Resource Extraction and Renewable Capacity: Dynamic Limit Pricing and Climate Policy Effects

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Abstract

We study the effects of different market structures and climate policy instruments on fossil fuel extraction and green energy capacity paths. The representative green energy firm invests in green capacity and delivers green energy at zero marginal costs. If the initial capacity level is sufficiently low, extraction decreases and green energy capacity over time. In case of a price-taking fossil fuel firm, energy consumption decreases over time until extraction ends. While a carbon tax reduces initial extraction, a green capacity or investment subsidy induces the weak green paradox in case of physical exhaustion. In case of a monopolistic fossil fuel firm, we identify two strategic effects: The well-known market power effect which postpones extraction, and a capacity investment effect which postpones green investment. In an empirically calibrated economy, these two effects cause energy consumption to rise initially, then remain virtually constant for a long time before falling sharply at the end of the extraction period. We find that neither a carbon tax nor a green capacity or investment subsidy induces the strong green paradox. Finally, while subsidies perform much worse than carbon taxes in terms of welfare, they imply much higher profits for the fuel firm with comparable climate damages, whether the firm is price-taking or monopolistic.

Keywords: climate policy, energy transition, monopoly
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