Why Delaying Climate Action Is a Gamble

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Abstract

In the debate on long-term climate targets the aspect of political feasibility has often been missing. We introduce this aspect and show that, for a given temperature target, if we decide to delay emissions reductions, we must be willing and able to undertake much more substantial emission reductions than with early action. If we are not, delaying action will put some of the lower long-term temperature targets out of reach. Those who want to delay are thus gambling that the costs of abatement will drop and the public pressure to abate will increase over time as a result of this delay.

1. Introduction

While there is general agreement that avoiding dangerous anthropogenic interference with the climate system will require long-term reductions in greenhouse gas emissions, there has been much debate concerning the timing and magnitude of these reductions. Some have argued that because our mitigation capabilities are expected to improve over time and the future climate is so uncertain, we should adopt a "wait and see" approach. Yohe et al. [1], however, argue that these same uncertainties also suggest that delayed action may not be preferable. They show that even a modest hedging strategy may go a long way toward reducing future abatement costs and ensuring that a number of long-term climate options remain open. This significant result makes a strong case for mitigation action in the near-term. Here, we build on this argument by introducing the aspect of political feasibility. Rather than taking a point of departure in assumptions about abatement costs or technological innovation, we ask instead what conditions must be met to ensure that delaying mitigation does not affect our ability to achieve long-term targets.

2. Political feasibility

In the literature on long-term climate agreements it is typically assumed that policymakers will be consistently both rational and knowledgeable in their handling of the issue. This presumption of rationality is reflected in recommendations to frame our actions (including near-term emissions reductions) within a long-term climate target that avoids "dangerous climate interference" [2] or to develop optimal long-term climate policies that account for both the costs and benefits of mitigation policy [3]. We would argue that it is more realistic to assume that a future agreement on emissions reductions will be based on what is politically feasible at that point in time – rather than on some optimized or cost-effective long-term mitigation scenario. The important point that is missed in other studies is that the connection between expected economic costs and a climate agreement is through the issue of political feasibility. While economic considerations are important, they are only one of the several factors that influence what a long-term climate agreement might look like. Political feasibility is determined by such constraints as the trade-off between the economic, environmental, social, and political costs and benefits of mitigation - particularly for the most influential political actors - as well as such concerns as enforcement, public pressure, fairness and burden-sharing.

In terms of climate policy, the factors that determine political feasibility are manifested in the emission reductions that can be agreed upon. Thus, when all these factors have played their role in the negotiations, we end up with one number that expresses the overall trade-off. Here, we define "political feasibility" as the maximum rate of emissions reductions that can be achieved in a given year.

There is little empirical evidence on which to base any estimate of what this maximum rate would be. Our only point of reference is the Kyoto Protocol, where the level of emissions reductions were not based on any long-term target or on expected climate damages. The Protocol requires industrialized countries to keep their CO_2-equivalent 2008-2012 emissions at (on average) 5% below their 1990 emissions, which corresponds to an annual emissions reduction rate of about 0.3%. The Kyoto Protocol's lack of binding targets for developing countries and the refusal of the United States and Australia to participate suggest that the feasible level for reducing global emissions in the near-term is significantly less than 0.3% per year. However, as a starting point in this study, we will assume that global emission reductions at a constant annual rate of 0.3% are feasible (sensitivity analysis shows that the choice of rate does not matter). The important assumption is not the level of this rate, but that political constraints will determine what emission reductions are feasible.

We use the DEEP economic model [4] to generate four emission scenarios for the period 1997 to 2100. The DEEP model is a multi-sector, multi-regional, multi-gas dynamic computable general equilibrium (CGE) model. For this project the model was set up with only one world region, and was run with a time horizon of 1997-2100. The climate agreement is implemented through global emissions trading (with CO_2, CH_4 and N_2O). Because we are not interested in the uncertainty in emissions prior to 2013 (when the early action agreement is implemented), we use rates for economic growth and technological progress from the SRES A1B scenario for the period up to this year in all cases.

The first emissions scenario is a business-as-usual (BAU) scenario, where no emission reductions take place, and economic growth and technological improvement follow the SRES A1B scenario. The second is the Early action scenario, where we assume that when the commitments under the Kyoto Protocol expire in 2012, a new agreement will be in place where global greenhouse gas emissions continue to be reduced by 0.3% annually. In the last two scenarios we delay action by 20 years to 2033 before we adopt the same policy of 0.3% annual emission reductions. Because the emissions growth during the intervening years differs as it follows the SRES A1B and B2 scenarios we call these scenarios Late action A1B and B2 respectively.

These four emission scenarios are fed into a simple climate model (SCM) [5] to obtain the projected temperature change in the year 2100. The SCM calculates global mean concentrations from emissions of 29 GHGs and radiative forcing for 35 components (including stratospheric and tropospheric O_3, and direct and indirect effects of aerosols). It incorporates a scheme for CO_2 [6] and an energy-balance climate/up-welling diffusion ocean model [7].

Table 1 shows the projected temperature change under the four emission scenarios and for three different climate sensitivities: 2.4, 3.5, 5.4°C – respectively the 5, 50, 95% probability intervals for climate sensitivity [8]. As we have made the initial assumption that it is not feasible to reduce global emissions at a rate greater than 0.3% per year (independent of the climate sensitivity), the temperature projections for each scenario show what temperature targets are feasible at each starting point and climate sensitivity. It is seen that if the political feasibility constraint does not change, the global mean temperature in 2100 will be 0.2–0.8 °C higher if we delay action than if we take early action.

Climate sensitivity (T_{2xCO2})	BAU (°C)	Early action (°C)	Late action A1B (°C)	Late action B2 (°C)
2.4 °C	3.2	2.2	2.8	2.4
3.5 °C	4.3	3.0	3.7	3.2
5.4 °C	5.7	4.0	4.8	4.2

Table 1: Global mean temperature above pre-industrial level in 2100 under different scenarios

3. Mitigation requirements under delayed action

We now ask what annual emission reductions are required if we are to achieve the same temperatures with late action as with early action. In other words, we ask how much the political constraints must be relaxed during the twenty years of no abatement if late action is to be at least as good as early action from an environmental point of view. We use an iterative algorithm that runs both the DEEP model and the climate model to find the required emission reductions.

Table 2 shows what annual emission reductions are required under late action in order to achieve the same temperatures as with early action. If we are to reach the same temperature as with an early start and annual reductions of 0.3%, waiting 20 years means we must be able to reduce emissions at a rate that is 3-7 times greater. The table shows that the climate sensitivity does not have any great impact on the required rate of emission reductions. What is important is the emissions growth during the period with no mitigation. This is because the emissions during the “wait and see” period of 2013-2033 must be compensated for by emissions reductions at a later date. The reason emissions reductions have to be dramatically greater if we delay mitigation is the long response time for CO_2 and the inertia of the climate system. This effect can be seen in figure 1 where the area of the compensating emissions reductions (Area B) is 25% larger than the area of the “wait and see” emissions (Area A).

Climate sensitivity (°C)	Temperature change in 2100 (°C)	Early action (% per year)	Late action A1B (% per year)	Late action B2 (% per year)
2.4	2.2	0.3	2.0	0.9
3.5	3.0	0.3	2.1	0.9
5.4	4.0	0.3	2.1	0.9

Table 2: Required annual emission reductions to achieve equal temperature in 2100

The results show very clearly that if we want to achieve a given long-term temperature target, we must be willing and able to undertake significantly more stringent and faster emission reductions if we decide to delay emissions reductions. In terms of political feasibility, this means that if we want to wait before taking on binding emission reductions, instead of doing all that is politically feasible today, we must be certain that our technological capacity and political willingness for undertaking mitigation will improve substantially as a result of delaying action.

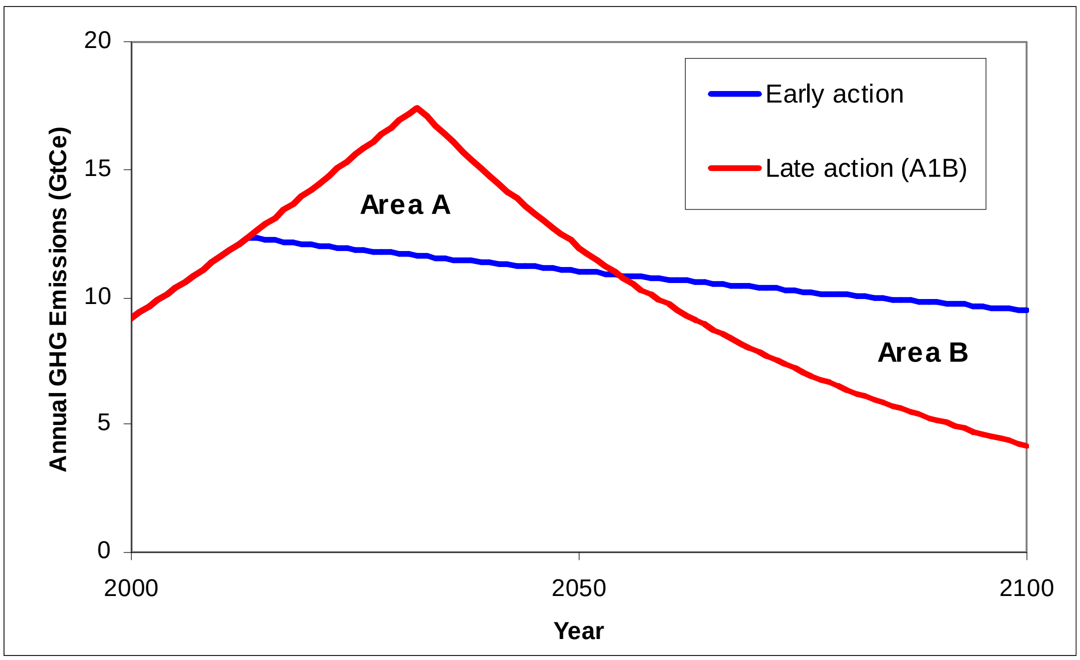

Figure 1: Emissions curves with constant annual reductions required to reach 3 °C warming in 2100 (with climate sensitivity 3.5 °C)

4. Sensitivity analysis

Two sets of sensitivity analyses are conducted; with respect to the choice of 0.3% as the initial rate of emissions reduction, and the choice of 2100 as a target year.

To see whether or not our results depended critically on how the initial early action reduction rate was set, we ran the models with two alternative values. We tested the model (always with the SRES A1B scenario and the 95% confidence interval climate sensitivity) with a value of 0% reduction per year. That is to say, we assume no further emission reductions are feasible, and that global emissions will be kept constant after 2012. We also test the model in a case where the feasible reductions from 2012 are twice as great (i.e. 0.6% annually). With constant emissions, the 2100 temperature target (as defined by what is possible under Early action) becomes 3.2 °C. With annual reductions of 0.6% the target becomes 2.8 °C. The annual emission reduction that achieves the 3.2 °C target with late action is 1.15%. In order to achieve the 2.8 °C target, the annual reductions must be as great as 3.0%. Thus, delaying action requires a significant increase in the rate of emissions reduction, largely independent of what initial reduction rate is chosen.

Another key assumption is that we set the temperature target for the year 2100. This year holds no specific significance; it is simply the target year that has been chosen in many other studies, such as [2]. As late action requires that we in the later years of the climate agreement keep our emissions below what they are with early action, we are on an emissions path where late action will achieve a lower temperature than early action at some point in the future. Thus, the earlier we set the temperature target, the more the results favor early action. We tested the models with target years of 2110 and 2090. In both cases we compare required emission cuts under late action with the initial 0.3% cuts under early action in the A1B scenario and with the best estimate of climate sensitivity (3.5 °C). For a target year of 2100, the annual emission cuts were required to be 2.0% with late action. For a target year of 2110, the annual cuts have to be 1.6%, and for a 2090 target they have to be 2.4%. This shows that the results are very sensitive with respect to the target year, yet still stresses the implications of early versus delayed climate action.

5. Conclusion

One can, of course, argue that politically feasible rate of emission reductions will increase over time, either because the public grows more concerned about climate change and demands stronger action (as climate impacts become more visible), or because the unrestricted economic growth in the interval increases our capacity for technological progress. One possibility is that we choose to invest in technological improvements rather than spend on mitigation during this period.

There are, however, many who would argue that it is more likely that the political feasibility will not necessarily increase if we delay. The public concern with climate change may not increase substantially over time, as the main uncertainties in the climate system may not be resolved in the coming decades [9], and other global issues, like economic development, may remain a priority. In fact, the limits to what emission reductions are feasible may actually increase as mitigation takes place – the public acceptance for climate mitigation policies will likely increase as a function of how long such policies have been in place. One of the main arguments as to why the Kyoto Protocol is important (despite the very modest impact it will have on long-term climate change) is that it establishes an institutional framework that will allow us to make greater emissions reductions in the future. Furthermore, if no action is taken in the near-term, the technological limits of our mitigation capabilities are unlikely to improve substantially, given the time lag of induced technological change, and the lost opportunity of learning by doing.

Our results show that if political feasibility remains unchanged, the temperature targets we can achieve with delayed action will most likely be around 0.5 °C warmer than with early action. This will put some of the lower long-term temperature targets out of reach. If, on the other hand political feasibility does increase, then it may still be possible to reach the same targets. The surprising result is just how great this increase must be. Even with a relatively modest assumption about what level of mitigation effort is feasible today, the results show that we must be able to reduce our emissions at a rate that is 3-7 times greater if we wait twenty years before reducing emissions. Those who want to delay are thus gambling that the costs of abatement will drop and the public pressure to abate will increase over time as a result of this delay.

6. References

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