Up the down-escalator?
Health, productivity and individual incentives under climate change

Ivan Frankovic (Deutsche Bundesbank), Michael Freiberger (IIASA), Michael Kuhn (Vienna Institute of Demography, IIASA) and Stefan Wrzaczek (IIASA)

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Abstract

Temperature increases in excess of the 1.5-degree limit are expected to yield substantial losses in peoples' health and productivity that stretch across the life course of many generations. By diminishing individual resources and capabilities as well as individuals' future prospects, climate impacts are additionally prone to alter individuals forward-looking behaviours, most notably investments into maintaining and enhancing human capital. Here, incentives may change either way, where only individuals with sufficient resources may engage in efforts to counteract detrimental climate impacts, whereas less resourced individuals may give up even on human capital investments they may otherwise undertake. To understand these behavioural impacts of climate change and their long-run consequences, we build a model of a continuous time economy populated by overlapping generations of individuals with a realistic demography and endogenous mortality and productivity. Individual behaviours and outcomes are traced along their lifecycle where human capital investments help them to enhance health and productivity and thereby insulate them against the negative impacts of climate change on their mortality and productivity. Besides detrimental impacts at the individual level, climate overshoot leads to a loss in aggregate-level productivity, depressing individuals' earnings. Our model traces out material and health outcomes as well as welfare along the cohort lifecycle and across the population. We calibrate our model to several country-specific contexts and simulate the impact of a number of climate scenarios on behavioural responses and economic and health outcomes as well as welfare across a succession of cohorts.

Extended Abstract

At temperature increases in excess of the 1.5-degree limit over an extended time horizon of around 200 years or more, climate overshoot (Reisinger et al., 2025) is expected to lead to substantial and negative impacts on individuals' health that stretch across the life course of many generations. These impacts do not only lead to significant losses in lives and livelihoods in the short run but, by diminishing individual resources and capabilities as well as their future prospects, are also prone to alter individuals forward-looking behaviours, most notably the investment they undertake into maintaining and enhancing their human capital (Borghi and Kuhn, 2024). Specifically, behavioural responses to climate overshoot may lie between a greater propensity to invest into the maintenance (if not enhancement) of health and productivity to counteract the negative impacts of overshoot (running up the down-escalator) and a lower propensity to invest that is tantamount to giving up and enjoying present day consumption (running down the down-escalator). The outcomes will depend on the extent of climate overshoot, economic and individual vulnerability, as well as on individual preferences. We would also expect that these responses exhibit a clear-cut age-gradient, where climate-induced changes in life expectancy and productivity are shifting incentives for investing into the preservation of health and human capital over the life-course, again likely to advance them. The emergence and – hopeful – decline of climate impacts during the overshoot, is implying that cohorts will be affected differently and may, indeed, exhibit different behavioural responses. Finally, the evidence on the short-term health and human capital impacts (as reviewed in Borghi and Kuhn, 2024) suggests that there are strong socio-economic gradients within cohorts. This implies that, indeed, resourceful individuals may seek protective investments (and run up the down-escalator), whereas disadvantaged individuals may give up (and run down the down-escalator). Such a development obviously exhibits large scope for exacerbating social inequality.

While the negative short-term impacts of climate change on population outcomes (and to some extent behaviours) are increasingly well documented and understood (see Borghi and Kuhn, 2024, for a review), little is known yet about the long-run impacts, as transmitted through behavioural change. Evidence from other contexts (Fortson, 2011, on HIV; Oster et al., 2013, on Huntington's disease) shows that the human capital responses to debilitating and life-threatening diseases may be negative and strong. In light of this, the concern about the wellbeing of future generations, and especially those affected increasingly by climate change must, however, not only take into account the direct impacts but also the impacts transmitted through the ability *and* willingness to engage in self-protection. From a policy perspective this implies that measures undertaken for the protection of the population must not only be conditioned on the anticipation of projected climate impacts but also on the anticipated behavioural responses. Indeed, the latter themselves are prone to respond to policymaking, implying that a good understanding of the behavioural nexus surrounding climate impacts and climate adaptation across the population is crucial for policymaking. This is not the least in as far as whether or not a period of overshoot and strong climate impacts is a temporary (if long) episode only very much depends on whether a population continues to be willing and able to respond to climate change. Finally, policymakers need to be aware of the potential for climate overshoot to widen socio-economic inequality (Ebi and Hess, 2020) but also induce divergent behavioural responses and, in fact, attitudes towards responding to climate change across the population.

To understand the impacts of run-away climate change and overshoot on the behaviour and wellbeing across generations, we adopt and expand an economic modelling framework developed in Frankovic (2017) for a detailed analysis of the behavioural responses to climate overshoot and the resulting outcomes. Specifically, we build a model of a continuous time economy of overlapping generations with a realistic demography and endogenous mortality and productivity. Individual behaviours and outcomes are traced along their lifecycle where human capital investments help them to enhance health and productivity and thereby insulate them against the negative impacts of climate change on their individual mortality and productivity. Besides these detrimental impacts at the individual level, climate overshoot leads to a loss in aggregate-level productivity, inducing a further downward pressure on individuals' earnings. Notably, our model not only traces out material and health outcomes but also welfare metrics along the cohort lifecycle and across the population. To address socio-economic gradients in behavioural responses and outcomes we expand Frankovic (2017) by adding a layer of socio-economic stratification (as related e.g. to education), following a similar approach to Frankovic and Kuhn (2019).

We calibrate our model to several country-specific contexts and subsequently simulate the impact of a number of overshoot scenarios on behavioural responses and economic and health outcomes as well as welfare across a succession of cohorts. Results will allow us to (1) establish first insights into the economic and health impacts of different overshoot scenarios; as well as (2) the underlying behavioural channels together with their macroeconomic repercussions. (3) This includes an analysis of impacts across the age-distribution and the socio-economic distribution of the population, as well as across different cohorts. (4) Comparison across scenarios will also allow us to establish critical thresholds in terms of overshoot impacts, economic and health-related vulnerability, as well as time scales, at which protective behaviour turns into "giving up" across the socio-economic strata. (5) Based on these insights, we propose policy schemes that allow (as well as possible) to preserve human capital investments in a way that embraces intra- and intergenerational fairness. (6) Finally, we explore the implications of overshoot for the incentives to engage in climate mitigation. (7) These can be conveniently expressed by calculating the social cost of carbon within the model and decomposing it into a productivity and health-related component.

Initial results reported in Frankovic (2017) are based on a calibration for Taiwan (Tung, 2011; Su et al., 2016) suggest the following: First, there is an ambiguous climate-induced effect protective health care spending, where climate-induced income losses lead to a reduction in consumption and protective spending, while the need to protect against losses in life expectancy trigger a shift in spending towards protective investments. Second, the highest age-groups tend to reduce their protective spending in the long run when facing higher mortality risks, even in the absence of a negative income effect. This is due to an (inevitable) loss in remaining life expectancy at high ages, which induces individuals to shift consumption to earlier (safe) years and thereby diminishes an incentive to survive to highest ages. This is mirrored in a strong reduction in the value of life (i.e. the willingness to pay for survival) for the highest age group. Third, it turns out that climate change is likely to have a negative effect on the value of life more generally. This can imply an increase in risky or unhealthy behavior and, indeed, depresses other forms of protective investments, such as

those relating to housing, working places and transport systems. Such a shift away from healthy behaviours does indeed suggest the indirect channel through which health is further deteriorated because of global warming.

The present work will update and generalize the modelling in Frankovic (2017) to account for socio-economic heterogeneity and include multiple forms of protection. It also studies a range of different climate scenarios, calibrated to more realistic data. Finally, the present work closes the loop to also study how the behavioural changes induced by climate change and the associated changes in the value of life feed back into the social cost of carbon and incentives to mitigate rather than adjust to climate change.

References

Borghi, J., & Kuhn, M. (2024). A health economics perspective on behavioural responses to climate change across geographic, socio-economic and demographic strata. *Environmental Research Letters*, *19*(8), 081001.

Ebi, K. L., & Hess, J. J. (2020). Health risks due to climate change: inequity in causes and consequences: study examines health risks due to climate change. *Health Affairs*, 39(12), 2056-2062.

Fortson, J. G. (2011). Mortality risk and human capital investment: the impact of HIV/AIDS in Sub-Saharan Africa. *The Review of Economics and Statistics*, 93(1), 1-15.

Frankovic, I. (2017). The impact of climate change on health expenditures, ECON WPS - Working Papers in Economic Theory and Policy 02/2017.

Frankovic, I., & Kuhn, M. (2019). Access to health care, medical progress and the emergence of the longevity gap: A general equilibrium analysis. *The Journal of the Economics of Ageing*, 14, 100188.

Oster, E., Shoulson, I., & Dorsey, E. R. (2013). Limited life expectancy, human capital and health investments. *American Economic Review*, *103*(5), 1977-2002.

Reisinger, A., Fuglestvedt, J. S., Pirani, A., Geden, O., Jones, C. D., Maharaj, S., ... & Seneviratne, S. I. (2025). Overshoot: A Conceptual Review of Exceeding and Returning to Global Warming of 1.5° C. *Annual Review of Environment and Resources*, *50*.

Su, H. J., Chen, M. J., & Chen, N. T. (2016). Climate variability and human health in Southeast Asia: A Taiwan study. In *Climate Change and Human Health Scenario in South and Southeast Asia* (pp. 237-242). Cham: Springer International Publishing.

Tung, A. C. (2011). Consumption over the lifecycle: an international comparison. In *Population aging and the generational economy*. Edward Elgar Publishing.