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Pollutant Abatement Investment under Technological Uncertainty

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Overview

The treatment of uncertainty is important in environmental policy decision making. In particular, how we treat uncertainty becomes more important when we consider environmental policies that are designed for long-term environmental issues like climate change. Especially technological progress plays a central role of environmental policy design (Jaffe, et al.,2002; Löschel, 2002). In this paper, we investigate how the technological change of output and pollutant abatement affects social welfare. To this end, we consider a representative consumer and firm in an economy and formulate the social welfare maximization problem.

Methods

A representative consumer has constant and absolute risk-averse preferences and received utility from consumption, $u(C) = -\frac{1}{\theta}\exp\{-\theta C\}$. A representative firm produces output using capital *K*. The firm's production function $f(K)$ is expressed as $f(K) = AK^{\alpha}$, where *A* reflects the level of technology and is govern by a stochastic differential equation (Wälde, 2011). Production generates pollutant emissions *P* proportional to output. Pollutant emissions *P* are expressed as $P = \gamma f(K)h(G)$, where $h(G)$ is the pollutant abatement function and *G* is the abatement capital. We specify $h(G)$ as $h(G) = (BG^{\lambda})^{-1}$, where B is the emission abatement technology and is govern by a stochastic differential equation. The consumer also suffers from pollutant emissions *P* and the damage to the consumer is measured by the following disutility/damage function: $D(P) = \exp\{\eta P\}$. The consumer's welfare is assumed to be obtained through multiplying by the utility and disutility: $w(C,P) = u(C)D(P)$.

Then, the central planner's problem is to choose the consumption rate and both capital investment rates in order to maximize the social welfare.

Results

We will solve the social welfare maximization problem. We derive the HJB equation of the central planner's problem and obtain the optimal consumption rate and investment rate. Furthermore, we conduct comparative statics with respect to some important parameters such that technological-change parameters and explore how these parameter impact on decision-making and social welfare.

Conclusions

In this paper, we consider the social welfare maximization problem by incorporating technological uncertainty, which is expressed stochastic differential equation. As a result of analysis, we will obtain the implication for environmental policy decision making.

References

Bucci, A., Colapinto, C., Forster, M., and La Torre, D. (2011). Stochastic technology shocks in an extended Uzawa–Lucas model: closed-form solution and long-run dynamics. Journal of Economics, 103(1), 83-99.

Jaffe, A. B., Newell, R. G., and Stavins, R. N. (2002). Environmental policy and technological change. Environmental and resource economics, 22(1-2), 41-70.

Löschel, A. (2002). Technological change in economic models of environmental policy: a survey. Ecological economics, 43(2), 105-126.

Wälde, K. (2011). Production technologies in stochastic continuous time models. Journal of Economic Dynamics and Control, 35(4), 616-622.