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Mitigating climate and biodiversity risks: a real option approach

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Abstract: Recent decades have witnessed sustained economic growth, but economic activities, in particular the rise of international trade, also generate negative environmental externalities. Currently, the projected trend in environmental processes consists in non-linear behaviors and potential for collapse or new (not predictable) stable states that are irreversible.

In this work, using real options theory, we examine whether through actions on GDP, biodiversity and climate there is a possibility of averting such system transitions. We propose a theoretical framework, where interactions between the economic and climate systems are modelled via three stochastic processes, namely the world GDP, temperature anomaly, and biodiversity intactness in forest. In our model, trade increases GDP growth, yet also increases the negative externalities and the probability of reaching tipping points in temperature and biodiversity. Environmental investments reduce short term world GDP growth as well as global warming, related health costs and the likelihood of reaching the tipping points. Our theoretical model is calibrated using economic and environmental data, and then used to compute the economic value of the real option to mitigate climate and biodiversity risks. In this talk, we will discuss some of the predictions of our model, in particular, the optimal policies consisting in combinations of trade, environmental investments and implementation timing. Among others, discount rate, estimates of externalities, efficiency of environmental investments to facilitate system transition play a significant role in the optimal policy response.