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Institutional Challenges to 'Patience' in the Collective Management of Public Goods

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Impatience is nothing but an unnoticed, self-defeating experience.

Sri Chinmoy

Abstract

I discuss institutional challenges to the practice of far-sighted, "patient" policies, such as restraint in present consumptive patterns in order to avoid future damages, be they environmental or social. These challenges arise from the excessive influence of "impatient" parties in a participatory decision process.

Introduction

Many of the collective decisions we make, as societies or as groups of nations, involve inter-temporal tradeoffs – balances of present and future benefits and damages. Virtually every investment strategy is evaluated in terms of its future return to present costs. Similarly, the harvesting of a natural resource, such as forests or mineral deposits, balances present benefits and future scarcity, and the pursuit of polluting activities balances present income and future damages. Indeed, decisions such as those are at the very heart of the sustainability debate.

The efficient balance between present and future depends on the degree to which we value the future. We all share a psychological tendency to undervalue the future in comparison to the present.

The closer to the present a certain amount of goods or services (utility) is provided, the more we value it. This tendency should be familiar to all of us from our daily life, and is also reflected formally in the economic environment by the presence of interest rates, which limit our investments to those that provide rates of return above a certain positive threshold.

In economic theory, this complex psychological phenomenon is commonly described by a single number called the factor of time discounting. This number is defined as the factor by which we discount, or undervalue, a unit of utility, for every additional time unit (a day, a year, a generation) by which it is further removed from the present. The lower this factor is, the more "impatient" or "short-sighted" our behaviour is, in the sense of an increased unwillingness to sacrifice present utility for the sake of future one.

For example, consider an individual with a discount factor of 90% per generation (25 years). Such a person attaches a value only 90% of its present value to a unit of utility that is provided to the next generation. If it is provided in two generations' time (50 years), such a person would value it at 90%X90%=81% of its present value, and so on.

Figure 1 shows the discounting factors associated with two individuals, one having a discounting factor of 90% per generation, which I call "farsighted", and the other of only 30% per generation, which I call "myopic". Clearly, the latter person is much more "impatient", and the difference becomes more manifest as the discounting is compounded over more generations.

The different discounting behaviour of these two individuals will be manifest in their tastes with regard to various investment decisions. For example, consider an investment, be it in education, the conservation of a forest, etc… that costs 100$ today, but provides returns of 150$ in 25 years (ignore the effects of inflation). While the myopic individual will deem such an investment unworthy (because 150$*30%=45$, which is less than

100$), the far-sighted individual will deem it worthy (because 150$*90%=135$, which is more than 100$).

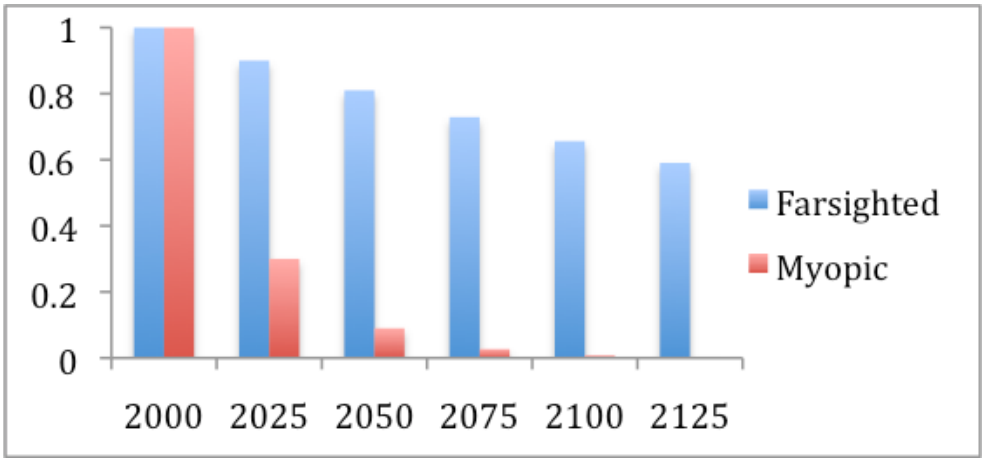


***Figure 1**: The future discounting factors of two individuals, one, farsighted, having a discount factor of 90% per generations (25 years), the other, myopic, having a factor of 30% per generation*

Global Climate change is perhaps the most pertinent example. Climate change mitigation requires a collective, globally coordinated effort. The degree to which we should reduce greenhouse gas emissions, and thus incur present abatement costs, in order to reduce future damages from climate change depends on our time discounting factor. Indeed, two prominent works on the economics of climate change reach very different recommendations on the desirable course of action, partly because of the different discount factors they use. Sir Nicholas Stern who advocates aggressive mitigation, uses a factor of 99.9% per year, whereas Prof. William Nordhaus, who finds that mitigation is premature, uses a factor of 97% per year (while the differences may seem small, when compounded over the time horizon of climate change impacts, about a 100 years, they add up to a very large factor). Dasgupta 2006 discusses this in detail.

There are many reasons to believe that people have a wide range of discount factors. For example, some empirical estimates find individuals' discount factors ranging from 100% to 30% (see, for example, Frederick, Loewenstein and O'Donoghue 2002). When facing a collective inter-temporal decision, these different

individuals will have different opinions on the best course of action. How might we expect group decisions to reflect and balance these different tastes?

The same question can be posed with regard to collective global decisions to be undertaken jointly by several nations. Here again, there are reasons to believe different countries may value the future differently. For example, it is widely believed that impatience, in the sense of a short term planning horizon, is higher the lower income is, and theory suggests that the discounting of consumption also increases with the growth rate of a country, so countries with high economic growth may tend to be more "impatient".

There are other situations in which we might expect discount factors to vary across stakeholders. Consider a fishery, or a primary forest, that is harvested by both commercial firms as well as households traditionally depending on it for their subsistence. Commercial firms that translate the forest's services into financial returns will harvest it in a rate that maximizes their stream of profits, and is thus determined by the market interest rate. Households depending on the forest in a much deeper way will, in contrast, be harvesting the forest according to a traditional system that probably ensures the long term sustainability of their livelihood, and will be much more patient (for example, not exceeding the natural re-growth rate).

In this paper, I discuss how groups, composed of members, be it individuals or nations, with different valuations of the future, might be expected to collectively value their future. Such collective decisions are needed when they pertain to public or common goods to avert a tragedy of the commons, but there are many possible socially efficient policies, each one corresponding to a different valuation of the future.

Below, I will point out two challenges that might lead to collective decisions that enhance collective "impatience" unless they are recognized and dealt with. The challenges are institutional, in the

sense that they may tend to plague the political economy of the decision making process unless special institutional measure are undertaken. Of course, if members of a group discount the future, any collective decision process that reflects the wills of all its members will also discount the future to some degree. Ideally, collective discounting is chosen to optimize aggregate inter-temporal welfare. What I show below is that the degree of impatience is likely to exceed this idealized level.

In some sense, any tendency to undervalue, or "discount" the future is an obstacle to achieving sustainability, by definition. In fact, there is a view that holds that even though individuals discount the future, social institutions, and governments in particular, should not, but instead value all times equally. While many social scientists consider this view to be paternalistic, some important economists, including one of the fathers of the discounted utility model, Ramsey, have upheld it. From this perspective, any tendency for social "impatience" is excessive, and institutions should be designed to minimize the degree of collective discounting.

The Kingdom of Bhutan is undergoing a profound institutional change - a transition from a far-sighted monarchy to a parliamentary democracy in which less patient attitudes are also likely to have an influence. One of the challenges to the designers of the constitution is the protection of the far-sighted vision of the monarchy (as reflected by Gross National Happiness, protection of forests, etc…) within the new democracy. In this sense, I hope the ideas in this paper might be of relevance to policy discussions in Bhutan.

The first challenge: lack of long-term commitment

Consider a group whose members have different discount factors. Consider further an inter-temporal allocation problem in which each member of the group has the same benefit and the same damages at each period in time. For example, we may be trying to decide whether to levy uniform, lump-sum taxes on all group

members in order to make a collective investment, for example in education, that will benefit everyone equally in the future.

Thus far, we have modeled the time preferences of each member in terms of a single number, the discount factor. If the discount factor was x, the second period's utility was valued at a fraction x of the same utility in the first period, the third period's utility was valued at a fraction x of the same utility in second period (i.e. x^2 of the first period), and so on – each period was valued at a fraction x of the previous period, no matter which period it was. Such discounting behaviour is called "geometric" or "exponential" discounting because the discounting factors form a geometric series.

It turns out, however, that for a group composed of members with different discount factor, the collective discounting factors that should be used when making optimal decisions for the group as a whole, display what is called "hyperbolic discounting". Specifically:

Proposition 1: The collective discounting of a group whose members have heterogeneous discount factors is hyperbolic: the discounting factor of period N+1 relative to period N is not constant, but increases for larger N. Asymptotically, in the long run, it approaches the largest discount factor in the group, i.e. that of the most patient member.

Proposition 1 is proved in the Appendix (see Gollier & Zeckhauser 2005 for a comprehensive formal treatment of this problem). However, proposition 1 is not hard to understand intuitively. Imagine a social planner that tries to allocate common resources inter-temporally in a way that benefits the group's aggregate welfare. The impatient members of the group, by definition, care about the short-term allocation much more than they do about the long-term allocation, and the patient members care about the long-term allocation and the short-term allocation more equally. This means that the near term allocation, i.e. the allocation of resources between earlier periods should reflect the tastes of the impatient

members disproportionally, and that the allocation of resources between the later periods should reflect the tastes of the patient members disproportionally. In other words, collective discounting should initially mirror the discount factors of the impatient, and later on mirror that of the more patient members, and more so with time, so that eventually, it should converge to that of the most patient member.

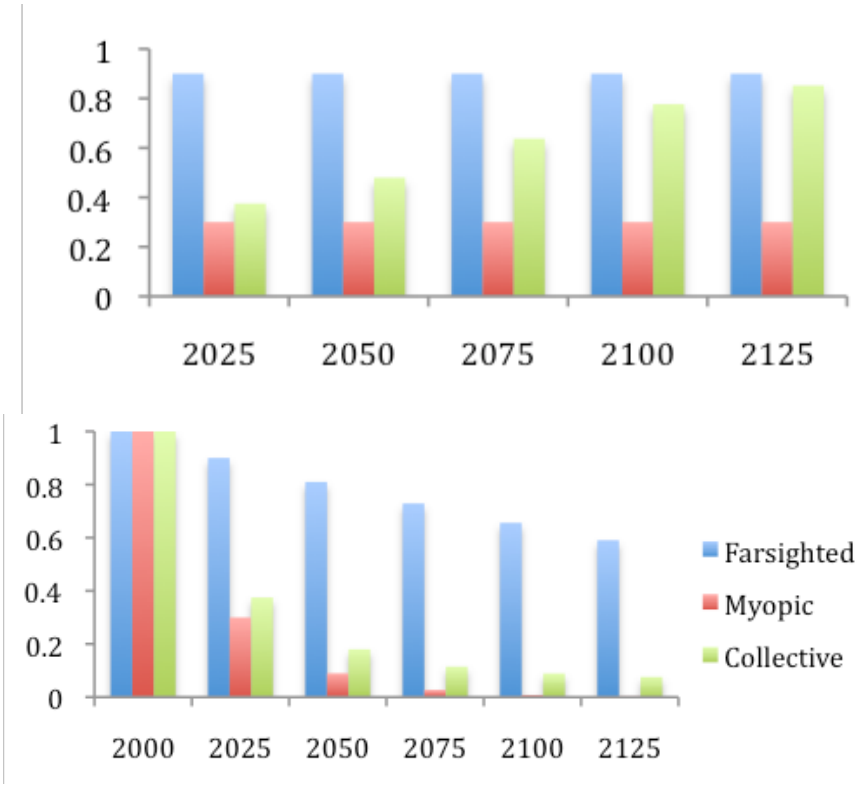


Figure 2. *Discount factors of the farsighted member, the myopic member, and the group's, at each period (compared to the first period (bottom) and compared to the previous period (top).*

As an example, consider a "group" consisting of our Mr. Farsighted and Mr. Myopic (short-sighted). Figure 2 shows the discount factors of each member and the "group" consisting of the two. On the right, the factor by which each period (generation) is discounted compared to the previous generation is shown. Whereas for both the myopic and the farsighted individuals, these factors do not change with time, the collective factor rises with time.

This type of discounting can have interesting impacts. As a simple example, suppose that Mr. Myopic and Mr. Farsighted need to manage an old-growth forest that they share, and have to decide how much of it should be cleared each year. Suppose they decide, jointly, to harvest 100 acres in 2000, 50 acres in 2025, 30 acres in 2050, and some other amounts in the future. This harvesting plan reflects their joint discounting factors: the more is harvested in each generation, the less remains for future generations, so the harvesting amounts reflect the degree to which the pair jointly values these future generations. Note that the decision to harvest 100 acres in 2000 is optimal only if the rest of the future harvesting amounts are followed in future generations.

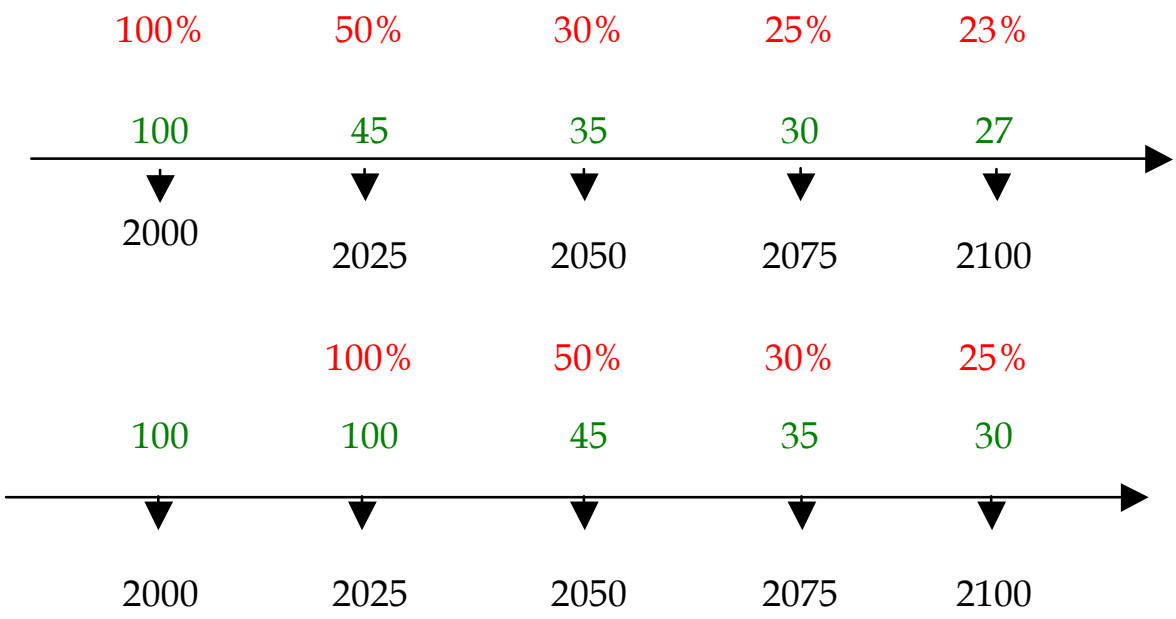
The pair indeed harvests 100 acres in 2000, but when the year 2025 arrives, rather than following the original plan and harvesting 50 acres, suppose they convene to re-evaluate their decisions. Because of hyperbolic discounting, future generations, as seen from 2025, are not valued, relative to each other, in the same way that they were from the perspective of 2000. In fact, the years 2050, 2075, 2100 etc… are now valued the way 2025, 2050, 2075 etc… were valued from the perspective of 2000. Accordingly, the pair now decides to again harvest 100 acres immediately, 50 acres in 2050, etc… Figure 3 shows this updated plan schematically. These dynamics eventually lead the pair to harvest 100 acres at each generation, which is a much faster rate of harvesting than the optimal plan as it was devised in 2000.

Such a situation, called "time inconsistent plans" would not occur if the two agents had the same discount factor, because then their joint discounting would be geometric, not hyperbolic, and thus relative discounting between successive generation would remain the same, no matter from which period they are viewed.

Essentially, the root of problem is that in the original plan, the tastes of the myopic member were allowed to disproportionally influence the initial harvesting rate, and the tastes of the far-sighted member dominated the harvesting rates further on in the future, because initially, the myopic member did not care about

what happened far in the future. But when that future actually arrives, Mr. myopic now realizes he does in fact care, and the collaborative decision process is updated to reflect that.

***Figure 3**: An example of inconsistency in a forest harvesting plan. Discounting factors (in blue), planned harvesting amounts (in hectares, green), as seen and decided upon*



To refrain from such excessively impatient behaviour, institutions are necessary that commit the group to its original plan. This can be politically challenging, since if all parties decide to update the plan, they can also decide to change any legislation that may try to prevent such a change. Still, a constitutional act that is backed by a non-political entity can be quite a powerful means of avoiding these kinds of dynamics. The constitutional protection of forests in Bhutan and the very presence of the King may prove to provide just such an institution.

Certain economic institutions may also be helpful. For example, if the governments announces future plans of restrictions on harvesting in the forms of aggregate caps, and also allows harvesting permits to be traded across firms and across times (effectively, a Cap and Trade system which also allows trading in

harvesting "futures"), the trading in future harvesting permits can create strong resistance in the market against an updating of harvesting caps, since such updating can reduce the value of traded permits and hurt some of these firms. This can in turn influence the government to stick to the original plan.

On the other hand, past experience seems to indicate that long-term environmental policies, especially in the international arena, are uncommon. The Kyoto protocol on climate change mitigation, for example, was of very short duration, and new climate treaties are not expected to commit countries for more than a decade or two, time scales that are short in comparison to the planning horizon relevant to the problem.

The second challenge: the excessive influence of the impatient in negotiated outcomes

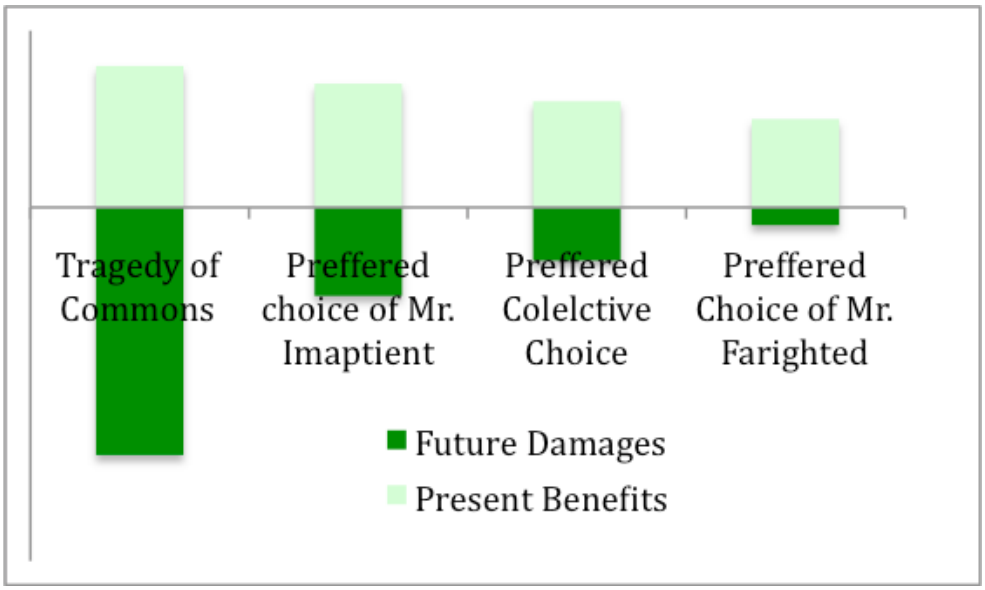
Thus far, we assumed that the group decisions are aimed at optimizing collective welfare – the sum of all members' inter-temporal welfares. Below, I argue that in fact, there are reasons to expect impatient members of the group will be able to sway collective decisions to place disproportionate weight on their own welfare, even if a social commitment mechanism exists.

The collective decision, I assume, is reached through some process of negotiation, which is in essence, a bargaining process. One prominent, and perhaps the most intuitive, theory of bargaining predicts that, when two or more parties can cooperate in more than one way, they will choose that way for which the benefits to all parties, relative to the non-cooperation outcome, will be equal. For example, when two parties need to split a cake, and in the absence of agreement none get any of it, this theory predicts they will decide to split it in half. But if one of the parties values the cake to a higher degree, this theory predicts the bargaining process will eventually allocate a lower share to that person. The reason is, simply, that this party has a weaker bargaining power and thus be willing accept such an outcome.

What is the non-cooperation outcome in our context? In most environmental problem, like the management of a shared forest, it is natural to expect that in the absence of any agreement on harvesting policies, no regulation will be enacted, and a 'tragedy of the commons' will ensue. Firms will tend to over-harvest the forest, simply because in the absence of regulation, there is no incentive for conservation – whatever is spared through personal restraint will be shared by all other parties in the following period. The tragedy of the commons will be manifest in an excessively high harvesting rate early on, higher than what either of the parties, even the impatient one, would have chosen on their own. This excessive impatience is actually inefficient, and a result of the externalities involved. A formal demonstration of this assertion requires the tools of dynamic game theory and is beyond the scope of this paper (the pioneering analysis of this problem can be found in Levhari and Milman 1980).

Figure 4 shows a schematic example of the ranking, in terms of impatience, of the consumption choices of Mr. Myopic and Mr. Farsighted if they were on their own, the collectively optimal choice (that maximizes the sum of their welfares) and the tragedy of the commons (the non-cooperative outcome). The horizontal axis measures impatience, as it is reflected in present consumption. This present consumption has associated future damages. In the tragedy of the commons, high present consumption is more than offset by future damages and is inefficient according to either the myopic or the farsighted discount factor. The optimal choice of present consumption depends on the discount factor - the collective optimum lies in between the individually optimal choices of Mr. Myopic and Mr. Farsighted.

Figure 4



If cooperative outcomes have lower utility, early on, and higher utility later on, in comparison to the non-cooperative outcomes (the tragedy of the commons), this means than the gains from cooperation lie in the future (and they more than make up for the early losses in cooperation). Now, since patient members value the future more, it seems plausible that patient members of the group will have more to gain from such cooperation. In other words, they will have a weaker bargaining power. Thus, we might expect that the negotiated cooperative decision will be oriented to emphasize the interests of the impatient members.

There are many ways in which the parties can cooperate. In economic terms, there are many Paretto-efficient policies. One of these (sometimes called the globally or socially optimal policy) is the equitable policy, the one we have discussed in the previous section. But there are others, and these give disproportionate weight to some of the parties. The above reasoning leads us to expect that a negotiation process on inter-temporal cooperative policy will tend to put greater emphasis on the interests of the more impatient members in the group. Formally,

Proposition 2: If the non-cooperative outcome is more impatient than any of the individually optimal policies, the gains from cooperation are always higher for the more patient members. As a

result, the bargaining outcome will reflect the preferences of the most impatient member.

Proposition 2 is proved in the appendix. The main implication is that the negotiated collective policy is likely to be as impatient as the most impatient member of the group is. In that sense, such an institution will lead to excessive collective impatience.

What can be done to ameliorate this outcome? One option is to allow for other forms of compensation between parties. For example, in the context of climate change, financial side transfers may provide another way to compensate more impatient parties instead of reflecting their discounting factor.

Alternatively, we might want to change the non-cooperative outcome. If instead of having no regulation at all when negotiations fail, constitutional or other institutions will dictate that when negotiations fail, all harvesting (in the example of the forest) is actually banned, the previous reasoning will now predict that it is the most patient members of the group that will have the highest bargaining power, and that collective negotiated policy will thus tend to be as patient as possible in the group.

From the point of view of economic efficiency, there is a complete symmetry between these two scenarios. But if we consider impatience and discounting to be a social "evil", then one mechanism to minimize discounting is to install a ban on harvesting in the absence of a negotiated outcome.

Conclusion

In the presence of a variety of time discounting within a group, a collective decision-making process on inter-temporal choices related to the management of common resources and public goods (or bads) can lead to excessive social "impatience".

Certain legal and economic institutions may be able to prevent these effects. If social discounting is considered as fundamentally

flawed for ethical reasons, they can provide the means to achieve more sustainable policy.

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Appendix – Mathematical formulation

Proof of proposition 1

Let the discount factor be β. Inter temporal welfare is:

$$W = (1-\beta)\sum_{t=1}^{\infty}\beta^t u_t$$

where t is an index of time period (year, generation, etc…) and u_t is utility at period t. the factor (1-β) ensures the weights given to all time periods sum up to unity.

Consider two individuals, one with discount factor β_1 and the other with discount factor β_2. Suppose the two individuals always have the same utility at each period. Aggregate welfare is then

$$W = W_1 + W_2 = \sum_{t=1}^{\infty}[(1-\beta_1)\beta_1^{\ t} + (1-\beta_2)\beta_2^{\ t}]u_t = \sum_{t=1}^{\infty} D_t u_t$$

where D_t is the aggregate discount factor for period t.

Proposition 1 states that:

D_{t+1}/D_t is decreasing at t increases.

$D_{t+1}/D_t \rightarrow \max(\beta_1,\beta_2)$ as $t\rightarrow\infty$.

Indeed,

$$\frac{D_{t+1}}{D_t} = \frac{(1-\beta_1)\beta_1^{\ t+1} + (1-\beta_2)\beta_2^{\ t+1}}{(1-\beta_1)\beta_1^{\ t} + (1-\beta_2)\beta_2^{\ t}}.$$

This expression can be viewed as a weighted average of the two discount factors β_1 and β_2. The weights are $(1-\beta_1)\beta_1^{\ t}$ and $(1-\beta_2)\beta_2^{\ t}$. Suppose for example that $\beta_1<\beta_2$. As t increases, these weights become more and more skewed towards β_2, and as t

approaches infinity, the ratio of these weights approaches infinity, i.e. placing all weight on β_2. Therefore, the above expression rises with t and converges asymptotically β_2.

Proof of proposition 2

As before, assume utilities at each period, for both the non-cooperative outcome and for the cooperative policies provide equal utilities, at each period, to both individuals.

For simplicity, assume that time consists of two periods, the present and the future, which I will denote as periods I and II. The indices 1 and 2 will refer, as before to the individual.

Let the uncooperative outcome's utilities be v_I and v_{II} (for the present and the future periods), for either individual, so that non-cooperative inter-temporal welfare for each individual is

$$W_1^{NC} = \frac{v_I + \beta_1 v_{II}}{1+\beta_1}, \; W_2^{NC} = \frac{v_I + \beta_2 v_{II}}{1+\beta_2}$$

(the NC suffix stands for non-cooperative). The factors in the denominators have been included, as before, to ensure the inter-temporal weights sum up to unity.

Now consider some cooperative policy that provides utilities u_I and u_{II} (in present and future, respectively) to each of the individuals. The cooperative Inter-temporal welfares are

$$W_1^{C} = \frac{u_I + \beta_1 u_{II}}{1+\beta_1}, \; W_2^{C} = \frac{u_I + \beta_2 u_{II}}{1+\beta_2}$$

Assume that the non-cooperative outcome has higher utility in the present, but lower utility in the future (which more than offsets it for both individuals). The gains from cooperation are

$$\Delta_i = W_i^{C} - W_i^{NC} = \frac{(u_I - v_I) + \beta_i (u_{II} - v_{II})}{1+\beta_i}, \; \text{i=1,2}$$

Our assumptions mean that in these two sums, the first summand is negative but the second is positive enough to make up for that.

Recall that we have chosen individual 1 to be the more impatient one, i.e. that $\beta_1<\beta_2$. It is then straightforward to notice, that as long as $\Delta_1 > 0$, it also holds that $\Delta_2 > \Delta_1$. Indeed, in the weighted averages that represent the gains from cooperation, there is greater weight given to the future term for individual 2, the more patient one. Since this future term is positive and offsets the negative present term, the whole expression is greater for the more patient individual. This is basically the content of proposition 2: that the gains from cooperation are always greater for the more patient individual.

It might be worth mentioning that the multitude of cooperative outcomes are the Paretto-efficient allocations of utility between present and future, subject to whatever inter-temporal constraints define the problem. Each such policy maximizes some weighted combination of both individuals' inter-temporal welfares $\alpha_1 W_1^C + \alpha_2 W_2^C$. For example, when $\alpha_1=\alpha_2=0.5$, this is the equitable social optimum discussed in section 1. When $\alpha_1=0$ and $\alpha_2=1$, this cooperative policy puts all emphasis on the welfare of individual 2, and vice versa. The point of the discussion in section 2 is that as long as a cooperative policy provides positive gains to the impatient individual, it provides higher gains to the patient individual. Thus, the impatient individual always has stronger bargaining power. In this simple model, we expect the bargaining process to lead the pair to adopt the cooperative policy with the greatest possible weight α_1 given to the impatient individual, as long as gains to the patient individual are still positive. It is easy to show, following the method of the first part of this appendix, that the more a cooperative policy is tilted towards one individual, it will be characterized by a collective discount factor which is tilted towards the discount factor of that individual.