Applying Asset Pricing Theory to Calibrate the Price of Climate Risk

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Abstract:

Pricing greenhouse gas emissions involves making trade-offs between consumption today and unknown damages in the (distant) future. The optimal carbon dioxide (CO2) price, thus, is based on society's willingness to substitute consumption across time and across uncertain states of nature. Standard constant relative risk aversion preference specifications conflate the two. Moreover, they are inconsistent with observed asset valuations, based on a large body of work in macroeconomics and finance. This literature has developed a richer set of preferences that are more consistent with asset price behavior and separate risk across time and across states of nature.

In this paper, we explore the implications of these richer preference specifications for the optimal CO2 price. We develop the EZ-Climate model, a simple discrete-time optimization model in which the representative agent has an Epstein-Zin preference specification, and in which uncertainty about the effect of CO2 emissions on global temperature and on eventual damages is gradually resolved over time. We embed a number of features including potential tail risk, exogenous and endogenous technological change, and backstop technologies. The EZ-Climate model suggests a high optimal carbon price today that is expected to decline over time as uncertainty about the damages is resolved. It also points to the importance of backstop technologies and to very large deadweight costs of delay. We decompose the optimal carbon price into two components: expected discounted damages and the risk premium.