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Abstract

In recent years, differences between traditional and green parties have been leveled with respect to climate protection. We show that this convergence in party platforms can be explained by successful international climate agreements. We set up a voting model where political parties differ in their preferences for climate protection and where climate protection causes both resource costs and distortions in the international allocation of production. Successful international agreements, which increase climate protection, reduce effective abatement costs and affect traditional parties in a different way than green parties, since a lower preference for climate protection implies a higher price (cost) elasticity of demand. Furthermore, we point out that increasing flexibility and efficiency in abatement mechanisms is preferable to forming a climate coalition that focuses directly on emission reduction commitments.

JEL-Classification: Q54, H41, D72

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1 Introduction

In the last two decades, a convergence in European politics and party platforms can be observed (see Dorussen and Nanou, 2006). This is in particular the case for climate policy.[1] A salient example for the latter is Germany, which reveals a striking continuity in anti-climate change action, though there have been several 'ideological' changes in government. In fact, all governments have not only continued the inherited policy, but also fostered efforts in reducing greenhouse gas emissions (e.g., Blum and Schubert, 2009, pp. 91–101). The leveling in German climate policy became most prominent when conservative Angela Merkel was celebrated as 'climate chancellor' at the G-8 meeting in Heiligendamm in 2007. Furthermore, her conservative-liberal government recently announced to reduce emissions by 40 percent (compared to the 1990-level) until 2020, matching the coalition agreement between the German social democrats and the green party in 2002.

Accordingly, several authors meanwhile state that the 'greens' have progressively lost their often claimed unique selling property in the field of environmental (climate) policy due to the success of civil-liberal parties in improving their specific scope in that policy field (e.g., Blühdorn, 2009). How can this convergence in climate policy be explained and do green parties have to fear this development?

The present paper argues that the observed convergence in climate polices can be explained by successful international agreements, increasing climate protection and decreasing effective abatement costs. 'Green' parties lose their unique green policy position, the more these agreements allow for flexibility and cost reduction, since 'non-green' parties will react more elastically.

This is a novel contribution to the literature. Previous papers examined what kind of climate policy measures are preferred by different interest groups (e.g., Svendsen, 1999, for the U.S.) or in which way different democratic systems affect environmental policy (Fredriksson and Wollscheid, 2007). Buchholz et al. (2005) analyze international environmental agreements, but focus on strategic voting and the negotiation process, applying a very different approach than we do. Neither

[1]Furthermore, there is also a convergence in international environmental policies across governments, with different ideological backgrounds. See, e.g., Tews et al. (2003) and Busch and Jörgens (2005).

paper has endogenized the effective costs of climate protection, nor analyzed, how implementing international abatement mechanisms lead to convergence in the behavior of parties on the national level. Hence, our results contribute to the literature on policy convergence of ideological parties, focused so far on repeated games and two-level bargaining, by adding a new explanatory channel.

Alesina (1988) analyzes a voting model with two ideological parties, which not only value being elected, but also have preferences on the implemented policies. Assuming uncertainty about the distribution of voters, in particular about the optimal point of the median voter, Alesina points out that neither in one-shot games nor in finitely repeated games complete policy convergence will emerge as long as parties cannot be committed to their announcements in the electoral campaign. After being elected, they will always implement their optimal policy. However, in an infinitely repeated election game, parties can coordinate and improve their utility by policy smoothing. To this end, they have to choose identical platforms and policies (and to share offices). Reputational losses and a return to a one-shot solution (i.e., a trigger strategy) in case of a one-time deviation once from the announced policies can sustain convergence in a time-consistent way, if the discount factors for both parties are sufficiently high (i.e., if they are sufficiently far-sighted).

Dorussen and Nanou (2006) pick up the approach of two-level games with national veto-players (Putnam, 1988; Tsebelis, 2002) and refer to the thesis that policy convergence on the domestic level restricts the government in the international bargaining, improving its bargaining power. The authors extend this idea by arguing that domestic parties strategically converge to a joint policy in order to improve the outcome on the supra-national level and, using the process of European integration as example, they provide some empirical evidence for their findings. Dorussen and Nanou (2006, p. 244) conclude that *"policy convergence may result from a 'rallying around the flag' effect, in particular when the polices coming from the EU level are perceived as a threat to the domestic status quo."*

While Alesina (1988) provides a rather static explanation, which cannot explain the change in platforms over the last 20 years, Dorussen and Nanou (2006) provide a convincing argument for EU integration, but their results imply that extreme parties even divert and become more radical. This is not what we observe in environmental issues.

Analyzing the example of international climate protection, our findings instead imply that policies converge because of a decrease in effective abatement costs. If climate (environmental) protection becomes less costly in terms of private consumption and firms' profits, traditional parties[2] react more elastically than 'green' parties on these cost reductions and the difference in their most preferred platforms shrinks. Indeed, international agreements such as the Kyoto-Protocol have significantly decreased abatement costs in the last 15 years, by establishing emission trading systems (ETS), installing a Clean Development Mechanism (CDM) and allowing for emission allowances from activities of 'avoided deforestation' (REDD).[3] Therefore, we provide an additional and relevant channel, which can explain the convergence of environmental party platforms across all types of parties over time.

In a one-dimensional voting setting, green parties do not need to fear this development, but this can change if the model is extended to a multi-dimensional approach. Indeed, strategic concerns in policy behavior might explain the failure of the post-Kyoto conference in Den Haag in 2000 and the position of the German green party in the debate on the nuclear phaseout. Furthermore, applying our results to an international setting, it follows that investments into and coordination of efficient and flexible abatement mechanisms are preferable as first steps to spending resources on negotiations on more stringent emission reduction commitments.

To derive our results, we set-up a model with $n+1$ countries, where producing a private good causes greenhouse gas (CO_2) emissions. National governments regulate emissions and fulfilling these regulations causes costs for price-taking firms, harming their international competitiveness, and reduces profits. Households consume the private good and a global public good 'climate protection', but differ in their preference for climate protection. Ideological parties offer a party platform in each country, defining a level of national climate protection. This model allows to analyze what happens, if some countries form a climate coalition, which ei-

[2]By our definition, traditional parties are primarily interested in private consumption, firms' profits and economic growth and value climate protection less than green parties.

[3]See, e.g., Brandt and Svendsen (2002); Bréchet and Lussis (2006); Anger and Sathaye (2008).

ther agrees on a common level of emission reduction or on implementing efficient abatement mechanisms, which decrease resource costs of reducing greenhouse gas emissions.

The remainder of this paper is structured as follows. Section 2 introduces the model. Then, section 3 discusses the effect of international agreements on the party platforms of national parties. An application of the approach to international negotiations on climate protection is provided in section 4. The paper ends with conclusions in section 5.

2 The Model

We assume a world, which consists of $n+1$ countries, each inhabited by a continuum of households. All households consume an aggregate private good x. Production of this good causes an additive atmosphere externality (Meade, 1972), which we will interpret as CO_2-emissions, causing global warming. Therefore, households also derive utility from climate protection G, which is provided as a global public good by governments via regulating firms' investments into emission reduction.

Firms All firms are price takers and the world market price for the consumption good x is denoted by p. There is one representative firm per country i, supplying $x_i^s(p)$ units to the world market and having pure production costs $c(x_i^s)$.

The government in country i regulates the emission of CO_2 by enforcing a national level of abatement effort G_i. The carbon abatement is proportional to production, viz., $G_i \cdot x_i^s$, and investing in abatement (i.e., in climate protection) causes resource costs p_G per unit of G_i. Hence, the firm in country i faces abatement costs $p_G \cdot G_i \cdot x_i^s$, as well. From the point of view of a firm, the unit costs p_G are exogenous; however, their level depends on the abatement measures, being implemented by the governments in international agreements.

Thus, profits of firm i are given by

$$\pi_i = p \cdot x_i^s - c(x_i^s) - p_G \cdot G_i \cdot x_i^s. \tag{1}$$

To simplify the analysis without affecting the main results, we assume convex pure production costs $c(x_i^s) = \frac{c}{2}(x_i^s)^2$, where $c > 0$ is a cost parameter.

Maximizing profits implies price equal to marginal costs so that optimal production in country i is given by

$$x_i^{s*} = \frac{p - p_G \cdot G_i}{c}, \tag{2}$$

resulting in maximum profits

$$\pi_i^* = \frac{1}{2}\frac{(p - p_G \cdot G_i)^2}{c}. \tag{3}$$

This approach neglects any positive effect of climate protection on production, i.e., innovations and growth in 'green' industries. However, it is straightforward to show that incorporating such spillover effects will even strengthen the results in this paper.

Households Population size in each country i is normalized to one and national households only differ in their preference for climate protection. We assume the utility function of a household h in country i to be

$$u_i = x_i + \alpha_{ih} \cdot v_i(G), \tag{4}$$

where x_i represents utility from consumption and where $\alpha_{ih} \cdot v_i(G)$ is the utility derived from global climate protection. Assuming positive, but decreasing marginal utility of climate protection, we have $v_i' > 0$, $v_i'' < 0$. α_{ih} is the preference factor for climate protection of household h in country i. The larger is α_{ih} the stronger is the preference for CO_2-reduction of household h in country i.

A household in country i is equipped with exogenous income M_i and earns a share in firm's profit π_i^*. Since population size is normalized to one and the price of the private good is given by p, this implies an aggregate demand function for good x in country i according to

$$x_i^d = \frac{M_i + \pi_i^*}{p}. \tag{5}$$

As climate protection by reducing CO_2-emissions is a global public good (or a positive atmosphere externality in the sense of Meade, 1952), the total level of climate protection G, consumed by households in any country, is the sum of national abatement investments. Hereby, we will assume that $K = 1+k$ countries are forming a climate coalition, which has agreed on collective action and which implements the same level of protection G^c in all member countries. The remaining $n-k$ countries choose their climate protection independently. Accordingly, total consumption of the public good is given by $G = (1+k) \cdot G^c + \sum_{j=k+1}^{n} G_j$. The fully non-cooperative case results for $k = 0$ and $G^c = G_i$.

Market Equilibrium The world market equilibrium for the consumption good is determined by equality of aggregate demand and aggregate supply, i.e.,

$$\sum_i x_i^d = \sum_i \frac{M_i + \pi_i^*}{p} = \sum_i x_i^s. \tag{6}$$

Substituting equation (3) for national profits π_i^* and equation (2) for national supply x_i^{s*}, and rearranging terms, leads to the market clearing condition

$$\begin{aligned} c\sum_i M_i + \frac{1+k}{2}(p - p_G G^c)^2 + \frac{1}{2}\sum_{j=k+1}^{n}(p - p_G G_j)^2 & \\ -(n+1)p^2 + p \cdot \left[(1+k)p_G G^c + p_G \sum_{j=k+1}^{n} G_j\right] &= 0. \end{aligned} \tag{7}$$

Equation (7) implicitly determines the world market price $p = p(p_G, G^c, G_{k+1}, ..., G_n, k)$ as function of marginal abatement costs p_G, of the levels of climate protection G^c and G_j and of the number of members in the climate coalition $K = 1+k$. Totally differentiating (7) exhibits the marginal effects of abatement costs p_G, of climate protection G^c and of the number of coalition members K on the equilibrium price p,

$$(n+1)p \cdot dp = \left[(1+k)(G^c)^2 + \sum_{j=k+1}^{n} G_j\right] p_G \cdot dp_G + (1+k)p_G^2 G^c \cdot dG^c + \frac{p_G^2}{2}(G^c - G_k) \cdot dk. \tag{8}$$

The first term on the RHS in equation (8) reveals a positive relation between the world market equilibrium price and abatement costs, since

$$\frac{dp}{dp_G} = \frac{(1+k)(G^c)^2 + \sum_{k+1}^{n} G_j^2}{(n+1)p} p_G > 0. \tag{9}$$

Higher marginal abatement costs, i.e., higher investment costs for reducing emissions on firm level, increase production costs in all countries. By partially shifting the cost increase to the demand side, the price of the consumption good will increase in the quadrat of the level of climate protection.

The second term in (8) implies

$$\frac{dp}{dG^c} = \frac{(1+k)p_G G^c}{(n+1)p} p_G > 0. \tag{10}$$

An increase in the protection level G^c within the climate coalition (in country i), increases effective production costs in the firms of these countries. Ceteris paribus the affected firms will decrease their production, which will raise the world market price. The price increase is the higher the more firms are affected, i.e., the larger is the climate coalition, and the higher the protection level.

Finally, from (8), it follows that

$$\frac{dp}{dk} = \frac{1}{2} \frac{p_G(G^c - G_k)}{(n+1)p} p_G. \tag{11}$$

A marginal increase in the number of member countries in the climate coalition will increase the world market price, if the new member country k has to increase its protection level ($G^c > G_k$). If so, the mechanism is the same as when the climate coalition increases its protection level G^c.

Party Platforms As is standard in the political economy literature, we simplify the voting problem and assume that voters have to decide on the national level of climate protection only. The climate preference parameter $\alpha_{ih} \geq 0$ is continuously distributed over households in each country i and the median voter m in country i has a preference parameter $\alpha_{im} = 1$. Note that α_{ih} can be uniformly distributed, implying $\alpha_{ih} \in [0, 2]$, but this does not have to be the case.

Ideological parties differ in their preferences for climate protection. We assume that there are at least $R \geq 4$ parties in country i and we denote the climate preference parameter of a party r by α_i^r. $\alpha_i^r < 1$ characterizes 'traditional parties', being primarily interested in firm profits and private consumption, whereas 'green parties' are characterized by a high preference for climate protection, $\alpha_i^r > 1$.[4]

A party platform G_i^r is defined as the level of national climate protection announced by a party r_i in country i, given the abatement costs p_G, the number of member countries in the climate coalition, $K = 1+k$, and the protection level in non-member countries, G_j. Party r_i will derive its party platform by maximizing the utility function in equation (4), given its preference parameter α_i^r and taking into account the effects on national profits and the world market price.

Consequently, the national protection level G_i^r announced by party r_i follows from

$$\max_{G_i^r} u_i^r = \frac{M_i + \pi_i^*}{p(p_G, G_i^r, k)} + \alpha_i^r \cdot v_i(G) \quad \text{s.t.} \quad G = (1+k)G_i^r + \sum_{j=k+1}^{n} G_j, \tag{12}$$

where we already made use of the national demand function (5). Hence, G_i^r is determined by the first order condition

$$-\frac{M_i + \pi_i^*}{p^2} \cdot \frac{dp}{dG_i^r} - \frac{p_G}{p} \cdot x_i^{s*} \cdot \frac{(n+1)p - (1+k)p_G G_i^r}{(n+1)p} + (1+k) \cdot \alpha_i^r \cdot v_i'(G) = 0. \tag{13}$$

The last term on the left hand side represents the increase in utility if the countries in the climate coalition marginally increase their climate protection level. The effect is the larger, the stronger the preferences for climate protection α_i^r are. The effect becomes also stronger, the more countries are member in the union, viz., the higher is k. The reason is that multilateral action within the union mitigates the standard underinvestment problem for public goods, where free-riding is always an option.

The total level of climate protection G is given by the sum of emission re-

[4] See, e.g., Wittman (1977, 1983) for ideological parties. The advantage of $R \geq 4$ parties is that we could drop the ideology component and, alternatively, could assume that vote-maximizing parties are picking the favored protection levels of decisive voters. Therefore, our model is compatible with a standard median voter model in the tradition of Downs (1957), as well.

ductions within the climate coalition plus the sum of unilaterally chosen climate protection in all countries outside the climate coalition.[5] Increasing climate protection, however, causes two kinds of costs. *First*, an increase in national climate protection decreases profits of the national firm, since the increase in costs is larger than the increase in the world market price. This can be taken from the second term on the left hand side of (13), where $(n+1)p-(1+k)p_G G_i^r > 0$, because $x_i^s = \frac{p-p_G G_i}{c} > 0$ and $n+1 \geq 1+k$. Decreasing profits decrease disposable income and with it private consumption. *Second*, an increase in G_i increases the world market price, see equation (10). This leads to a further decrease in private consumption. The latter effect is represented by the first term on the left hand side of (13).

Inserting maximum profits from equation (3) as well as the supply function in (2), the second order condition reads after rearrangements

$$\begin{aligned} SOC &= \frac{p_G^2 \cdot G_i^r}{2c(n+1)p^2}\left[\frac{6cM_i}{p^2}+\frac{p_G \cdot G_i^r}{p^2}(p_G \cdot G_i^r - 2x_i^s) - \frac{n+1}{1+k}\right]\frac{dp}{dG_i^r} \\ &- \frac{p_G^2}{2c(n+1)p^3}\left[2cM_i + p_G \cdot G_i^r(p_G \cdot G_i^r - 2x_i^s) - \frac{n+1}{1+k}p^2\right] \qquad (14) \\ &+ (1+k)\alpha_i^r \cdot v_i''(G) < 0, \end{aligned}$$

which is fulfilled at least as long as the subutility function over climate protection, $v_i(G)$, is sufficiently concave.

Climate Coalitions We define a climate coalition as a union of countries, which either commit to a common level G^c of climate protection in all member countries i, i.e., $G_i = G^c \; \forall i = 1, \ldots 1+k$, or which agree on establishing international abatement mechanisms, affecting resource costs p_G of climate protection.

A successful climate coalition is then a union, where either any new member country k has to increase its primal protection level to $G^c > G_k$. Alternatively, a successful climate coalition implements an international abatement mechanism,

[5]For $k=0$, we have the non-cooperative case, where all countries choose their climate protection unilaterally. The advantage of our chosen setting is that the effect of writing bilateral or multilateral contracts on the party platform G_i^r can easily be derived by varying the number of coalition members k (e.g., from $k=0$ to $k=1$).

decreasing the resource costs p_G. The latter features the focus of cooperative agreements on cost-reducing, economically efficient flexibility mechanisms. Examples are the Clean Development Mechanism (CDM), where countries are allowed to fulfill their emission reduction by investing in developing countries, which have a lower standard of energy efficiency and therefore lower marginal abatement costs (see, e.g., Bréchet and Lussis, 2006; Haites and Yamin, 2000, Partridge and Gamkhar, 2010), or the establishment of international emission trading systems (Buchner and Carraro, 2006).[6] More recently, economic flexibility has been increased by including 'avoided deforestation and forest degradation' (REDD) in a post-Kyoto agreement as negotiated at the Copenhagen climate summit in December 2009 (see Copenhagen Accord, paragraph 6).

Note that 'successful' in our terms only implies an increase in climate protection and a decrease in effective abatement costs; it does not need to imply an optimal solution for climate protection. Hence, even if regime-effectiveness is violated and all countries in a coalition do not increase climate protection more than they would do in a unilateral setting, such a coalition would be 'successful', as long as effective abatement costs decrease. Furthermore, we are modeling efficient abatement mechanisms in an ideal world. In reality, these mechanisms have to be designed soundly in order to avoid situations, where, e.g., CDM-measures represent pure windfall gains, since they would have been implemented by host-countries anyway, or where they even are counterproductive and increase global emissions. See, e.g., Flues et al. (2010) and Partridge and Gamkhar (2010).

3 Policy Convergence

We are now going to show that both successful international agreements on the level of climate protection and implementing (economically) efficient abatement mechanisms will lead to a convergence in party platforms G_i^r in a country i. The same holds true for cost-saving progress, improving abatement technologies.

[6]In fact, the International Energy Agency (2000, p. 234f) argued very early that fulfilling the Kyoto-commitments necessarily requires implementing an international emission trading system, since domestic measures alone would carry too high economic costs. Furthermore, the abatement costs would decrease in the number of participating countries.

3.1 Forming A Climate Coalition

First, we analyze the effect of a climate coalition, where all members agree on a common level of climate protection. Though highly stylized, this setting features, e.g., the Kyoto-Protocol. The major difference here is that we assume an agreement on identical protection levels, whereas in the Kyoto-Protocol countries committed themselves to distinct abatement levels. However, our analysis can furthermore capture the effect of a bilateral climate treaty by evaluating all results at $k = 0$.

We are interested in the effect of such agreements on the different party platforms within one country, i.e., on the reaction functions of national parties. Therefore, we do not solve for the equilibrium outcome of climate protection and we do not examine under what conditions such a coalition is stable and incentive-compatible. See, e.g., Besley and Coates (2003, section 5) for an optimal cooperative solution (and its justification) in a centralized setting of providing local public goods with spillover effects.

In our model, the effect of expanding the climate coalition on the party platform G_i^r of a party with preference α_i^r in a coalition country i can be derived from implicitly differentiating the first order condition (13). Focusing on a successful climate coalition, country k, newly entering the coalition, has a primal protection level being lower than the commitment level in the coalition, i.e., $G^c > G_k$.[7] Hence, from (11), the world market price for good x increases, $\frac{\partial p}{\partial k} > 0$, and firms' profits in all other countries increase as well, since $\frac{\partial \pi_i}{\partial p} = x_i^s > 0 \, \forall \, i \neq k$ from (3).

However, the effect on the desired level of climate protection G_i^r is ambiguous. A price increase ceteris paribus has a negative effect on consumption and it will depend on whether country i is a net exporter or a net importer of good x, whether utility in private consumption increases or decreases, as from equation (5)

$$\frac{\partial x_i^d}{\partial p} = \frac{x_i^s - x_i^d}{p}. \tag{15}$$

Furthermore, there is a negative effect on the marginal willingness to pay, which

[7] This is also the most reasonable assumption, because it is hardly realistic that a country with high protection level voluntarily joins a climate coalition, where it has to decrease its standard.

decreases due to diminishing marginal utility, when country k increases its protection level. See the appendix to Lemma 1 for the formal effects in detail.

Nevertheless, we can state that

Lemma 1. *Assume country k joins a climate coalition. The climate protection level G_i^r offered in any party platform in a coalition country i will unambiguously increase, if the previous protection level in the joining country is sufficiently close to the protection level in country i.*

Proof. See Appendix A.1. □

If the difference in protection levels becomes sufficiently small (i.e., $G^c - G_k \rightarrow 0$), there will be no price effect (viz., $\frac{\partial p}{\partial k} \approx 0$) and there will be no decrease in marginal willingness to pay. Hence, we remain with the positive effect of mitigating the standard free-riding externality in providing public goods, as we have a partially cooperative solution, now. Note that Lemma 1 states only a sufficient, but not a necessary condition for an increase in G_i^r.

The interesting result, however, is the effect on the difference between protection levels offered by different parties in country i. Indeed, there will be a platform convergence, if enlarging the climate coalition raises the desired protection level for all parties, i.e., for any preference parameter α_i^r. This follows from

$$\frac{\partial\left(\frac{\partial G_i^r}{\partial k}\right)}{\partial \alpha_i^r} = -\frac{v_i''(G)}{SOC^2}\left[(G_i^r - G_k)\cdot SOC - \frac{\partial H}{\partial k}(1+k)\right] < 0 \quad \text{if} \quad \frac{\partial G_i^r}{\partial k} > 0, \quad (16)$$

where $\text{sign}\{\frac{\partial H}{\partial k}\} = \text{sign}\{\frac{\partial G_i^r}{\partial k}\}$ and where $SOC < 0$ is given by equation (14).

Proposition 1. *If a new member has to increase its protection level for entering the climate coalition and if this increase raises the protection level offered in all party platforms in country i, then there will be a platform convergence in the sense that the announced protection levels across parties are converging to a common value.*

Proof. See Appendix A.2 □

The intuition behind this result is as follows: If more countries join a successful climate coalition, their firms face higher production costs due to an increase in their protection levels, and the world market price for the consumption good increases. Therefore, increased national climate protection in any country i is less harmful to the competitiveness of the industry in the country under consideration. In other words, the more countries form a successful climate coalition, the less distortive national climate protection requirements will be, with respect to the international allocation of production. Though, the increase in price p for good x has ceteris paribus a negative effect on consumption, the total effect reduces effective abatement costs by reducing the indirect 'economic' costs for any given resource cost p_G of climate protection. However, the reduction in effective abatement costs matters more for traditional parties, having a smaller preference parameter α_i^r than for green parties, since the former are relatively more interested in profits and private consumption. Consequently, traditional parties will catch up and the level of climate protection offered in their party platform will approach the level offered by green parties: we observe a convergence in policy platforms defined over environmental policy (i.e., climate protection).

The crucial assumption in Proposition 1 is that forming a climate coalition (and signing a treaty on environmental protection respectively) enhances the level of protection. Supporting evidence is indirectly provided by the fact that the Kyoto-Protocol is effective in fostering environmental protection, though it is less dynamic than other examples and though there are some problems in its institutional design. The European Environment Agency calculated for the EU-15 that the Kyoto-induced additional effort – neglecting additional flexibility instruments – has led to an emission reduction of 6.2 percent by 2008 compared with a projected augmentation of emissions in a business-as-usual-scenario (European Environmental Agency 2006, p. 5; 2009, p. 9). Incorporating further flexibility mechanisms should add an additional reduction of 4.6 percent (European Environmental Agency, 2009, p. 11). In total, the EU would easily fulfill the 8 percent reduction as required by the Kyoto-Protocol and most emission reductions are attributed to EU-policy regulations.[8]

Besides the Kyoto-Protocol, there are many examples of international envi-

[8] About 82 percent of the emission savings in the EU-27 in 2010 are expected to be driven by EU-Commission directives aiming to implement the Kyoto-Protocol. See European Environmental Agency (2009, p. 48f).

ronmental agreements, e.g., the 'Montreal Protocol on Substances that Deplete the Ozone Layer' or the 'International Convention for the Prevention of Pollution From Ships' (MARPOL 73/78), which – in accordance with rationalist regime-theory in the field of international relations – actually caused a gradual enhancement of national environmental protection standards over time and which were backed by a broad consensus among member countries.[9] These agreements and the necessary national regulations were widely supported by all national parties in the member countries.

Note, however, that the effect described in Proposition 1 does not change voting shares in a one-dimensional voting decision. We observe a shift in optimal climate protection for each voter, but the distribution of voters remains the same. Thus, the outcome of an election will not change as long as all party platforms are adjusted accordingly. This may change if there are more dimensions besides climate protection, as will be shortly discussed in subsection 3.3.

3.2 Introducing Efficient Abatement Mechanisms

The alternative to committing to a certain protection level is an agreement on improving the abatement mechanisms. One example is the designated possibility of purchasing emission allowances from activities of 'avoided deforestation' in regions with rainforests within the framework of a post-Kyoto climate agreement. Investments in reducing emissions from deforestation and forest degradation grant emission allowances, which can be traded in the European Emission Trading System (ETS); see Schlamadinger et al. (2005) for the so-called REDD-mechanism. Such flexibility in abatement mechanisms is considered as decreasing marginal abatement costs, since, e.g., a REDD measure is less costly than traditional abatement measures in industrial countries (see Anger and Sathaye, 2009).

Hence, the effect, which such agreements on efficient abatement mechanisms have on party platforms, corresponds to the effects of cost-saving technological progress in abatement mechanisms. Thus, we are able to deal with both issues by analyzing a decrease in (marginal) resource costs p_G for providing climate

[9] See, e.g., Gehring (1994; ch.4), Victor (1995) and Zürn (1997, pp. 48) for an overview and summary of the effectiveness of older agreements.

protection.

Simple intuition would tell us that the protection level G_i^r, offered by any party p_i, should increase when its price p_G decreases. Indeed, a decrease in resource costs will increase a firm's profits in country i, at least as long as $G^c \geq G_j$. The decrease in production costs is of first order and dominates the negative effect from a reduced world market price p. See Lemma 2.

Lemma 2. *A reduction in resource costs p_G of climate protection increases profits in any climate coalition country i, if the protection level in the climate coalition is higher than in non-member countries, i.e., $\frac{\partial \pi_i}{\partial p_G} < 0$ if $G^c \geq G_j$.*

Proof. See Appendix A.3. □

From Lemma 2 and the reduction in the world market price p, see equation (9), it also follows that private consumption $x_i^d = \frac{M_i + \pi_i^*}{p}$ will always increase, $\frac{\partial x_i^d}{\partial p_G} < 0$. Thus, relaxing the cost of climate protection should increase protection levels.

However, first intuition may fail, since there are opposing price and quantity effects, and we cannot sign the change of climate protection offered in reaction to a reduction of resource costs p_G. Lower resource costs make climate protection per unit produced cheaper, but at the same time lower resource costs increase total production. Hence, the combined marginal effect on firms' profits is ambiguous. A similar argument applies to private consumption: the increase in the world market price is lower for lower resource costs, but as households consume more units, they have to pay the increased price on more units. Accordingly, the marginal effect on utility in private consumption is also ambiguous. See appendix A.4 for a formal analysis. We are left with

$$\frac{\partial G_i^r}{\partial p_G} = -\frac{\frac{\partial H}{\partial p_G}}{\frac{\partial H}{\partial G_i^r}} \gtrless 0 \tag{17}$$

from implicitly differentiating the first order condition (13). Note that $\frac{\partial H}{\partial G_i^r} = SOC < 0$.

Our main interest, however, is in comparing the magnitude of this change across different parties. Fortunately, the effect of the preference parameter α_i

on the change in equation (17) can be signed and we find

$$\frac{\partial\left(\frac{\partial G_i^r}{\partial p_G}\right)}{\partial \alpha_i} = \frac{v_i''(G)(1+k)}{SOC^2} \cdot \frac{\partial H}{\partial p_G} > 0, \quad \text{if} \quad \frac{\partial G_i^r}{\partial p_G} < 0. \tag{18}$$

The interpretation of equation (18) is summarized as

Proposition 2. *If lower resource costs foster climate protection in all party platforms in country i, implementing an efficient abatement mechanism, decreasing resource costs of climate protection, will lead to a convergence in protection levels offered by parties in that country.*

Proof. See Appendix A.4. □

A decrease in marginal resource costs p_G will always have a stronger positive impact on parties with lower preference for climate protection. Thus, no matter if marginal abatement costs decrease due to implementing more efficient mechanisms by an international agreement or by cost-saving technological progress, there will be a convergence in party platforms as long as a cost decrease fosters the protection level.

Thereby, improving the efficiency of abatement mechanisms as an explanatory variable should be of relevance. These improvements were already embedded in the Kyoto-Protocol, where (i) a group of countries (e.g., the EU) can assign emission reductions differently across member countries as long as the group fulfills its aggregate reduction ("EU emission bubble"); where (ii) countries can invest in emission abatement in other (non-treaty) countries and claim the achieved reductions ("joint implementation"); and where (iii) special rules for investments in developing countries are introduced ("clean development mechanism" CDM), leading to a similar effect like joint implementation. Since then efficiency has increased by more flexibility in CDM measures (see EU linking-directive 2004/101/EG) and by implementing the REDD approach on avoided deforestation. Furthermore, a global linking of different, regional Emission Trading Systems (Anger, 2006) and including the transportation sector or households in the Emission Trading System (Endres and Ohl, 2005) are under discussion at the moment.[10]

In any case, the convergence is driven by the fact that the reduction in private consumption, which is necessary for increasing climate protection, is the smaller the more abatement costs decrease. As traditional parties are more concerned about private consumption and firms' profits, they react more strongly on this cost decrease. Hence, the increase of climate protection in their party platforms will be higher than for green parties, as the latter value private consumption less (and demand climate protection less elastically, respectively).

Again, in a one-dimensional setting, there will be a shift in optimal climate protection levels for each voter, but the distribution of voters remains constant.

3.3 Discussion

From our analysis it follows that, at least for a policy of internalizing additive atmosphere externalities (i.e., for providing global public goods), there can be other reasons for policy convergence besides repeated games and time consistency issues (Alesina, 1988) and two-level games (e.g., Dorussen and Nanou, 2006). International agreements on increasing climate protection levels or on improving abatement mechanisms can lead to a platform convergence in member countries, if national parties (and voters) put different weights on, e.g., climate protection. These agreements will reduce effective economic costs of internalization and since parties with lower weights on climate protection value private consumption more, they will respond more strongly to a cost decrease, implying a larger increase in offered protection levels compared to the increase in party platforms of green parties.

This effect can be illustrated in a simplified diagram, see Figure 1. Assume that effective marginal abatement costs (*MC*) are linear and that there are 'linear demand functions' (*MB*) for climate protection, reflecting reaction functions of different parties in country i. The demand functions are drawn for different preference parameters α_i^r, where $\alpha_i^1 > \alpha_i^2 > \alpha_i^3$. Optimal party platforms for each party r_i in country i are found by the intersection of its demand function MB_{ir} with the marginal cost curve MC. Then, the analysis can be summarized in Figure 1 by

[10] Both amendments would balance abatement costs between economies and sectors.

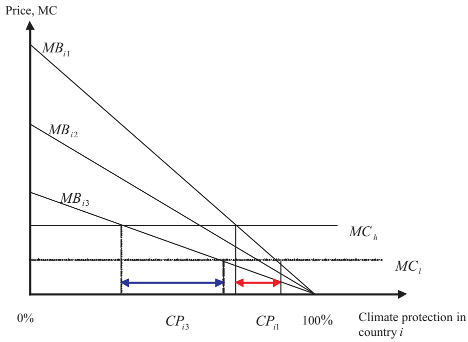

Figure 1: Party platform changes in climate protection

examining the effect of a downward shift in marginal costs from MC_h to MC_l.

For all parties, a reduction in effective abatement costs will increase the level of offered climate protection. However, the increase is larger for traditional parties than for green parties ($\Delta CP_{i3} > \Delta CP_{i1}$), since the latter demand climate protection less elastically. Indeed, if the price (i.e., effective costs) of climate protection dropped to zero, all parties would offer a full reduction in emission, viz., a protection level of 100%.

Can one infer from our findings that green parties should fear successful climate agreements? Our model shows that they do not have to in a one-dimensional world, when the level of desired climate protection is shifted for the entire distribution of voters. Though green parties will lose their unique green policy position (i.e., their unique selling proposition), their share of votes can still remain very stable in election outcomes.

However, the picture changes if one allows for multi-dimensional settings. Assume that voters consider two issues: climate protection and crime prevention. For simplicity presume that both issues are independent of each other and that green parties have a unique selling proposition in climate protection, whereas traditional parties are rather seen as competent in providing crime prevention. In such a world, a policy convergence in climate protection can have disastrous effects for green parties. Since the difference in climate protection levels shrinks or even becomes marginal, crime prevention becomes the focal point for voters. Consequently, green parties have either to adjust to the stricter crime-prevention regime of traditional parties in order to preserve voting shares or they might be marginalized, if they stick to their original party platform (e.g., in case of ideological parties). As an example might serve the secession of the so-called 'realo-fraction' from the Swiss green party and the foundation of the (nation-wide) green liberal party in 2007. Whilst the Swiss 'greens' are still very left-wing relative to European average, the Swiss 'green-liberals' clearly moved into the political center – and, for a newly founded party, have been relatively successful in their first election campaign (see, e.g., Baer and Seitz, 2008). In this sense, green parties really should fear successful international agreements on climate protection, though these agreements lead to better climate protection.

In fact, there is anecdotal evidence that green parties have tried to prevent too efficient international agreements and in particular have opposed to implement flexible market mechanisms. A salient example is the 6^{th} Conference of the Parties to the Framework Convention on Climate Change in The Hague in November 2000, where the French and German environmental ministers, being negotiators on behalf of the EU, prevented a compromise with the U.S. administration.[11] The U.S. government preferred a market-based solution, including an extended consideration of carbon sinks and emission trading, and credibly threatened with a withdrawal from their Kyoto-commitments, if their claims should not be fulfilled. In the end, the U.S. stepped back from the Kyoto-Protocol due to the opposition of the EU against a further extension of economic flexibility. The failure of this conference turned out to be a major setback for climate protection.[12] Afterwards, many observers mainly blamed green party members or supporters from the environmental ministries – especially the German Jürgen Trittin – to have

[11] At that time, both ministers, Dominique Voynet and Jürgen Trittin, were members of the green party in the respective country.

[12] Even compared to a situation, where the desired flexibility mechanisms would have been callow and less effective in reducing emissions, the withdrawal of the U.S. from the Kyoto-Protocol created umpteen times more emissions. See Brandt and Svendsen (2002, p. 1191f) and Jacoby and Reiner (2001, p. 302).

strategically prevented a market-driven compromise solution (see, e.g., Jacoby and Reiner, 2001, p. 301f; Vrolijk, 2001, p.167f; and Grubb and Yamin, 2001, p. 275).

Another example might be the strong defense of the agreement on nuclear phaseout in Germany. Postponing the phaseout could eventually smooth the costs of changing the energy mix, until sufficient renewable energy is available, but the German greens are not willing to discuss this issue at all. Following our analysis, this might not be due to the fact that the nuclear phaseout is one of their foundation principles (as often declared), but driven by the desire to keep the costs of climate protection rather high.

Put together, the observed behavior of 'green' politicians might be explained by strategic concerns in policy making in order to sustain their unique selling proposition. Clearly, this issue deserves further analysis, but this topic is left for further research, since it is beyond the scope of the present paper.

4 An International Application

Our analysis can also be transferred to an international setting, by interpreting differences in the preference parameter α_i^r as differences in the national priorities of climate protection.

Some years ago, the focus of both politicians and political scientists was lying on implementing 'command-and-control regulations', establishing a kind of 'international government' and enforcing commitments on emission reduction. However, the negotiating history of the international climate protection regime clearly shows that this kind of policy approach created too many conflicts with other international laws and institutionalized normative principles. Examples are the right to "catch up", being guaranteed to developing countries in the Johannesburg Declaration of 2002, which then served as further justification for developing countries not to engage in national abatement obligations (Pohlmann, 2004), and the ban of carbon taxes on imports (from countries with lax climate protection), since these taxes are at odds with the free trade regulation of the WTO (Pitschas, 1995, Whalley and Walsh, 2009). Furthermore, the 'command-and-control' approach turned out to be ineffective (Nordhaus, 2006). Its failure became most obvious during the latest climate summit in Copenhagen in December 2009, having raised doubts that successful climate agreements on protection levels (i.e., on reductions in emissions) can internationally be implemented at the moment. One reason should be that countries are still willing to avoid losses in production (stemming from costly climate requirements) and in national purchasing power (due to an increased world market price).

Therefore, most of the recent contributions to international climate policy clearly favor market-based solutions. The majority of these authors recommends higher economic flexibility, improving the efficiency of abatement mechanisms, e.g., by connecting emission trading systems and by implementing CDM and REDD, in order to decrease marginal abatement costs as much as possible. See Endres (2010, part 5) and Whalley and Walsh (2009) for an overview. Others include mechanisms for technological cooperation (Buchner and Carraro, 2006) or carbon taxes as a hybrid price-quantity solution (e.g., Aldy et al., 2003; Nordhaus, 2006). According to Brandt and Svendsen (2002) and Stavins (2008), making global abatement measures more efficient by ameliorating flexibility-mechanisms appears to be the only way of advancing international cooperation in this field at this stage.

Our results support this view. Implementing efficient abatement mechanisms and improving abatement technologies seem to be advantageous. First, production costs and the world market price are decreased. Under mild conditions this increases firms' profits and it increases consumption. This is the major difference to forming a climate coalition and committing to protection levels, where an increasing world market price always has a negative effect on consumption. In that sense a strategy for more flexibility and efficiency would take into account the worries about the economic development of countries (as, e.g., being present in reluctant countries like China, India and the U.S.). Consequently, countries are more willing to increase their voluntary protection levels. Second, if improving abatement mechanisms leads to higher protection levels in all countries, we can conclude from transferring Proposition 2 to an international level that there will be a convergence in desired climate protection levels across countries. Countries with less emphasis on climate protection will increase their voluntary climate protection effort more than those countries which are highly concerned about global warming. Accordingly, it should also be easier to sign agreements with commitments on protection levels in a second step, since the difference between national objectives is leveled. Hence, we support the view in Endres and Ohl (2002) that the “cooperative push” of an international environmental agreement significantly depends on the (correct) choice of abatement instruments.

In a nutshell, one policy relevant interpretation of our results is that the priority of climate policy should be investing resources and effort into improving and implementing efficient abatement mechanisms and providing (free) access to these mechanisms. Such a strategy should foster international climate protection in various ways and prove more efficient than spending resources on climate conferences (as, e.g., the Copenhagen summit 2009), if climate agendas of countries differ a lot.

5 Conclusions

Analyzing a model of international climate protection, we have shown that the convergence in environmental party platforms across parties can be explained by successful international agreements. If these agreements decrease the effective abatement costs, the optimal level of climate protection increases more for traditional parties than for green parties and the difference shrinks. This is driven by the fact that traditional parties react more elastically on reductions in abatement costs, since they are primarily interested in firms’ profits and purchasing power and appreciate cost reductions strongly.

Green parties do not need to fear the loss of their unique selling proposition as long as there is only a one-dimensional voting problem. However, in a multidimensional setting, the effect can be disastrous. Further research should clarify whether green parties are well aware of this problem and strategically try to prevent market-based abatement mechanisms and too efficient climate agreements, as indicated by some anecdotal evidence. If so, their guideline would be that ‘more climate protection is fine, but at rather high costs, please’. Furthermore, this strategic concern might also be the true reason for defending a very strict position in the debate on German nuclear phaseout.

From an international point of view, it can be taken from our model that investing into efficient abatement mechanisms is preferable to climate summits which fail because the objectives of countries are too divergent. Reducing abatement costs first by establishing efficient and flexible mechanisms should lead to a convergence in national interests and should allow for signing a post-Kyoto agreement on emission reductions in a second step.

A Appendix

A.1 Proof of Lemma 1

Evaluating the first order condition (13) for the optimal level of climate protection G_i^*, we define

$$H = -\frac{M_i + \pi_i^*}{p^2} \cdot \frac{dp}{dG_i} - \frac{p_G}{p} \cdot x_i^{s*} \cdot \frac{(n+1)p - (1+k)p_G G_i^*}{(n+1)p} + (1+k) \cdot \alpha_i^r \cdot v_i'(G) \equiv 0. \tag{19}$$

The effect of enlarging the climate coalition by country k on the party platform of a party (and the desired protection level of a voter, respectively) with preference parameter α_i^r is found by implicitly differentiating equation (19) in order to find

$$\frac{\partial G_i^*}{\partial k} = -\frac{\frac{\partial H}{\partial k}}{\frac{\partial H}{\partial G_i^r}} = -\frac{\frac{\partial H}{\partial k}}{SOC}. \tag{20}$$

Since $SOC < 0$ from equation (14), we are left with

$$\text{sign}\{\frac{\partial G_i^r}{\partial k}\} = \text{sign}\{\frac{\partial H}{\partial k}\}. \tag{21}$$

Partially differentiating equation (19) leads to

$$\begin{aligned}\frac{\partial H}{\partial k} &= \frac{p_G^2 G_i^*}{p^2 c(n+1)} \left[\frac{3cM_i}{p^2} + \frac{1+p_G G_i^*}{p^2}\left(\frac{3}{2}p_G G_i^* - p\right) - \frac{n+1}{1+k}\right]\frac{dp}{dk} \\ &+ \frac{p_G}{p(1+k)^2} x_i^s + \alpha_i^r v_i''(G)(G_i^* - G_k) \gtrless 0,\end{aligned} \tag{22}$$

where $\frac{dp}{dk} = \frac{1}{2}\frac{p_G(G_i^* - G_k)}{(n+1)p} p_G$ from equation (11).

The term in squared brackets in the first line of (22) is ambiguous and in particular depends on the magnitude of the price effect on profits π_i and demand x_i^d. The first term in the second line is positive, since x_i^s implies $p - p_G G_i^* > 0$, whereas the second term is negative if $G_i^* = G^c > G_k$.

In case the difference between the protection level in the coalition and the original level in country k is sufficiently small, $G^c - G_k \to 0$, we can utilize $\frac{dp}{dk} \to 0$ and both the first line and the second term in the second line of (22) cancel. If so, we are left with

$$\frac{\partial H}{\partial k} = \frac{p_G}{p(1+k)^2} x_i^s > 0, \tag{23}$$

which proves Lemma 1.

A.2 Proof of Proposition 1

The effect of the preference parameter α_i^r on the change in the desired and announced protection level G_i^* driven by enlarging the climate coalition for country k is obtained by differentiating equation (20) for α_i^r. Consequently,

$$\frac{\partial\left(\frac{\partial G_i^r}{\partial k}\right)}{\partial \alpha_i^r} = -\frac{v_i''(G)}{SOC^2}\left[(G_i^* - G_k) \cdot SOC - \frac{\partial H}{\partial k}(1+k)\right]. \tag{24}$$

The conditions in Proposition 1 imply $G_i^* > G_k$ and $\frac{\partial G_i^r}{\partial k} > 0$. Recognizing from equation (22) that $\text{sign}\{\frac{\partial H}{\partial k}\} = \text{sign}\{\frac{\partial G_i^r}{\partial k}\}$ and utilizing that the second order condition is negative, $SOC < 0$, we find

$$\frac{\partial\left(\frac{\partial G_i^r}{\partial k}\right)}{\partial \alpha_i^r} < 0 \tag{25}$$

in equation (16). Therefore the increase in the offered protection level decreases in the preference parameter α_i^r for climate protection. Since a high preference parameter implies originally a high protection level in the party platform, the distance between protection levels is reduced across platforms and we have a convergence in party platforms.

A.3 Proof of Lemma 2

Differentiating the profit function (3) for p_G and utilizing the effect (9) leads to

$$\frac{\partial \pi_i}{\partial p_G} = x_i^s \cdot \left[\frac{\partial p}{\partial p_G} - G_i^*\right] = \frac{x_i^s}{p}\left[\frac{(1+k)p_G(G_i^*)^2 + \sum_{j=k+1}^n p_G G_j^2}{n+1} - pG_i^*\right]. \quad (26)$$

Adding and subtracting $\frac{\sum_{j=k+1}^n p_G(G_i^*)^2}{n+1}$ in the term in squared brackets on the far RHS results in

$$\begin{aligned}\frac{\partial \pi_i}{\partial p_G} &= \frac{x_i^s}{p}\left[p_G(G_i^*)^2 - pG_i^* + \frac{\sum_{j=k+1}^n p_G\left(G_j^2 - (G_i^*)^2\right)}{n+1}\right] \\ &= -\frac{G_i^*}{p}\pi_i - \frac{\sum_{j=k+1}^n p_G\left((G_i^*)^2 - G_j^2\right)}{n+1}\frac{x_i^s}{p} < 0, \quad (27)\end{aligned}$$

if $G_i^* \geq G_j$.

A.4 Proof of Proposition 2

The FOC (13) for the optimal policy platform can be rewritten as

$$H = -\frac{x_i^d}{p} \cdot \frac{dp}{dG_i^r} - \frac{1}{p} \cdot \frac{\partial \pi_i}{\partial G_i} + (1+k) \cdot \alpha_i^r \cdot v_i'(G) = 0, \quad (28)$$

and from applying comparative statics and $SOC < 0$, it follows $\text{sign}\{\frac{\partial G_i^*}{\partial p_G}\} = \text{sign}\{\frac{\partial H}{\partial p_G}\}$. Unfortunately, this effect

$$\begin{aligned}\frac{\partial H}{\partial p_G} &= \frac{p_G^2 G_i^*}{p^2 c(n+1)}\left[\frac{3cM_i}{p^2} + \frac{1+p_G G_i^*}{p^2}\left(\frac{3}{2}p_G G_i^* - p\right) - \frac{n+1}{1+k}\right]\frac{dp}{dp_G} \\ &+ \left(x_i^s - 2x_i^d\right)\frac{1+k}{(n+1)p^2}p_G G_i^* + \frac{(n+1)p - (1+k)p_G G_i^*}{(n+1)cp} \quad (29) \\ &+ x_i^s G_i^* \frac{(1+k)p_G^2 G_i^*}{(n+1)p^3} \gtreqless 0\end{aligned}$$

cannot be signed in general. The reason is that a decrease in resource costs p_G reduces abatement costs per unit of production, but at the same time total production increases, implying that marginal abatement costs are increased ceteris paribus. See

$$\frac{\partial\left(\frac{\partial \pi_i}{\partial G_i}\right)}{\partial p_G} = \underbrace{\frac{\partial x_i^s}{\partial p_G} \cdot \left[\frac{\partial p}{\partial G_i} - p_G\right]}_{(+)} + \underbrace{x_i^s \cdot \left[\frac{\partial\left(\frac{\partial p}{\partial G_i}\right)}{\partial p_G} - 1\right]}_{(+/-)} \gtrless 0. \tag{30}$$

The analogous argument holds true for the effect on marginal abatement costs in private consumption. A decrease in p_G fosters income and reduces the increase in the world market price, but the still increasing world market price must be paid on more units, because consumption has increased ceteris paribus. Again, the total effect on the margin is ambiguous, because

$$\frac{\partial\left(\frac{x_i^d}{p} \cdot \frac{dp}{dG_i^r}\right)}{\partial p_G} = \underbrace{\frac{\partial x_i^d}{\partial p_G} \frac{1}{p} \frac{\partial p}{\partial G_i^r}}_{(-)} - \underbrace{\frac{x_i^d}{p} \frac{dp}{dp_G} \frac{dp}{dG_i^r}}_{(+)} + \underbrace{\frac{x_i^d}{p} \frac{\partial\left(\frac{dp}{dG_i^r}\right)}{\partial p_G}}_{(+)} \gtrless 0. \tag{31}$$

However, if a decrease in resource costs p_G increases climate protection G_i, we have $\frac{\partial H}{\partial p_G} < 0$ from equation (17). Applying this in equation (18), Proposition 2 follows immediately, because $\frac{\partial\left(\frac{\partial G_i^r}{\partial p_G}\right)}{\partial \alpha_i^r} > 0$ from $v_i''(G) < 0$ and $\frac{\partial H}{\partial p_G} < 0$.

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