Resource Consumption with Endogenous Time preference

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ABSTRACT

Scarcity rents for exhaustible resources increase at the rate of interest. This is well-known Hoteling's rule. Although there are a lot of variations that derive similar rules, the implication remains the same. The dynamics of exhaustible resource use is driven by interest rates. Then, we face a question: in what way are these interest rates determined? This question has never been answered in the framework of Hoteling and his successors.

Unlike in resource economics, debates on interest rates and time preference have been intense in other fields of economics. In particular, in welfare economics, specifying discount factors falls in moral philosophy (e.g., Arrow and Kurz, 1970). Recent studies on this line include those on hyperbolic discounting (e.g., Weitzman, 2001, *AER*).

In macroeconomic theory, many studies have been done on models in which time preference depends on endogenous economic variables. Among those, habit formation models in which a history of consumption determines time preference are popular in these days (e.g., Obstfeld, 1990, *JME*). A classical one in this category includes the Uzawa-Epstein time preference (Uzawa, 1968; Epstein and Hynes, 1983, *JPE* ; Epstein, 1987, *JET*).

This paper re-examines a classical topic of exhaustible resource use on the basis of recent development of models of time preference and discount factors. It analyzes the effects of endogenous time preference on dynamic properties of resource use, contrasting to classical Hoteling's results: we develop an analytical model that incorporates endogenous time preference into the decision framework of resource consumption. The model structure is the following:

- Cake-eating economy,
- Availability of a backstop technology, and
- the Uzawa-Epstein formulation of time preference.

The results are expected to provide contributions not only to the literature of pure economic theory, but also to recent climate policy debates on discounting factors, for example, Nordhaus' (2007, *JEL*) critique to the Stern Review.

Key words: Hoteling's rule, discount rates, backstop technology
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