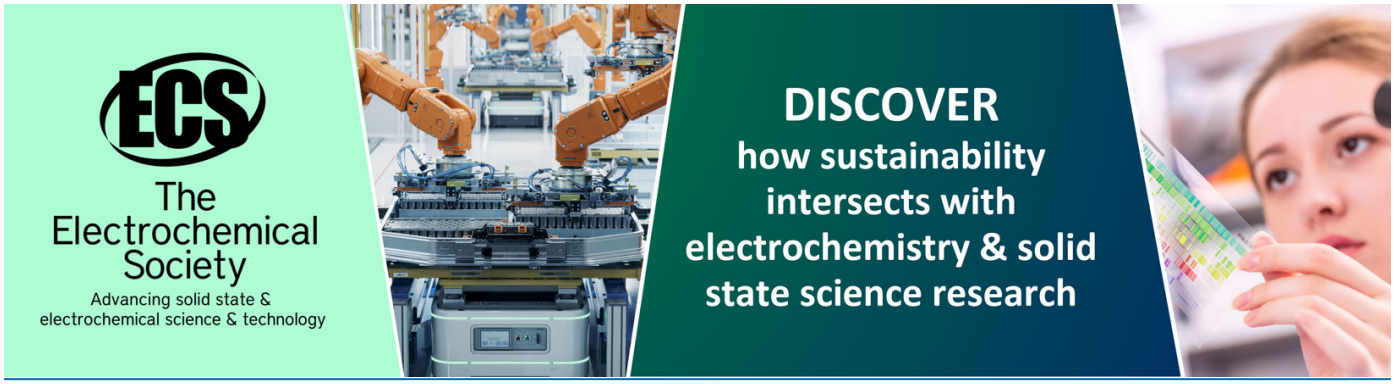
Climate change and Ethiopia



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It is now widely recognized that developing countries—and in particular low-income countries in tropical and sub-tropical regions—will be disproportionately affected by the adverse impacts of climate change. This study modifies and extends a dynamic single country Computable General Equilibrium (CGE) model to include stochastic elements that are characteristic of climate change and a representation of the sectors that are most likely to be affected in order to evaluate potential adaptation policies. The focus of the modeling is on stochastic elements in general and extreme events in particular. Surprisingly, this focus is relatively new in the economics of climate change. It follows on the work of Hope (2006), who developed the PAGE model. By placing risk and uncertainty at center stage, the PAGE model illustrates that the potential economic damages from climate change, and hence the potential gains from mitigation and effective adaptation, are much larger than had previously been estimated. As stated recently by Stern (2008, p. 18), "most studies prior to a year or two ago grossly underestimated damages from business as usual." A failure to recognize the potential for significant damages as a result of rare events represented the primary source of this underestimation. When viewed through the optic of rare events, a fundamental challenge, if not the fundamental challenge, of the economics of climate change involves representing a highly uncertain future climate distribution. The approach employed here follows recent work by Weitzman (2007). He proves that Bayesian updating of nonergodic systems causes rational agents to significantly thicken the tails of their subjective prior distributions of future outcomes. We employ information theory to preserve the information content of past climate realizations while fattening the tails of the historical distribution in order to account for the implications of climate change. The magnitude of the shift is motivated by existing studies of Ethiopia and by the revealed behavior of investors in the development of subjective prior distributions concerning the evolution of the US economy. Both, but especially the latter, imply that rational decision-makers should substantially increase the weight on relatively rare outcomes as compared with historical experience. Our case country, Ethiopia, is heavily dependent on rain-fed agriculture, and its geographical location and topography in combination with low adaptive capacity entail a high vulnerability to adverse impacts of climate change. In 2006/07, agricultural production generated around 46 percent of Ethiopia's gross domestic product and employed 80 percent of the working population. Historically, there is a strong observable link between climate variations and overall economic performance. This is due to both direct impacts on agricultural sector performance and indirect links to other sectors of the economy. We find that expansion of variance on its own has a relatively minor impact on growth rates. If the future is like the past, but with just increased variation, the impact of climate shocks on average growth rates is modest. If the shocks become more negative, the impact is much more serious even if trend underlying growth in total factor productivity is maintained. This occurs because extreme events, such as flooding, lead to destruction of capital stocks. Extended drought also reduces livestock herds, which is a primary factor of production for rural smallholders. The worst case scenario results in growth rates almost two percentage points lower than in the base run. We also show that the implications of climate variability are not evenly distributed across the macroeconomic aggregates. Aggregate consumption always has a higher coefficient of variation (CV) than the other macro aggregates indicating that the burden of adjustment appears to fall more heavily on consumers. On the other hand, the CV for aggregate absorption is always smaller than for real GDP, indicating that international trade serves to dampen the impact of climate shocks on aggregate demand. Even without specific adaptation policies, the economy endogenously adjusts to the new environment. Compared with the levels projected under the assumption that the observed level of historical climate variability continues into the future, the climate change scenarios all induce shrinkage in the agricultural sector both in relative terms and (more forcefully) in absolute value. These results point to important policy choices with respect to the role of the agricultural sector in development strategies in the presence of climate change. On a long run view, one must decide whether to invest in agriculture in order to combat climate change impacts or invest outside of agriculture in order to reduce the exposure of the overall economy to climate change. These choices depend on the quality of investment opportunities inside and outside of agriculture as well as projections of world prices for basic foodstuffs. In this light, the results indicate substantial potential for

increases in agricultural productivity through investment in water harvesting, irrigation and road infrastructure in the relatively near term. This is both good adaptation policy and good development policy. At the same time, even with these adaptations in place, the modeling highlights the relative weakness of Ethiopia's non-agricultural sectors in absorbing surplus labor. Creating opportunities for generation of value added (particularly employment) outside of agriculture remains one of the dominant challenges both to development and successful adaptation to climate change.

References:

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