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Abstract

Given the global public good properties of climate change mitigation, mitigation efforts have to rely on the willingness of individuals to voluntarily contribute to this public good, either under the form of "green" consumer behavior or through the acceptance of costly climate policy. This paper discusses and reconciles two seminal contributions identifying the rationales for voluntary efforts toward climate change mitigation. Based on the existing literature, it confirms that conditional cooperation may respond to perceived effectiveness and social norms, as suggested by the theory. When the social norm is not visible, conditional cooperation may rely on general beliefs of trustworthiness, i.e. trust. As a result, the conceptual framework of this paper supports the idea of reciprocal countries, thus contributing to endogenize the participation of countries to emissions abatement efforts and to international climate agreements.

Keywords

Social norms; Collective action; Pro-environmental behavior; Climate policy; Trust

JEL codes

D70, F59, H23, M30, Q54, Q58

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1 Introduction

Since climate change mitigation shares the property of a global public good, reaching an agreement to stabilize greenhouse gas emissions at the global level and translating the agreed targets into domestic policy would require countries and citizens within countries to cooperate in a situation in which they would not have the rationale to do it, according to a narrow definition of rationality. Yet, individuals may be more sophisticated than the theory allows (Sen 1977) and do not follow the "rational" selfish strategy. Cooperation is indeed often observed in reality (cf. e.g. Dawes and Thaler 1988) and an important literature developed to emphasize cooperative behavior in a range of economic interactions (see Fehr and Schmidt 1999).

From a theoretical perspective it is not straightforward to formalize cooperation. In the environmental arena, a successful example is represented by the model of Nyborg et al. (2006), which, building on previous theoretical simplifications such as Brekke et al. (2003), introduces a self-image benefit in a simple optimization problem and so allows individuals to take into account non-monetary components of their pay-offs. In short, agents may prefer a green good over a grey good if the self-image benefit that the green choice would generate exceeds the cost differential between the two products. The self-image benefit depends on the environmental benefit that the green choice generates and to the social norm regarding the adoption of this good.

More recently, much attention has been given to the influential contribution of Ostrom (2009), who collects many examples of bottom-up initiatives to mitigate climate change to show the existence and to some extent the magnitude of cooperation in the climate commons (cf. also Ostrom 2010; Tavoni and Levin 2014). Based on the stylized evidence that cooperation exists also in global dilemmas as in local commons, Ostrom suggests that individuals in the climate commons form a general belief on the trustworthiness of others to cooperate (i.e. trust) and behave accordingly. Hence, in a given context, people trusting others to provide efforts to reduce their carbon footprint may be more willing to do the same efforts themselves. As a result, managing global dilemmas may not be that different from managing local commons (cf. Ostrom 1990).

In this paper, I argue that the approaches of Nyborg et al. (2006) and Ostrom (2009) share a common perspective and that the role of trust introduced by the former may fit very well the theoretical framework of the latter. I discuss the empirical evidence available so far and how it may corroborate such common perspective. In this way I reconcile the two contributions and provide, based on Nyborg et al. (2006), solid foundations to Ostrom's "loose" ideas. This paper also shows that such joint framework may contribute to endogenize climate policy at the country level and participation in international climate negotiations. In particular, I show that this framework may be able to provide microeconomic foundations to Nyborg (2014), whose model identifies the possible outcome of international negotiations based on the possible presence of reciprocating countries. Nyborg (2014) depicts relatively well the current pattern of cross-country cooperation in the climate commons, but does not explain why some countries act as reciprocators while others do not.

2 Self-image benefit and trust

2.1 The original model of Nyborg et al. (2006)

Cooperation is made possible in Nyborg et al. (2006) thanks to a self-image benefit denoted S that individuals enjoy if in the choice between two goods they opt for the morally superior (green) alternative. The green alternative is chosen as long as the self-image benefit S exceeds the cost differential C of buying the more sophisticated and expensive green option. S depends positively on B and a, where B represents the external benefit that the green action yields and a is the

share of the population n having chosen the green option, and thus represents the norm (i.e. $a = \frac{(\sum x_i)}{n}$). In short, the main algebra consists in the individual i maximizing its payoff p_i[1]:

$$p_i = (S + b - C)x_i = (S - c)x_i \tag{1}$$

where $x_i = 1$ if the individual buys the green option and 0 otherwise. b represents the environmental benefit enjoyed by the individual itself (which is often negligible), so that $B = b(n-1)$ is the societywide non-rival environmental benefit. Then, $c = C - b$ measures the net private cost of opting for the green option, without taking into account social motivations, so that $c > 0$ and the public good framework is set. S is function of B and a, i.e. $S = s(B, a)$ with $s(B, a)$ being concave and increasing (and differentiable).
It follows from (1) that $x_i = 1$ if $s(B, a) > c$. Multiple equilibria are then possible depending on B, a and c. While this model presumes that individuals are conditional cooperators, in reality, a population of heterogeneous individuals may be composed of unconditional Kantian cooperators (cf. Roemer 2010), conditional cooperators and unconditional uncooperators (cf. Ostrom 2000). Yet, it is reasonable from both a theoretical and a policy perspective to focus on the behavior of those individuals that may be affected by a (and B).

This short introduction to the structure of the model is useful to orient the discussion all throughout the paper. In what follows, I first extend the set of possible green goods so to include climate policy and assess the relevance of the model based on recent empirical evidence on the role of B. Second, I discuss the relevance of the model in predicting green behavior based on recent empirical evidence on the role of a. I argue that the expectation of a may be very close to what the literature defines as *trust* and discuss the existing evidence on the possible linkages between trust and the climate commons. Third, starting from the original model I discuss a simple framework in which citizens determine the level of cooperation of their country in international negotiations, thus contributing to provide microeconomic foundations to the growing economic literature on international climate negotiations.

2.2 Climate policy

In their conceptual analysis of the linkages between trust, cooperation, pro-environmental behavior and eventually greenhouse gas emissions, Carattini et al. (2015) stress that the green good under scrutiny in Nyborg et al. (2006) may also be a green policy. Citizens and policymakers have indeed the choice of supporting green policies over grey alternatives (or no policy at all). The policy endogeneity is particularly important in the case of environmental taxes. Indeed, despite their relatively old theoretical foundations, the implementation of carbon taxes is a rather recent (and very heterogeneous) phenomenon (cf. Baranzini and Carattini 2014b; World Bank 2014).

A relatively new literature tries to explain the seldom application of market-based instruments of environmental and climate policy. For instance, Kirchgassner and Schneider (2003) emphasize the different political economy aspects related with the implementation of environmental taxes and reforms, attempting at identifying the possible winners and losers among industries, politicians and bureaucrats. The power of lobbying has proven very powerful in avoiding possible energy taxes (cf. Rocchi et al. 2014) or in softening those that were finally implemented (cf. e.g. Godal and Holtsmark 2001; Bruvoll and Larsen 2004; Lin and Li 2011; Spash and Lo 2012). However, lobbying from energy-intensive industries is probably not the only explanation for the lagging implementation of such taxes. Environmental taxes are indeed also very unpopular among

[1] In this model individuals are supposed to be optimizing their pay-offs, while taking into account non-monetary rewards. Since it is more likely that individuals are not fully rational and gradually adapt their behavior as the external conditions change, in this model the representative individual does not revise the strategy in a continuous way but rather at random moments. That is, this model shares to some extent the same evolutionary spirit of Tavoni et al. (2012).

voters, which may also join the group of losers (cf. again Kirchgassner and Schneider 2003).Yet, environmental taxes do not seem much more popular when revenues are used to reduce distortionary taxes on labor or redistributed lump-sum to the population (cf. e.g. Dresner et al. 2006; Baranzini et al. 2014). The pressure of people disliking environmental taxes may be so strong to push politicians to abandon their proposed reforms (see e.g. the French case in Deroubaix and Lévèque 2006) or to reject the proposed reforms in a ballot (see e.g. the Swiss case in Thalmann 2004). Hence, it is particularly relevant to identify the theoretical determinants of the adoption of climate policy instruments and the possible ways to spur such adoption. In this section, I argue that Nyborg et al. (2006) can contribute to complement the current, mainly empirical, literature on the acceptability of environmental taxes.

Several explanations may be given for the reticence of people to support energy and carbon taxes, also when they may be net winners. In general, people have a preference for progressive (or at least neutral) taxes, as shown by e.g. Bristow et al. (2010), Kallbekken and Sælen (2011) and Brannlund and Persson (2012). They may also be concerned about competitiveness and employment effects (cf. Thalmann 2004). Yet, the main obstacle emphasized by the literature and barely addressed by policymakers is that people do not conceive the difference between "Pigouvian" and "Ramsey" taxes (Kallbekken et al. 2011). Hence, people fail to understand the incentive effect of Pigouvian taxes and thus neglect any environmental benefit from the new taxes unless revenues are explicitly earmarked (cf. the "issue-linkage" concept in Sælen and Kallbekken (2011). It follows that a recurrent result in the literature is a high correlation between perceived effectiveness of the Pigouvian tax and its acceptability (cf. e.g. Brouwer et al. 2008; Bristow et al. 2010; Kallbekken and Sælen 2011; Sælen and Kallbekken 2011; Baranzini and Carattini 2014a; see also Drews and van den Bergh forthcoming).

Overall, the literature suggests that some individuals may be willing to support (possibly costly) environmental taxes if they would perceive the benefit B that these mechanisms generate. Climate policy may thus be a field in which it would be particularly relevant to apply the lessons from Nyborg et al. (2006) in terms of informational campaigns and advertising, especially in what concerns the perception of B. Interestingly, social norms (see next section) may also affect the perception that people have of the effectiveness of climate-policy instruments such as carbon taxes, as shown by Bolsen et al. (2014) based on treatments suggesting that a very large or a very tiny proportion of the population is willing to support taxes on polluters in an effort to tackle climate change.

2.3 Social norm and trust

As anticipated, B is not the only component that influences cooperation in Nyborg et al. (2006). The a component in the model refers to the social norm, which is at first supposed to be observable. In a later stage, Nyborg et al. (2006) relax this assumption by allowing possible misspercceptions $\hat{a}$ of the social norm a. The salience of the social norm is indeed very context-dependent.

Recent social network analysis has shown a particular case in which the adoption of a green technology may be particularly salient: rooftop solar photovoltaic (PV) panels. Rooftops convey information about the norm so that the individuals revising their strategy may "simply mimic [...] the strategy of their neighbor" (Nyborg et al. 2006, page 357). Empirical evidence in this sense is provided by Bollinger and Gillingham (2012), whose spatial analysis on the adoption of solar PV relies on Californian data, and Graziano and Gillingham (2014), which improve the methodology of the former with data from Connecticut. Both studies show that peer effects shape the spatial distribution of solar panels, whose adoption is mainly the result of a phenomenon of social contagion.

Further evidence on the role of visibility as determinant of peer effects in the adoption of green technologies is provided by the case of hybrid cars. As shown by Narayanan and Nair (2013) for

California, peer effects seem to exist in the adoption of hybrid cars, but only for the Toyota Prius Hybrid and not, for instance, for the Honda Civic Hybrid. While the Prius exists only in its hybrid form and is thus "by construction" a green car, the hybrid versions of the Civic are "visually exact versions of their nonhybrid versions" (Narayanan and Nair 2013, p. 72). Hence, going green seems to be contagious only if sufficiently visible as to modify the perception of the social norm a. In the words of Ostrom (2000), driving a Prius would provide at least a noisy signal about other's adherence to social norms and may thus be sufficient to initiate reciprocity among conditional cooperators, while this may not be the case with a Civic.

In many other cases the norm is not visible in its own nature, but may be made visible through external intervention. An increasing number of studies focus on information campaigns and social marketing interventions aimed at influencing the perception of the social norm that people have, mainly when $\hat{a} < a$. Following Cialdini (2003), descriptive norms have increasingly being associated to injunctive norms to redirect people's behavior toward environmentally superior alternatives. Schultz et al. (2007) apply Cialdini's lesson to a field experiment on household energy consumption and find that people tend to converge toward the level of consumption of their neighbors, when information about the latter is provided by the experimenters. Of course, this convergence does not necessarily imply lower energy consumption for each household, since those underconsuming will also move their consumption upward to match the norm. Yet, the authors address this perverse effect by recurring to injunctive norms. In the study the injunctive messages consist in giving formal approval to the behavior of the households consuming less than average, hence giving value to their efforts.

A similar experiment was conducted on a much larger scale on behalf of several utilities by the company Opower, which provided treated households with home energy reports designed to spur energy conservation. Allcott and Rogers (2014) analyze the long-run effects of the Opower behavioral intervention and find that people react to the comparison with the energy consumption of their neighbors (and with their own past energy consumption) even after several reports. The program continues to be effective in reducing energy consumption even after a half decade and also when discontinued, i.e. the previously treated households do not return to pre-treatment consumption levels and keep consuming less energy that the peers in the control group. The cost effectiveness analysis in Allcott and Rogers (2014) confirms how powerful social norms may be, in line with what is predicted by the advertisement feature in Nyborg et al. (2006).

Observability is also the key feature of another behavioral intervention focusing on the voluntary participation in "demand response" programs and studied by Yoeli et al. (2013). The aim of these programs is to have a pool of households willing to have their energy consumption remotely controlled and potentially reduced during demand peaks to prevent blackouts and costs explosion. Participating households provide each a minor contribution to the public good, while carrying the cost of lower comfort due to their electric appliances being remotely switched off. This large field experiment provides evidence based on more than 2'000 participants indicating that the treatment simply showing how many neighbors are taking part in the program engenders much more participation than a monetary reward of $25. The authors argue that even a monetary reward of about $170 may still underperform the social norm treatment. Observability is shown to matter for those individuals thinking that voluntary participation in demand response program is a public good, confirming that an inclination to cooperate (or reciprocate) is a necessary condition for a to affect behavior. Finally, greater effects are found when people live in apartments rather than houses and this difference is explained by the authors by the many more interactions between neighbors in the former case.

While in the experimental settings of Schultz et al. (2007) and Allcott and Rogers (2014) households could also save money by adapting their behavior as desired by experimenters, behavioral interventions can also be effective when c is clearly positive. Recently, a flourishing literature has developed assessing the willingness to pay of individuals for climate change mitiga-

tion (see Nemet and Johnson 2010), thus complementing the more specific literature on the public acceptability of climate policy instruments. This literature has focused on both the average and the median willingness to pay (WTP). The reason for this is that while the average WTP is in general positive, often boosted by some outliers, the median WTP tends to be very close to zero, potentially leading to rather pessimistic inferences for the median voter. Similarly to Schultz et al. (2007), Löschel et al. (2013) provide information to the treated group about the level of contribution in the control group, in terms of WTP for climate change mitigation. Not surprisingly absent any injunctive norm, the authors end up with very similar values for the average and median WTPs in the treatment and control groups, since not only those individuals that would have otherwise undercontributed compared to the norm adjust their WTP upward, but also those that would have otherwise been "overly" generous prefer to stick to the norm and revise downward their contribution. Hence, what the treatment does is clearly reducing the variance in WTPs. To avoid this issue, Lindman et al. (2013) design a semi-experimental study where they provide to Swedish students fake numbers about the rate of participation of the Swedish population in CO_2 offset programs. As predicted by the model of Nyborg et al. (2006), the high numbers given in the survey for a (or rather a manipulated norm $\tilde{a} > a$) do affect the students' contributions, whose WTPs are positively correlated with the supposed average participation of Swedes in CO_2 offset programs.

At this point, one question may be whether acting upon a is also possible on a very large scale. Arguably, it can be, in some specific contexts. A good illustration is provided by the very recent decision of several Swiss utilities to set the green mix as default electricity product, generally leaving to households the choice to opt-out and move back to the cheaper "grey" mix. The evidence available so far seems to indicate that people tend to stick to the new default mix. While several economic mechanisms such as transaction costs and status-quo bias may explain this pattern, there is no doubt that this decision changes the norm a, which all of a sudden goes to 1. Since a changes, S changes too and it may thus no longer be profitable for the individual i to switch back to the grey option. Remarkably, this intervention modifies the norm in a very transparent way, since the new norm of 100% green electricity as default for everybody is announced to all customers.

In most cases, however, it is particularly hard to know the level of cooperation of others. This is, actually, one of the reasons why Lindman et al. (2013) use fake numbers for the population's average willingness to pay for CO_2 offsets in their Swedish study. Yet, in the presence of uncertainty, agents may form beliefs on the expected cooperation from others and behave accordingly. For instance, when evaluating the willingness to pay of Swiss individuals for climate change mitigation, Blasch and Farsi (2012) find that the private demand for carbon offsets positively depends on "people's expectation about the percentage of [...] consumers that participates in voluntary carbon offsetting schemes" (p. 20). Hence, people may not observe a but base their behavior on the expectation of cooperation such that $\hat{a}=E(a)$. Indeed, in many instances of real life individuals have to trust others and hope that these are trustworthy cooperators. The model of Nyborg et al. (2006) thus fits very well the seminal contribution of Ostrom (2009), where the author argues that trust influences behavior in the climate commons as in local dilemmas (cf. Ostrom 1990), and as a result individuals trusting others to provide efforts to reduce their carbon footprint may be more willing to do the same efforts themselves (see also Ostrom 2010).

Hence, one may expect peer effects to explain the local patterns in the adoption of green technologies or pro-environmental behavior, and the level of generalized trust to shape the adoption of green technologies and pro-environmental behavior at a larger scale. Although still scant, the empirical evidence on the cross-country differences in efforts for climate change mitigation seems supporting this intuition. Carattini et al. (2015) use a set of panel data for Europe over the period 1990-2007 to examine the link between trust and greenhouse gas emissions and find a negative correlation between the two variables. The authors argue that the higher the level

of trust, the higher the willingness to cooperate in the climate commons and hence the lower the emissions. As discussed, this willingness to cooperate may not only imply biking to work instead of driving but also casting a yes-vote in favor of more stringent environmental policy. In this respect, using data on the adoption of Agenda 21 programs, Owen and Videras (2008) show that there is a positive correlation between trust and the number of programs targeting sustainable development according to the Agenda 21 guidelines. Further evidence in this sense is provided by the meta-analysis of Alló and Loureiro (2014), in which countries with a high propensity to conform to social norms are associated with higher willingness-to-pay for climate change mitigation.

2.4 International climate agreements

The model of Nyborg et al. (2006), coupled with the intuition of Ostrom (2009), may thus be particularly relevant in explaining the large differences across countries in the way climate change mitigation is approached. For instance, in the light of this discussion, it may no longer surprise to see high-trust countries such as the Scandinavian economies having taken the lead in implementing theoretically stringent instruments of climate policy such as carbon taxes.

Indeed, explaining the cooperation of countries in the climate commons requires once again moving beyond the standard maximization of economic payoffs. A possible application of the conceptual framework presented in this paper could be the participation of countries in climate negotiations and in concerted efforts toward climate change mitigation, in particular as analyzed by Nyborg (2014). Nyborg (2014) explores the mechanisms behind a possible coalition of countries susceptible to provide a positive quantity of emissions abatements and find that, to the contrary of a standard framework à la Barrett (2006), a grand coalition of abating countries can exist if countries have reciprocal preferences, i.e. if they act as conditional cooperators. Even if some countries free ride, a smaller coalition with all reciprocating countries may still exist and lead to a positive level of abatement. Hence, in spite of its necessary simplifications, the model of Nyborg (2014) seems to depict relatively well the current picture of cross-country mitigation efforts, with a cluster of abating countries and a large group of free riders.

Nyborg (2014) provides an as-if model looking at what could happen if countries had reciprocal preferences without claiming that they do. In the model, these preferences have to be common knowledge, a feature necessary to have countries coordinating in an equilibrium and forming a coalition. Following the reasoning in the previous sections of this paper and as noted by Nyborg (2014), countries may have reciprocal preferences if their median voter does. Endogenizing the choice of being a reciprocal country in the spirit of Nyborg et al. (2006) and Ostrom (2009) implies that the median voter in this country chooses the green (reciprocal) climate policy over a grey alternative if $\hat{a}$ (the level of generalized trust) is, everything else equal, large enough. These preferences may also be common knowledge, if climate policy is the result of a relatively transparent democratic decision-making process, as described in section 2.2.

Reciprocal preferences are likely to be necessary even in the context of a powerful treaty with external sanctions, as proposed by Nordhaus (2015). In such setting, countries can cooperate without departing from a narrowly rational perspective, but arguably much collective action is required to create a club of countries willing to push forward such proposal and get other countries on board if anything for a round of first-stage treaty design negotiations. As noted by Nordhaus (2015, p. 1362) "treaties do not spring full grown" but are the result of a long and complicated process, which may also have some features of social contagion. As analyzed by Fankhauser et al. (forthcoming), in the last decades one of the main determinants of countries' adoption of climate change laws has indeed been the passage of such laws elsewhere. Consistently with what suggested by the authors, this finding seems to point to an important and yet underestimated role for contagion in the international diffusion of climate policy, and more in general for poten-

tially reciprocal preferences of voters and countries. Trust and reciprocity are thus very likely to be necessary ingredients to build an effective climate regime, while sanctions (as proposed by Nordhaus 2015, or under different forms) are necessary for its survival. As noted by Ostrom (2000), most long-surviving regimes develop a system of monitoring and enforcement with graduated sanctions, since "rule infractions [...] can generate a downward cascade of cooperation in a group that relies only on cooperation and has no capacity to sanction. [...] With local monitors, conditional cooperators are assured that someone is generally checking on the conformance of others to local rules. Thus, they can continue their own cooperation without constant fear that others are taking advantage of them" (p. 151).

3 Conclusion

Contrary to what standard economic theory presumes, a certain level of cooperation is present in the climate commons (Ostrom 2009). What are the roots of such cooperation? According to Elinor Ostrom, social norms are determinant in spurring cooperation among individuals, in particular by shaping the expectation of cooperation from others and in turn cooperation itself. That is, the environmental bright side of social capital.

Ostrom's legacy consists in a simple, yet powerful, intuition: local norms influence behavior also in global public good situations, as they do in local dilemmas (see Ostrom 1990). This paper discusses how to formalize Ostrom's intuition drawing extensively from the seminal model of Nyborg et al. (2006). This model, indeed, does not only fit very well Ostrom's hypothesis on trust and the climate commons, but also the existing strands of empirical evidence on the private demand for climate change mitigation.

The two seminal contributions are thus reconciled in a common framework, which may serve as a basis for the empirical identification of the drivers of cooperation in the climate commons. This paper also shows that when citizens are conditional cooperators and pay attention to the social norm, social-capital abundant countries may adopt a reciprocal attitude in the international arena and provide emissions abatements even in the absence of a full international agreement, as it is currently the case in the real world.

This paper thus addresses the pressing question of how to deal with the global public good which is climate change mitigation and provides to the literature a conceptual framework bringing to the issue a touch of optimism, by underlying the importance of social norms, and a touch of pessimism, by recalling the endogeneity of climate policy.

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