

DISSERTATION ABSTRACT

Essays on Economic Growth and Development: New Perspectives from Health, Education, and Wealth

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The purpose of this doctoral dissertation is to provide theoretical and empirical analyses of the long-term growth and development of nations. Using endogenous growth models (or semi-endogenous growth model), we investigate the effects health, education and wealth have on a country's growth and development. The organization of the dissertation is as follows.

Chapter 1. Overview of this Article

Chapter 2. Health as a Development Device

Chapter 3. Mincerian Approach in Human Capital Growth Model: Theory and Empirics

Chapter 4. Non-Separable Utility, Wealth Effects, and Economic Growth

Chapter 5. Summary and Conclusions

Chapter 1 presents an overview of this dissertation. In Chapter 2, we examine the equilibrium property of the intertemporal representative agent model with health capital accumulation, and investigate the role of health investment and public health environment in the long-term development in developing countries. Chapter 3 employs a Mincerian growth model with ideas and human capital creation, and resolves the recently highlighted human capital empirical puzzle. In Chapter 4, we use an intertemporal optimizing monetary growth model and analyze the effects of wealth-enhanced social status in the economy. The last chapter provides a brief summary and the conclusions of this dissertation.

First topic: Importance of health factor for long-term development (Chapter 2)

In recent years, aggregate health expenditures as a share of GDP has shown a tendency to rise in many countries. For this reason, the health costs cannot be ignored when we perform an economic analysis, and therefore the concern about the relationship between health factors and economic performances has been growing for the last several years. Mushkin (1962) showed some time ago that human capital can also be accumulated through improvements in health status. Thus, it is surprising that health, which is another component of human capital, has been largely ignored in the growth studies when it is a significant factor in long-run growth.

In Chapter 2 of this dissertation, we examine the role of health factors in long-term development and analyze the equilibrium properties of an endogenous growth model with

human capital, health capital and physical capital accumulation under existing endogenous technological progress.

The role of human capital formation in the growth process has been extensively analyzed in the theoretical literature. The seminal paper by Robert Lucas (1988), “On the Mechanics of Economic Development,” is one of the most stimulating papers in new growth theory. In his pioneering model, human capital directly participates in the production process as a productive factor. In this sense, the accumulation of human capital would directly contribute the growth of output. He argues that the importance of human capital accumulation for economic growth and development in a simple framework of two-sector endogenous growth model. Our theoretical model shares the same property as Lucas’s human capital production technology.

It has been recognized that expenditures on medical services and exercise can be viewed as investments in health capital and analyzed using the frameworks of capital theory. Michael Grossman’s (1972) human capital model of the demand for health, in particular, has been argued by some to be one of the major theoretical innovations to have emerged from health economics. In the Grossman model, individuals may invest in health by combining time with purchased inputs. The incentive for investing in health is that by increasing the health stock the individual increases the amount of time available for earning income or for producing consumption goods. As a consequence, good health contributes to welfare and economic performances.

We take into account that health influences intertemporal decision-making in several different channels. First, it serves as the sub-engine to the supply of human capital services. This is because the effective labor force needs for not only human capital but also a certain level of health. Second, the provision of health services directly competes with the supply of labor services allocated to goods production and human capital production through formal schooling. In terms of a growth perspective, the positive contribution of good health to labor productivity is particularly important. However, the supply of health service requires labor resources. Accordingly, there seems to be a direct trade-off between health and human capital accumulation. That is, an expansion of the health sector may promote growth through increased health of the population, while a contraction of the health sector could also free the labor resources necessary to promote growth by means of an increase in human capital production. In the same way, there is also a direct trade-off between the resources used in the health sector and the final good sector. Third, good health influences intertemporal decision-making follows from the observation that health can generate positive utility of its own. To capture this feature, we incorporate health in the utility function next to consumption. Moreover, in the case of a command optimum economy, we take into account of intertemporal welfare effects of providing health services through the positive impact on longevity of the population. However, due to technical reasons, we are forced to ignore the impact in the case of a decentralized economy.

Allowing for the above characteristics about health and human capital, we introduce the

effects of skill driven technological change (henceforth SDTC) to the model, since this enables us to analyze the technological development process in developing countries. The SDTC specification represents the effects of a highly skilled worker who can use more physical capital goods than a lower one. This implies the number of capital goods that workers can use is limited by their (average) human capital levels. Under the existing process of specific technological change (SDTC), we extend the notable two-sector growth models of Uzawa (1965) and Lucas (1988) following van Zon and Muysken (2001). By this extension, we can study in detail the trade-off between health and human capital, the effects of SDTC, and their consequences for long-term development of the economy.

Our model has mainly four-distinct features. First, we analyze both the command optimum economy and the decentralized economy. In the presence of external effects, it will not be the case that the command optimum paths and the decentralized equilibrium paths coincide. In the present analyses, several externalities are actually present which would be ignored in individual decision-making. Second, we only study the steady-state situations with balanced growth paths, thus the transitional dynamics to the steady-state is not included in this dissertation. Third, concerning the production structure, we assume that the health capital formation is specified as decreasing returns to scale, whereas the human capital generation is characterized by constant returns to scale. Fourth, to simplify our studies, we assume that in the steady-state both the average health level and the age of population are constant. Note that, as we mentioned before, the factor of the age of population is only studied in the analysis of the command optimum economy.

Based on this framework, we show that the improved public health environment is indispensable for sustainable development of the economy. This implies that good health becomes a necessary condition for growth taking-off. In an example from the study of the command optimum case, when the economy is in the unimproved public health environment, any reallocation of labor force caused by the SDTC yields three-distinct growth patterns. In a worst development case of three possible cases, we can confirm that the economy falls into the situation of 'low growth' and 'poor health'. As a consequence, a healthy body, which is supported by the improved public health environment, has an important role as a basic device of economic development.

Moreover, we derive a conjecture on the aging problem from the theoretical analysis. Using simple econometric tests, we show that the conjecture has explanatory power for the recent productivity slowdown in advanced economies.

Second topic: Does human capital accumulation cause growth? (Chapter 3)

In the system of national accounts, capital income contains only the return to physical capital, such as plant and its equipment. More generally, however, individuals accumulate capital

whenever they forgo consumption today in order to produce more income tomorrow. In this respect, one of the most important forms of capital accumulation is the acquisition of skills (embodied knowledge). Such human capital is accumulated by both school education and on-the-job training (OJT). In terms of a growth perspective, human capital obtained through school education has been emphasized as a critical determinant of economic growth. A greater amount of educational attainment implies more skilled and productive workers, who in consequence increase an economy's output. While well-educated workers also help to facilitate the absorption of more advanced technologies from developed countries. Moreover, the level and distribution of educational attainment has a significant impact on social outcomes, such as child mortality, fertility, education of children, and income distribution.

Chapter 3 examines the relationship between growth and human capital accumulation through school education. To this end, we construct and study empirically a knowledge driven growth model that integrates the production of final good, human capital, and ideas. Our model is fundamentally based on Jones (1996, 1998), Hall and Jones (1999), and Bils and Klenow (2000).

In the growth literature, endogenous growth models with human capital accumulation occupy an important place in the modern economic theory. It has been recognized the impact of human capital accumulation on economic growth for more than a decade, following Uzawa (1965) and the modern formulation of Lucas (1988), Romer (1990), Rebelo (1991), and Caballe and Santos (1993). In empirical growth literature related to human capital, Mankiw *et al.* (1992), Benhabib and Spiegel (1994), Islam (1995), Pritchett (1996), Bernanke and Gürkaynak (2001), and among many others have studied the role of human capital in the form of educational attainment using similar theoretical specifications.

The model we present here generates a regression specification that is very similar to that employed by Mankiw *et al.* (1992), but the economic background underlying the specification is very different. In particular, the model emphasizes the importance of knowledge and ideas, and therefore this leads to knowledge driven growth. The notion of knowledge driven growth is described as the SDTC specification introduced in Chapter 2. As we have indicated earlier, this specification represents the effects of a highly skilled worker who can use more capital goods than a lower one, and therefore implies the number of capital goods that workers can use is limited by their skill (embodied knowledge) levels. In addition, we incorporate microeconomic evidence indicated by Mincer (1974) to the model. Mincer said that an increase in the level of the time fraction spent acquiring human capital will have proportional effects on labor productivity and wages. The model specification involving these effects is called a *Mincerian model*.

Within this theoretical framework, we provide one possible resolution of an empirical puzzle on human capital variable. The puzzle is summarized as follows.

Benhabib and Spiegel (1994), Islam (1995), Pritchett (1996), and other researches present in various ways a puzzle involving the relationship between human capital and economic growth. The puzzle appears when one looks at a growth-accounting approach that involves variables such as Barro and Lee (2000) human capital stocks. In either simple or multivariate regressions of the growth rates of output on the growth rates of the human capital stock, the human capital variable appears with a negative coefficient.

The formulation of our model with the Mincerian approach suggests that it is not the growth rate of educational attainment as a proxy of human capital variable that is employed in the specification, but rather the change in the level. In our empirical analyses, the Mincerian specification plays a definite role for a natural resolution of the recently documented empirical puzzle. Regressions using this approach look remarkably similar to the Mankiw *et al.* (1992) style level regressions in which the human capital variable plays an important role.

For its theoretical specification, one needs to divide the educational attainment variable by the average time endowment of individuals in years. In the former empirical studies on human capital and growth, however, this is not part of the analysis. Therefore, we will proceed to the additional estimation considering a consistency problem between theoretical specification and empirical model. Instead of picking a simple educational attainment variable, we apply a new human capital index to the estimation. The index is calculated by using Barro and Lee's average years of schooling and the life expectancy at birth as a proxy of the time endowment of individuals (from the World Bank's *World Development Indicators*). This additional estimation based on the Mincerian approach also provides one possible resolution of the human capital empirical puzzle.

As we have mentioned earlier, the empirical growth literature, including Benhabib and Spiegel (1994), Islam (1995), and Pritchett (1996), has employed average years of schooling (or educational attainment) as a measure of the stock of human capital per person. If we consider the characteristics of average years of schooling, however, there is a possibility of the underestimation of the human capital variable because the data has the bound-years property. To deal with this data problem, countries are divided into developed and developing countries; e.g. OECD and non-OECD countries. In the case of the estimation for non-OECD countries, we are able to confirm resolution of the empirical puzzle when the Mincerian approach is employed. From the results of statistical significance on human capital variable, we prove the effectiveness of the above sample grouping.

Third topic: The spirit of capitalism and wealth accumulation (Chapter 4)

In recent years, the theoretical literature on economic growth has analyzed the role of social status in the capitalist economy. In reality, we can observe phenomenon that individuals' choices

to expend effort on economic activities are often motivated by social rewards not just pecuniary rewards. This is in line with the spirit of capitalism advocated by Max Weber (1958):

Man is dominated by the making of money, by acquisition as the ultimate purpose of his life. Economic acquisition is no longer subordinated to man as the means for the satisfaction of his material needs. This reversal of what we should call the natural relationship, so irrational from a naïve point of view, is evidently a leading principle of capitalism.
(*The Protestant Ethic and the Spirit of Capitalism*, 1958, p.53)

Many growth-based models have tried to offer new perspectives for the issue of spirit of capitalism or wealth-enhanced social status.

Chapter 4 investigates the effects of wealth-enhanced social status in an endogenous growth economy. To this end, we employ an optimizing monetary growth model with non-separable utility function and a cash-in-advance constraint (hereinafter CIA constraint) on consumption goods. The role of wealth-enhanced social status in an optimal growth model has been investigated; for example Wirl (1994), Zou (1994), Corneo and Jeanne (1997, 2001), and Futagami and Shibata (1998). The remarkable feature of these models is to define wealth-enhanced social status and wealth directly or indirectly in the agent's utility function. This implies that individuals accumulate wealth not only for consumption, but also for its own sake. Consequently, the agent's preference should depend on one's wealth (capital) holdings as well as one's consumption. Mordecai Kurz first noted such a linkage with formal analysis and named it "wealth effects". These studies, however, stand on the viewpoints of *real* rather than *monetary* aspects.

On the other hand, the effects of money growth on economic growth have long been a central issue in the macroeconomic literature (e.g. Tobin, 1965; Sidrauski, 1967; Stockman, 1981). In particular, Marquis and Reffett (1991) are relevant to our research. They incorporate money into the two-sector Uzawa-Lucas structure through the CIA constraint, and conclude that the long-run growth rate is independent to changes in the rate of money growth when only consumption or physical capital is liquidity constrained. Very few efforts, however, have been made to study the linkages among wealth accumulation through capital holdings, agent's preference and monetary economy. In actuality, the capital stock contributes as an input to production but also reflects cultural assets that provide direct utility. Therefore, our important task in this chapter is to integrate the above noted two research directions under more standard environment.

Our starting point is the model of Chang *et al.* (2000). They showed that an increase in the rate of money growth raises the long-run growth rate of the economy as well as an increase in the degree of wealth-enhanced social status. In the optimizing monetary growth models,

including Chang *et al.* (2000), however, the relation between preference structure and wealth-enhanced social status has not been fully investigated. This is because most of the models concerning growth and wealth effects assume simple utility functions that satisfy additive separability between consumption and wealth. The main difference between these models and our present analysis is that we employ the non-separable utility function between consumption and wealth. Within this framework, we mainly investigate that the economic impact of an increase in the rate of money growth under existing wealth-enhanced social status. By this analysis, we can obtain the following two principal results: (i) if the effects of wealth-enhanced social status are disregarded, an increase in the rate of money growth does not affect the steady-state growth rate; on the other hand, (ii) if we consider wealth effects, changes in the rate of money growth decrease the rate of long-run growth. The latter result is in sharp contrast with the typical conclusion of the relevant field.

Notes:

Chapter 2, Chapter 3, and Chapter 4 of this dissertation are based on the following several papers, which were already published from some organizations and the journal.

Chapter 2, "Health as a Development Device."

Hosoya, K. (2001) "Health, Longevity, and the Productivity Slowdown," *Project on Intergenerational Equity, Institute of Economic Research, Hitotsubashi University, Discussion Paper Series, No.25.*

Hosoya, K. (2001) "A Role of Health and Human Capital in Developing Economy," *Research Network Program of Contemporary Economics, Graduate School of Economics, Hitotsubashi University, Discussion Paper Series, No.2001-05.*

Chapter 3, "Mincerian Approach in Human Capital Growth Model: Theory and Empirics."

Hosoya, K. (2002) "Mincerian Approach in Human Capital Growth Model: Theory and Empirics," *Research Network Program of Contemporary Economics, Graduate School of Economics, Hitotsubashi University, Discussion Paper Series, No.2001-07.*

Chapter 4, "Non-Separable Utility, Wealth Effects, and Economic Growth."

Hosoya, K. (2002) "Non-Separable Utility, Wealth Effects, and Economic Growth in a Monetary Economy," *Economics Bulletin, Vol.15, No.10, pp.1-8.*