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On the optimal accumulation of renewable energy generation capacity

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Abstract

As fossil fuels are finite and responsible for environmental problems, renewables have been promoted in recent decades. To study the optimal accumulation of a generation capacity for renewable energy (backstop) and the trade-off between capital investments, backstop capacity investments and consumption, we develop a capital-energy economy with exhaustible fossil fuels. It turns out that optimal economic evolution and, therefore, the steady-state levels of capital, backstop capacity, and consumption depend on the capital endowment and the time preference rate. If the latter is low and the former is high, an intertemporal consumption trade-off renders the accumulation of an excess capacity optimal. In contrast, given a low capital endowment and a high time preference rate, the trade-off is not beneficial, so that capacity investments are nil for all points of time.

Keywords: Energy transition, Renewable energy, Capacity constraint, Fossil fuels

JEL classification: O10, Q32, Q40, Q42

1. Introduction

Renewable energies, such as solar and wind power, play an important role in both political and academic discussion as they can serve as a clean substitute for exhaustible and polluting fossil fuels. On the one hand, the concerns about the proceeding climate change have strengthen the political relevance of renewable energies. As they do not cause CO_2 emissions, their promotion is widely mentioned in the climate protection discussion.

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