China Economic Review 23 (2012) 1104–1119

Contents lists available at SciVerse ScienceDirect

China Economic Review

Health investment, physical capital accumulation, and economic growth☆

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ARTICLE INFO

Article history:
Received 18 November 2011
Received in revised form 16 June 2012
Accepted 16 July 2012
Available online 21 July 2012

JEL classification:
E2
I0
O1
O4

Keywords:
Health investment
Health
Economic growth
Physical capital accumulation

ABSTRACT

This paper analyzes the effect of health investment, and hence of health capital, on physical capital accumulation and long-run economic growth in an extended Ramsey model with an Arrow–Romer production function and a Grossman (1972) utility function. The paper concludes that economic growth is related to both the health growth rate and the health level. While growth in health capital always facilitates economic growth, the gross effect of health level on the rate of economic growth depends on how it affects physical capital accumulation. If the negative effect of health on economic growth through its influence on physical capital accumulation is not taken into consideration, then health level has a positive effect on the rate of economic growth by improving the efficiency of labor production. However, since health investment may crowd out physical capital investment and thus influence physical capital accumulation, excessive investment in health may have a negative effect on economic growth. Empirical tests of these theoretical hypotheses using panel data from individual provinces of China produce results that are consistent with our theoretical conclusions.

1. Introduction

In recent decades, the ratio of health spending to GDP has surged in developed country. For example, health spending accounted for only 4% of GDP during the 1930s in the United States. However, the ratio increased to 13.1% during the 1990s and to 14.5 during the 2000s (Tang & Zhang, 2007). Why does the ratio of health spending to GDP increase with economic growth? How does the increase of health spending affect physical capital accumulation and long-run economic growth? The relationship between health spending, physical capital accumulation and long-run economic growth has received a great deal of attention. This paper focuses on the fundamental macroeconomic relationship between health investment/spending, physical capital accumulation, and long-run economic growth. By extending traditional growth models to allow for the consideration of health generation, we study the dynamics of physical capital accumulation and health level, and their effects on long-run economic growth through an economic growth model featuring the Arrow–Romer production function and the Grossman (1972) utility function.

The paper contributes to the existing literature on health and growth in two respects: first, we study the effect of health spending/investment and health level on physical capital accumulation and economic growth and find that economic growth is related to both the growth rate of health and the level of health. We also find that the gross effect of health level on the rate of economic growth

☆ We would like to thank Jianfang Yang and Zhigang Wang for generously providing us with the data they have collected. This project is supported by the Shanghai Leading Academic Discipline Project, Project Number: B101.

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1043-951X/$ – see front matter
doi:10.1016/j.chieco.2012.07.002

depends on how it affects physical capital accumulation. If the negative effect of health investment/spending on economic growth through its influence on physical capital accumulation is not taken into consideration, then the health level has a positive effect on growth by improving the efficiency of labor production. However, since health investment may crowd out physical capital investment and thus influence physical capital accumulation, excessive investment/spending in health may have a negative impact on economic growth. We test these theoretical hypotheses empirically using a panel data from individual provinces of China and obtain results consistent with our theoretical conclusions. Second, we find that introducing health level into an economy may lead to the existence of a development trap in the Grossman–Arrow–Romer model, in which case growth will persist only in an economy where initial capital exceeds a certain level, otherwise the economy will get into a negative-growth trap. Thus, countries that differ in their initial states may develop and grow in different ways.

As we note below, there is an extensive body of literature, both empirical and theoretical, focusing on the effect of health on economic growth and development. Most of these papers argued that health, as a type of human capital similar to education, will facilitate economic growth by improving labor productivity. However, since better health can provide an individual with additional utility from the consumption of other goods, health will differ from other forms of human capital at least in one respect, that a person purchases medical services not only as human investment but also to maintain "good health," just as Grossman (1972) emphasized. Therefore, if "health" is a normal good, then health level and/or health investment/spending will continue to increase in the process of economic growth and may crowd out physical capital investment and thus harm economic growth in the long run. This characteristic of health has been noted by Baumol (1967) and van Zon and Muysken (2001, 2003). In a Lucas (1988) endogenous growth model with health investment, van Zon and Muysken (2001, 2003) analyzed this effect of health on economic growth and concluded that a slowdown in growth can be explained by a preference for health that is positively influenced by a growing per capita income, or explained by an aging population, and growth may virtually disappear in countries with high rates of decay of health, low productivity of the health-sector, or high rates of discount.

In an Arrow–Romer (Arrow, 1962; Romer, 1986) endogenous growth model with health investment, this paper considers the effect of health on economic growth in a setting in which health enters the production function as human capital, but also appears as a service in the individual's utility function. Given these assumptions, health level must increase as income increases, similar to van Zon and Muysken (2001, 2003). On the other hand, since higher health level requires higher health investment/spending, an increase in health level may reduce physical capital investment when output is constant. Therefore, increases in health level may harm economic growth if the contribution of health capital to production is insufficient. We test the positive effect of health investment on economic growth using a panel data from individual provinces in China. Our empirical results show that the negative effect of health investment/spending on economic growth is determined by the ratio of health investment/spending to physical capital stock and is statistically significant. In addition, in the case of Arrow–Romer production function, due to the spillover effects of physical capital in the economy, health level may have a spillover effect on economic growth by influencing the returns to physical capital and hence physical capital accumulation. As a result, a development trap may exist in the Grossman–Arrow–Romer model. This result is different from van Zon and Muysken (2001, 2003).

During the last 20 years, especially after 2000, a large number of studies were produced that investigated the theoretical relationship between health and growth. A pioneering analytical study in this field is Grossman (1972). However, his study focused on the provision of health services from a microeconomic demand perspective and ignored the possible interaction between health and the process of physical capital accumulation, education investment as human capital, and knowledge accumulation as the driving force behind economic growth. Barro (1996) first studied in a theoretical framework the macroeconomic effects of health as one of the most important components in human capital. In a three-sector neoclassical growth model that incorporated a concept of health capital as well as schooling capital, Barro analyzed the effect of health capital on schooling capital and physical capital and the interaction between these three factors, and further discussed public policy implications in the cases of health services as a publicly subsidized private good and as a public good. By adding a health accumulation function to the Cass–Koopmans optimal-growth model, Muysken, Yetkiner, and Ziesemer (1999) also investigated the growth implications of health as another component of human capital similar to education. Compared with Barro's (1996) static analysis of the impact of exogenous parameters on the steady state, Muysken et al. (1999) further analyzed the impact of optimal health care expenditure on steady-state growth and transition dynamics. However, Barro (1996) and Muysken et al. (1999) only concerned with the effect of health on economic growth through its influence on labor productivity, and neither considered the impact of health services on economic growth through utilities.

Extending the Lucas (1988) endogenous growth model to include health investment and taking into account that health services can provide utility, van Zon and Muysken (2001, 2003) discussed the macroeconomic effects on economic growth of health human capital deriving from health investment. Compared with Barro (1996), in addition to the effect of health on labor productivity, van Zon and Muysken (2001, 2003) also considered three other channels through which health influences economic growth: 1) health increases education human capital accumulation; 2) health services increase an agent's utility; and 3) health improvement increases longevity and thus leads to an aging population. While the first two effects of health on labor productivity and education human capital accumulation tend to facilitate economic growth, the last two effects suggest that health investment may exceed the optimal amount when the marginal contribution of health investment to growth equals the marginal cost to growth. This will crowd out too much physical capital investment and harm physical capital accumulation. Accordingly, health investment may in the end impede the progress of economic growth.

By introducing the effects of skill-driven technological change (henceforth SDTC) into van Zon and Muysken (2001, 2003), in an endogenous growth model that integrates SDTC, human capital accumulation through formal schooling, and health capital accumulation, Hosoya (2002, 2003) investigated the relationships among economic growth, average health level, labor allocation, and population longevity. Compared with van Zon and Muysken (2001, 2003) and Hosoya (2002, 2003), this paper also considers the