

## Human Capital and Optimal Policy in a Lucas-Type Model

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We present a design of fiscal policy capable of providing the required incentives to make a decentralized economy with externalities move along the optimal transitional path in a Lucas-type human capital model. *Journal of Economic Literature* Classification Numbers: O41, E62, J24. © 2000 Academic Press

### 1. INTRODUCTION

The Uzawa (1965) model of economic growth has been the subject of considerable study since the reformulation by Lucas (1988), and many extensions have subsequently been proposed. On one hand, consideration has been given to the transitional dynamics. Caballé and Santos (1993) develop the transitional dynamics without externalities. When externalities are present, four papers stand out: that of Mulligan and Sala-i-Martin (1993), which carries out a numerical approach; that of Xie (1994), which studies the transitional dynamics for a particular case; that of Benhabib and Perli (1994), which solves it in the general case where the human capital externality affects the production of goods; and that of Chamley (1993), which considers the externality affecting the accumulation of human capital. On the other hand, the extensions include the use of physical capital in the educational sector, as in the case of Bond *et al.* (1996), or of leisure in the utility function, as in the case of Ladrón de Guevara *et al.* (1997).

Furthermore, the effects of public policies have been considered within the same framework. Most of the analysis concentrates on the long-run

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effects of changes in tax structures in the model without externalities, as in the work of Lucas (1988). Stockey and Rebelo (1995) focus their attention on how these effects depend on model features and parameter values. Mino (1996) analyzes the long-run impacts of a change in taxation, as well as its transitional effects. When externalities are present, we can cite Chamley (1993), who analyzes the effects of a change in capital income taxation, and Jones *et al.* (1993), who study optimal taxation and the effects of changes in the tax structure on growth rate and welfare by means of numerical simulations of a set of models calibrated for the U.S. economy.

Government intervention is not justified in the absence of externalities, because competitive equilibrium is optimal. Hence, the analysis of taxation must focus on searching for the second-best solution or studying the effects of changes in tax rates. However, the presence of externalities leads to a decentralized solution in the Lucas model that is not optimal from the social point of view. The agents do not take into account the positive effect that average human capital has on labor productivity, so that the fraction of time they devote to education is inferior to the optimal, as is the steady-state growth rate. Thus the government could intervene to induce the agents to devote more time to education, in this way increasing both labor and physical capital productivity and, as a consequence, improving total welfare. Broadly speaking, the type of fiscal policy required is obvious. Lucas (1990) has already drawn our attention to “*increased subsidies to schooling*, that would... have potentially large effects on human capital accumulation and long term growth rates... [It] might well be an interesting subject for future research within the framework I have used here,” and indeed, the line of research to which he refers has not been exhausted.

In the light of this, our aim is to add a perspective that we think is worthy of consideration. Thus, in this paper we derive a fiscal policy that is capable of providing the required incentives to make the decentralized economy equilibrium with externalities be Pareto optimal, not only in the steady state, but also in the transitory phase. From among the previously quoted papers, only Jones *et al.* (1993) deal with the evolution of optimal tax rates along the transitional period in a model with externalities, obtaining these rates by means of numerical simulation. We also study optimal taxation, but we adopt an analytical approach which enables us to propose a public action rule that leads the market economy to the steady-state social optimum through a path that is also optimal.

One of the most significant results we find is the existence of a complete set of possibilities of financing the optimal policy. We verify, first, that the return on the physical capital must be free of taxes; second, that a negative tax on human capital income without a direct subsidy to the time devoted

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