The effect of carbon price uncertainty on decarbonization efforts and economic growth

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Abstract

Joint work with Alain Bensoussan (UT Dallas), Oluwadamilola Adeniyi Oyekan (UT Dallas), Viswanath Ramakrishna (UT Dallas). Carbon prices, e.g., in the European Union, and their uncertainty affect firms' investment decisions (possibly with an adverse effect on "economic growth") and allegedly promote the adoption of greener practices by incentivizing decarbonization efforts. Recent empirical studies documented the impact of carbon prices' uncertainty on firms' decarbonization efforts. We develop stylized continuous-time, real options models to study decarbonization efforts, in case of (1) an already operating firm ('old economy') and of (2) a new business venture ('new economy'). In both cases, the firm has an incentive to reduce its footprint (e.g., adopting carbon capture technologies) given the long-term cost of carbon emissions. A new venture will decide based on this cost and project value, making the underlying real-options problem two-dimensional. In both cases, we characterize the optimal exercise strategies and value functions. To price the real option in the second case, we design an operator-splitting algorithm that approximates its 'penalized' solution of the corresponding dynamic programming equation. We also analytically establish comparative statics results, with respect to key parameters, especially carbon price uncertainty and the correlation with the firm's underlying profit.

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