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Human capital, inequality, endogenous growth and educational subsidy: A theoretical analysis[☆]

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ABSTRACT

This paper develops an endogenous growth model with dualism in human capital accumulation of two types of individuals. The government imposes a proportional income tax on rich individuals and uses the tax revenue to finance the educational subsidy given to poor individuals. We find out the properties of the optimal tax financed educational subsidy policy in the semi-stationary equilibrium of the model using the technique of Stackelberg differential game.

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1. Introduction

With the emergence of the ‘new’ growth theory, human capital accumulation with its role on economic growth has appeared as a major area of research in macroeconomics. This literature has started with the seminal paper of Lucas (1988) that shows the growth rate of per capita income to depend on the growth rate of human capital which in turn depends on the time allocations of individuals for acquiring skill. The Lucas (1988) model has been extended and reanalysed by various economists in various directions.

A subset of that literature deals with the effects of taxation on the long-term growth rate in these Lucas-type models. This includes the works of Jones et al. (1993), Stokey and Rebelo (1995), Chamley (1992), Mino (1996), Uhlig and Yanagawa (1996), Ortigueira (1998), Alonso-Carrera and Freire-Seren (2004) and De Hek (2005) etc. However, all these authors are interested in analysing the effects of exogenous changes in the fiscal instruments; and do not design any endogenous fiscal policy introducing endogenous behaviour of the government. Gomez (2003) and Garcia-Castrillo and Sanso (2000) claim to design optimal fiscal policies in the Lucas (1988) model. However, optimality in their models is defined in a limited sense. Fiscal instruments are designed to correct market failures arising from external effects of human capital. However, they do not adopt the framework of a Stackelberg differential game in which the government designs the optimal fiscal policy solving an optimal control problem subject to intertemporal equilibrium conditions of individuals.

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These Stackelberg differential games¹ are nowadays widely used to study the dynamic interaction between the government and private agents. In a Stackelberg differential game, the government naturally plays the role of a leader setting the fiscal policies; and private agents act as followers determining their levels of consumption, investment, labour supply and so on. The government then takes private agents' best responses into account and designs the optimal policy. Judd (1985, 1997), Chamley (1986), Lansing (1999), Guo and Lansing (1999) and Mino (2001) etc are interested in the optimality of taxation in exogenous growth models using the framework of an open loop Stackelberg differential game. Park and Philippopoulos (2003, 2004) and Ben Gad (2003) analyse optimal fiscal policies in endogenously growing economies using the similar framework; and also analyse the role of fiscal policy on the indeterminacy problem of the transitional growth path. Only Ben Gad (2003) considers a Lucas (1988) type of model. However, in his model, tax revenue is not used to subsidize the human capital accumulation sector.

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". Many authors analyse the issue of education subsidy in recent years. The set of literature includes works of Zhang (2003), Blankenau and Simpson (2004), Bovenberg and Jacobs (2003, 2005), Boskin (1975), Blankenau (2005), Brett and Weymark (2003) and of many others. Most of them deal with the effects of subsidies and of public educational expenditures on economic growth. However, none of these papers analyses the optimality of educational subsidy policy using the framework of a Stackelberg differential game. In Bovenberg and Jacobs (2005), human capital accumulation is endogenous. Private agents take their decision in three period OLG set up and the government solves an optimal control problem to find out the dynamics of optimal fiscal policy. However, they neither consider a Lucas (1988) type model nor relate these policies to growth-theoretic issues like steady-state equilibrium and transitional dynamics.

The present paper develops an endogenous growth model of an economy in which the human capital accumulation is viewed as the source of economic growth and in which dualism exists in the mechanism of human capital accumulation of two types of individuals – the rich and the poor. There exists a substantial theoretical literature dealing with the structural dualism in less developed countries.² However, none of the existing dual economy models focuses on the dualism in the mechanism of human capital formation of two different groups of individuals. In a less developed economy, the stock of human capital of a poor individual is far lower than that of a rich individual. Also there exists a difference in the mechanism of human capital accumulation between a rich individual and a poor individual. Rich individuals can spend a lot of time and resources for their education. However, poor individuals have neither time nor resources to spend for their education. However, they receive support from exogenous sources. The Government sets up free public schools; and introduces various schemes of paying book grants and scholarships to the meritorious students coming from the poor families. It also meets the cost of public education programme through taxes imposed on rich individuals. In India, the government gives special emphasis to the subsidized education programme for the people belonging to scheduled castes and scheduled tribes majority of whom are economically backward; and backwardness in education is considered as one of the important causes of their economic backwardness. So the efficiency enhancement mechanisms for rich individuals and poor individuals are different. While rich individuals can build up their human capital on their own, poor individuals need the support from the government to accumulate their human capital.

In the present model, we assume that the representative rich individual has a high initial level human capital endowment and an efficient human capital accumulation technology.³ The representative poor individual lags behind both in terms of initial human capital endowment and in terms of the productivity of human capital accumulation technology. We call them rich and poor because human capital is an important determinant of income.⁴ However, poor individuals are benefited by the fiscal policy of the government in this model; and redistributive taxes are imposed on the income of rich individuals to finance the educational subsidy given to poor individuals. Neither Lucas (1988) himself nor any extension of the Lucas (1988) model has considered this dualism in human capital accumulation. Our objective is to analyse properties of the optimum tax financed educational subsidy policy in the long-run equilibrium of the model. We do this adopting a framework of Stackelberg differential game.

We derive some interesting results from this model. It appears to be optimal to adopt a tax financed educational subsidy policy for poor individuals in the long-run equilibrium of the model. This optimal tax financed educational subsidy rate varies positively with the relative weight given to the consumption of the representative poor individual in the social welfare function and with the learning ability of the representative poor individual. However, this rate varies positively with the learning ability of the representative rich individual who is the tax payer and negatively with the rate at which individuals discount their future consumptions. The degree of human capital inequality in the long-run equilibrium varies positively

¹ Whether the solution obtained from a Stackelberg differential game is time consistent or not is a debatable topic. See works of Xie (1997), Dockner et al. (1999), Van Long and Shimomura (2000) and Karp and Lee (2003) etc.

² This includes the work of e.g Lewis (1954), Ranis and Fei (1961), Sen (1966), Dixit (1969), Todaro (1969) and Benabou (1994, 1996a,b).

³ It means that the rich individual has a higher ability of learning and a larger stock of secondary inputs of human capital accumulation.

⁴ The empirical works on the skilled–unskilled wage inequality in different countries, i.e., the works of Robbins (1994a,b), Lachler (2001), Beyer et al. (1999), Marjit and Acharyya (2003) and Wood (1997) etc. have a debate over this hypothesis. Beyer et al. (1999) have shown that the extent of wage inequality and the proportion of the labour force with college degrees in the post liberalization period in Chile were negatively related. According to the World Development Report (1995), increased educational opportunities exerted downward pressures on wage inequality in Columbia and Costa Rica. Many other works have shown the opposite empirical picture in many other countries.

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