abatement and not on the distribution among countries this implies that voters and NGOs are largely interested in whether or not an agreement that improves upon the status quo is reached. Hence, we can think of the benefits as being related not only to the actual benefits of abatement, but also to the symbolic value of reaching an agreement as voters will have the comfort that the issue is being addressed. The costs αn_i, on the other hand, depend only on the abatement undertaken in the country itself. This captures that resistance to costly abatement policies mainly arise from the producer interests that worry about the share of the cost they have to bear. To simplify the analysis, we assume that the political support function is linear in the two arguments and that $\beta_i > 0$, $\alpha > 0$, and $B(0,0) = 0$. Further, we assume that the abatement cost function is linear over the relevant range, i.e.,

1 The precise amount of abatement undertaken in case burden sharing fails depends on the particular circumstances surrounding the negotiations. We return to this point below.

2 The political support function can be derived from a number of different models of political competition. Grossman and Helpman (1994) show how it can be derived from a common agency model in which lobby groups seek influence on policy by means of election campaign contributions. Coughlin and Nitzan (1981) show how, under some circumstances, competition between two political parties for votes can lead to a political support function. For our purposes, the precise structure of political competition is, however, not important.

$c_i(.) = c(.) = \alpha n_i$ for all i. Cross-country differences in the political attitude towards environmental preservation are captured by β_i: the political weight given to the benefits relative to the costs of abatement. We refer to β_i as the environmental valuation of country i.

In addition to the political support that a particular agreement might carry domestically, each representative also cares about concluding the negotiations successfully because of the prestige and publicity that follow from doing just that. While all representatives are likely to care about this, we focus on the case in which it is mainly the chairman that benefits. We therefore assume that the representative holding the chair in period t gains utility m, if he or she is able to conclude the negotiations successfully. For simplicity we let m be the same for all representatives, and we refer to it as the chairman rent. We can now define the payoff of representative i in period t<T as follows:

$$v_{i,t} = \begin{cases} \lambda_{i,t} m + \beta_i B(N^A; Q) - \alpha n_{i,t} & \text{if } S_t = \text{A} \quad \text{for all } i \\ 0 & \text{if not} \end{cases} \tag{2}$$

where $\lambda_{i,t}$ is equal to 1 if the representative from country i holds the chair in round t, and is equal to 0 otherwise.[1] The payoffs obtained in period T, where the negotiations terminate without agreement, are:

$$v_{i,T} = \beta_i B(\overline{N}; Q) - \alpha \overline{n}_i \tag{3}$$

The representatives discount their payoffs at the common discount rate $\delta \in [0,1]$. To keep the algebra simple, we assume in the following that T=3 and I=2. We may think of the two countries as representing the group of cohesion and the group of non-cohesion countries, respectively.

5.2 The equilibrium

Before we proceed to the analysis, the following assumption should be highlighted:

1 Here, we are implicitly assuming that Q=0 in case no agreement is reached.

Assumption 1. Suppose that

$$(\beta_1 + \beta_2)B(N^A;Q) - \alpha N^A \geq (\beta_1 + \beta_2)B(\overline{N}\ ;Q) - \alpha\overline{N} \tag{4}$$

$$(\beta_1 + \beta_2)B(N^A;Q) - \alpha N^A > 0 \tag{5}$$

The assumption basically says that there are gains from cooperation (equation (4)), and that the region would not want to set a regional target or agree to an international target that yields less joint (net) welfare than what could be obtained if nobody undertook any abatement at all (equation (5)).

5.2.1 Characterisation of equilibrium

We use the notion of subgame perfect Nash equilibrium to define a bargaining equilibrium of the game outlined above. Accordingly, we can precede by backwards induction to identify possible equilibrium configurations.

In round 2 of the negotiations, the representative from country 2 holds the chair, and it is he who makes an offer. If the chairman wants to conclude the negotiations before they move on to the terminal stage, he must put forward an offer that the representative from country 1 wants to accept. The representative from country 1 only accepts an offer that yields at least the political support she would get domestically by rejecting the offer and moving on to the terminal stage where each country implements its own target. Letting $\{n_{1,2}^P, N^A - n_{1,2}^P\}$ represent a "second round" offer or proposal, we can characterise the set of acceptable offers by the following inequality:

$$\beta_1 B(N^A;Q) - \alpha n_{1,2}^P \geq \delta\left(\beta_1 B(\overline{N};Q) - \alpha\overline{n}_1\right) \tag{6}$$

Rewriting equation (6), we get

$$n_{1,2}^P \leq \alpha^{-1}\beta_1\left(B(N^A;Q) - \delta B(\overline{N};Q)\right) + \delta\overline{n}_1 \tag{7}$$

The "optimal" offer from the point of view of the chairman, denoted $\hat{n}_{1,2}^{P}$, is that which makes the representative from country 1 just indifferent between accepting and rejecting, i.e., the offer that makes equation (7) hold with equality:

$$\hat{n}_{1,2}^{P} = \alpha^{-1}\beta_1\left(B(N^A;Q) - \delta B(\overline{N};Q)\right) + \delta\overline{n}_1 \tag{8}$$

We see that if there were no political benefits associated with having a regional target and having this target implemented sooner rather than later, then country 1 would not be willing to accept a burden sharing agreement that required it to go beyond its domestic target ($\overline{n}_1$) appropriately discounted. However, when the regional target is to the benefit of all, and a successful burden sharing agreement avoids delays in the implementation of the target, country 2 may be willing to take on more abatement than its domestic target.

The question, however, remains if the representative from country 2 wants to make an acceptable offer or if he prefers the negotiations to proceed to the terminal stage. The representative from country 2 prefers to make an acceptable offer if and only if

$$m + \beta_2 B(N^A;Q) - \alpha(N^A - \hat{n}_{1,2}^{P}) \geq \delta\left(\beta_2 B(\overline{N};Q) - \alpha(\overline{N} - \overline{n}_1)\right) \tag{9}$$

Using equation (8), we see that this condition is equivalent to

$$m + (\beta_1 + \beta_2)B(N^A;Q) - \delta N^A \geq \delta\left((\beta_1 + \beta_2)B(\overline{N};Q) - \alpha\overline{N}\right) \tag{10}$$

Note that equation (10) is identical to equation (4) of Assumption 1 if $\delta = 1$ and m=0. It is therefore clear that the representative from country 2 always wants to make an acceptable proposal (as $\delta < 1$). This is because the joint surplus from reaching a burden sharing agreement today is larger than the joint discounted surplus of continuing to the terminal stage. Moreover, the presence of the chairman rent ($m > 0$) increases his eagerness to reach an agreement. Hence, we conclude that if the second round of the negotiations were to be reached, the representative of country 2 would propose the burden sharing rule given by equation (8) and the representative of country 1 would accept the offer.

The two representatives take all this into account when they start round 1 of the negotiations under the chairmanship of the representative of country 1. If she wants to conclude the negotiations successfully, she needs to make an offer to the representative from country 2 that makes him at least as well off as he would be by rejecting the offer, and letting the negotiations proceed to round 2. Letting $\{n_{1,1}^P, N^A - n_{1,1}^P\}$ denote a "first round" offer or proposal, we can characterise the set of acceptable offers by the following inequality:

$$\beta_2 B(N^A;Q) - \alpha\left(N^A - n_{1,1}^P\right) \geq \delta\left(m + \beta_2 B(N^A;Q) - \alpha(N^A - \hat{n}_{1,2}^P)\right) \qquad (11)$$

Rearranging, we get

$$N^A - n_{1,1}^P \leq \delta(N^A - \hat{n}_{1,2}^P) + \alpha^{-1}(1-\delta)\beta_2 B(N^A;Q) - \alpha^{-1}\delta m \qquad (12)$$

where $\hat{n}_{1,2}^P$ is given by equation (8). The first term on the right hand side of condition (12), ceteris paribus, shows that the representative from country 2 would not be willing to accept a burden sharing agreement that requires his country to undertake more abatement that it would be required to undertake if the negotiations proceed to the second round, $N^A - \hat{n}_{1,2}^P$, appropriately discounted. The two additional terms, however, show that other considerations must be taken into account as well. The second term shows that the representative would be willing to undertake more than $\delta\left(N^A - \hat{n}_{1,2}^P\right)$. This is because, by doing so, his constituency would be able to enjoy the fruits of the joint effort sooner. The third term captures the fact that the representative of country 2 by accepting an agreement today forgoes the opportunity to chair the next round of negotiations. This implies that he is pickier about which offers to accept: the higher the chairman rent, the less abatement effort he is willing to accept in the current round.

The representative from country 1 chairing the negotiations in the first round would be willing to make an acceptable offer if and only if

$$m + \beta_1 B(N^A;Q) - \alpha\hat{n}_{1,1}^P \geq \delta\left(\beta_1 B(N^A;Q) - \alpha\hat{n}_{1,2}^P\right) \qquad (13)$$

where $\hat{n}_{1,2}^{P}$ is given by equation (8) and

$$\hat{n}_{1,1}^{P} = -\alpha^{-1}(1-\delta)\left(\beta_2 B(N^A;Q) - \alpha N^A\right) + \alpha^{-1}\delta m + \delta\hat{n}_{1,2}^{P} \qquad (14)$$

Rearranging equation (13), using equation (8) and (14), we get

$$m + (\beta_1 + \beta_2)B(N^A;Q) - \alpha N^A \geq 0 \qquad (15)$$

We see that condition (15) is always satisfied if the agreement, as assumed, yields positive joint surplus. We summarise the analysis in the following Proposition.

Proposition 1. The bargaining game has a unique subgame perfect equilibrium where the negotiations are concluded after the first round. The regional abatement target, N^A, is shared between the two countries as follows:

$$n_1^A = \left(\frac{\delta(\beta_1+\beta_2)-\beta_2}{\alpha}\right)B(N^A;Q) + (1-\delta)N_A + \delta^2\bar{n}_1 + \frac{\delta}{\alpha}m - \frac{\delta^2\beta_1}{\alpha}B(\bar{N};Q) \qquad (16)$$

and $n_2^A = N^A - n_1^A$.

Proof. Equation (16) follows from equation (14) using equation (8)

5.2.2 Results and interpretations

Proposition 1 gives rise to some interesting results, which can help us understand better the outcome of the burden sharing agreement in the EU. The first result shows how the chairman rent affects the outcome of the negotiations.

- **The cost of leadership.** It follows immediately from equation (16) that n_1^A --the share of total abatement undertaken by the chairman's country -- is increasing in m – the chairman rent. That is, the price of being able to close the negotiations is paid in terms of additional abatement concessions. The higher the chairman rent, the

more concessions are needed to get a burden sharing agreement accepted. The point is a bit subtler than it might appear at first. While the representative of country 1 herself cares about reaching an agreement under her chairmanship, it is the fact that her potential successor (the representative from the other country) also cares about being the one to conclude the negotiations that really matters. The higher the chairman rent, the more reluctant he is to accept a deal today (thereby foregoing the option to become chair), and so, the more the representative from country 1 would have to offer to get the burden sharing agreement accepted.

The next results are based on a distinction between the pre- and post-Kyoto case. The two cases, of course, differ along many dimensions: the targets are not the same, the amount of abatement undertaken in countries outside the region is not the same and so on. We shall, however, disregard these differences in what follows and instead focus on one particular aspect that we regard as being particularly important for understanding the observed differences in bargaining outcomes. The aspect we have in mind is what happens if a burden sharing agreement is not being reached, i.e., how $\overline{n}_1, \overline{n}_2$ and $\overline{N}$ are determined in the two cases.

- **The pre-Kyoto case.** In this case, the regional target is not implemented. Instead, each country implements a domestic target. The domestic targets are the outcome of a non-cooperative game in which the countries simultaneously and non-cooperatively determine how much abatement to undertake. It can be shown that only the country with the highest environmental valuation will undertake abatement -- the other country will free ride.[1] Total abatement in the region in the pre-Kyoto case is therefore determined by the condition: $\beta_k B'(\overline{N}) = \alpha$ where country k is the country that values environmental improvements the most, and $\overline{n}_k = \overline{N}$ while $\overline{n}_i = 0$. We shall refer to country k as the environmentally friendly country, and to the other as the free rider country. It is natural to assume that $\overline{N} < N^A$.

- **The post-Kyoto case.** In this case, the countries have collectively committed during negotiations with the rest of the world to undertake a certain amount of abatement. This commitment is still binding if the countries should not be able to reach an

1 To see this notice that the country with the highest valuation wants to undertake more abatement than the other country because it values the political benefits more at the margin. Since the political benefit is a function of *total* abatement, the government in the country with the lower environmental valuation realises that it would lose political support by abating itself -- given that the other country is abating up to the level it finds privately optimal.

agreement on how to share the abatement effort. Hence, instead of playing a non-cooperative game that allows environmentally unfriendly countries to free ride, each country would have to implement an equal share of the region's international commitment, i.e., N_1^A/I in case of no agreement. Accordingly, the total amount of abatement will be the same whether or not a burden sharing agreement is reached, i.e., $\overline{N} = N^A$.

The next result is concerned with how the burden sharing agreement is affected by the domestic targets in the pre-Kyoto case. Within the current set-up it is clear that the domestic targets play no role in the post-Kyoto case.[1]

- **The cost of high domestic targets.** When the domestic targets are determined as the outcome of a non-cooperative game, we know only one of the two countries – the environmentally friendly country -- will undertake abatement, while the other country will enjoy a free ride. The environmentally friendly country wants to abate more and so wants to set a more ambitious domestic target when the benefits are given more weight in the political support function, i.e., when β is high. It turns out that having an ambitious domestic target is harmful in the sense that the domestic ambition translates into a larger share of the burden for the environmentally friendly country – independently of who holds the chair in the conclusive negotiations (in round 1). Hence, we would expect to see, in the pre-Kyoto case, those countries with a high domestic target to take on the lion's share of the burden of implementing the regional target.

  To see why this is so, we need to consider two cases, depending on whether it is the free rider or the environmentally friendly country that holds the chair in round 1. First, let us consider the case in which the environmentally friendly country itself holds the chair in the first round ($\beta_1 > \beta_2$, $\overline{n}_1 = \overline{N} > 0$ and $\overline{n}_2 = 0$). Using equation (16), a simple calculation yields:

$$\frac{\partial n_1^A}{\partial \beta_1} = \frac{\delta}{\alpha}\left(B(N^A;Q) - \delta B(\overline{n}_1;Q)\right) + \delta^2\left(1 - \frac{\beta_1}{\alpha}B'(\overline{n}_1;Q)\right)\frac{\partial \overline{n}_1}{\partial \beta_1} > 0 \qquad (17)$$

1 More generally, the domestic targets might well matter for other reasons that the one highlighted here. For example, if the environmental valuations are private information to the representatives, then the domestic targets, which might be observed publicly, could serve as signals of the political benefits, and thereby affect the outcome of the negotiations.

Since the environmentally friendly country is choosing its target ($\bar{n}_1$) optimally, the expression inside the second bracket is equal to zero. It is, therefore, clear that the more political support the chairman derives from the benefits (and so, the more ambitious her domestic target is), the more she needs to concede to the free rider, i.e., n_1^A is increasing in β_1. This is because the free rider knows that he can, if he rejects the offer now, get the environmentally friendly country to accept a relatively large share in the second round (see equation (8)), and so, he is more reluctant to accept a deal in round 1.

Second, let us consider the case in which it is the free rider that holds the chair in the first round ($\beta_2 > \beta_1$, $\bar{n}_2 = \bar{N} > 0$ and $\bar{n}_1 = 0$)

$$\frac{\partial n_1^A}{\partial \beta_2} = \frac{\delta - 1}{\alpha} B(N^A; Q) - \frac{\beta_1 \delta^2}{\alpha} B'(\bar{n}_2; Q) \frac{\partial \bar{n}_2}{\partial \beta_2} < 0 \qquad (19)$$

Since $\delta < 1$ and $\frac{\partial \bar{n}_2}{\partial \beta_2} > 0$, it is again clear that the environmentally friendly country suffers from having an ambitious domestic target. This is due to the fact that the free rider – looking ahead to what would happen in round 2 – realises that she would be able to elicit a relatively favourable offer from the environmentally friendly country. Consequently, the environmentally friendly country is, ceteris paribus, not that keen on moving on to round 2, and the free rider can exploit this "reluctance to reject" in round 1, and get the environmentally friendly country to take on the lion's share of the burden.

The next result compares the outcome of the bargaining game in the pre- and post-Kyoto case focussing on the difference in what happens if no burden sharing agreement is reached (the status quo).

- **The status quo effect.** To understand the difference between the burden share agreement before and after Kyoto, we can use equation (16) to derive the change in the share of abatement undertaken by country 1:

$$\left. \frac{\Delta n_1^A}{\alpha} \right|_{\beta_1 > \beta_2} = \delta^2 \left(\beta_1 B(\bar{n}_1) - \alpha \bar{n}_1 - \left(\beta_1 B(N^A) - \alpha \tfrac{N^A}{2} \right) \right) \qquad (20)$$

$$\left.\frac{\Delta n_2^A}{\alpha}\right|_{\beta_2>\beta_1} = \delta^2\left(\left(\beta_1 B(N^A) - \alpha\tfrac{N^A}{2}\right) - \beta_1 B(\bar{n}_2)\right) \qquad (21)$$

Equation (20) shows how the burden of the environmentally friendly country (in that case country 1) is affected when the bargaining regime changes from the pre- to the post-Kyoto regime. It is clear that the environmentally friendly country's share goes down if having the agreement implemented and taking on half the burden of abatement generates more political support than allowing country 2 to free ride and not having the agreement implemented. A sufficient condition is that the domestic target of the environmentally friendly country ($\bar{n}_1$) is greater than $\frac{N^A}{2}$.

Equation (21) shows what happens to the burden of the environmentally friendly country when it is the free rider that holds the chair in the first round. In this case, the outcome depends on whether the free rider prefers the situation in which the agreement is not implemented and he takes a free ride on the efforts of the environmentally friendly country to the situation in which the agreement is implemented and he must bear half the burden. If, as it would be plausible to assume, the free rider prefers the former outcome to the latter, then the environmentally friendly country will fare better in the post-Kyoto case, even when the free rider country holds the chair. In conclusion, we see that the burden falling on the shoulders of the environmentally friendly country is likely to be lower in the post- than in the pre-Kyoto case. The reason is simply that the bargaining position of the environmentally friendly country improves when the international commitment prevents the "free rider" from free riding.

5.3 Conclusion and discussion

In spite of its shortcomings, the EU burden sharing agreement by and large can be seen as a success story. The EU can pride itself for having accomplished agreements in fields that in the international arena are still unresolved or put off to forthcoming commitment periods. Most notably, all Member States including the low-emitting and low-income cohesion states have been involved in the agreement and have accepted absolute emission targets. In contrast, all developing countries including those with high growth expectancies have been left out from taking over reduction obligations in the international burden sharing scheme for the first commitment period. Omission of this

point has already proven a serious pitfall to international climate policy as it was stated as one of the reasons for the US to reject the Kyoto Protocol.

Clearly, the starting point of the EU had been considerably more favourable than in international negotiations. Member States are more homogeneous and amount to only a medium size number. The economic situation of most developing countries is by no means comparable with the economic situation of cohesion countries. In addition, Member States are already co-operating in many other areas making uncooperative behaviour in the burden sharing negotiations potentially more costly.

In the negotiation process, some factors proved to facilitate the agreement in particular. First, countries with strong interests in climate policy – as revealed through high domestic reduction targets – took over a lion's share of the burden. Second, the involvement of a neutral institution facilitated a constructive discussion as it made the multifaceted individual claims more transparent. In the expert proposal that was taken as a basis for negotiation, the allocation of emission allowances is tailored to sector specific circumstances. Thus, it was possible to overcome resistance from the best organised groups, most notably the heavy industry sector, which in the proposal is treated more lenient than the more disperse light industry sector and household consumers. A third factor that presumably eased the negotiations was the fact that the agreement was reached in two stages. A plausible explanation is that the negotiators are more willing to adopt a certain target in the first place if they know that it can still be corrected later on. Once preliminary targets exist, on the other hand, negotiation of binding targets do not have to start from the beginning. In the negotiation of the pre-Kyoto BSA the pressure from outside clearly accelerated the process of agreement in the EU. Last but not least, the analysis of the negotiation process suggests that the chairman's personal satisfaction from brokering a deal is also helpful to bring about an agreement.

The factors described above did not only facilitate the agreement but also had an influence on the final sharing rule adopted. The effects of these factors on the share of the total burden that a country has to shoulder could be traced in a simple game-theoretical model. For this, we deducted the subgame perfect equilibrium proposal that in a two-country setting, country 1 is willing to offer and country 2 is willing to accept if the negotiations terminate after T rounds by default. The model showed, that the share of total abatement undertaken in the chairman's country increases in the chairman's rent

m and that a high domestic target always translates into a larger share of the burden. The model also reveals the fundamental difference between the pre- and the post-Kyoto negotiations. While in the pre-Kyoto case, the country with a lower valuation of the environment can free-ride on the environmentally friendly country's abatement efforts, the international commitment prevents free-riding in the post-Kyoto case. The fall-back position of the free-rider is considerably lowered by the fact that it needs to bear half of the burden if negotiations fail. This explains nicely why in the negotiation process the cohesion countries took over a much larger share in the post-Kyoto BSA than in the pre-Kyoto BSA.

In an outlook to international negotiations the European agreement could serve as an example. Either within the framework of the Kyoto Protocol or apart from it other "bubbles" could be formed and internal burden sharing schemes could be negotiated. For example, Japan and South-East-Asia together with Australia and the pacific island states as well as North and Latin America could form regional blocks. This regional grouping has the advantage that national particularities can be taken into account more appropriately and differentiated obligations can be negotiated. With the number of negotiating parties reduced differing interests become easier to handle.

As a general finding the analysis showed that an equitable burden distribution cannot be expected to result from the negotiations. Looking at the asymmetrical distribution of costs and benefits of climate protection, high-emitting countries that are less affected by the adverse effects of climate change clearly hold a better bargaining position. As there is no supranational authority that could force them to commit to targets, equity claims are the "bargaining chip" that cohesion and developing countries can play in their favour. As such, equity claims cannot be fully realised but help to countervail the power of high emitting countries.

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