KNOWLEDGE AND HUMAN CAPITAL

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Human capital plays a dual role in the process of economic growth. First, human capital is a stock of skills directly used as a factor of production. It can be combined with physical capital and unskilled labour to produce total output. Increasing these factor inputs results in larger total output and thus economic growth. The second role of human capital is the role of human capital in economic growth by stimulating technological change. Although in economic growth studies the role of human capital is usually referred to in one way or another, it is far from clear how human capital induces technological change.

In 1994 A. Wood distinguishes between direct skills, that are embodied in workers, and technology (technological knowledge), which is embodied in capital or intermediate goods. A. Wood argues that the technological knowledge in use represents indirect skills, since technological knowledge has been embodied in the physical means of production by the prior application of workers' skills. The definitions of knowledge and skills emphasize the relevance of workers' skills in both bearing and exchanging information. Skills can be embodied in two ways: directly in workers and indirectly by applying workers' skills to all kinds of materials. The Wood's definitions imply that the embodiment of knowledge is not possible without direct or indirect interference of workers and the use of their skills [1].

Technological knowledge is regarded as the main factor of economic growth. It can be explain by two features of technological knowledge. First, technological knowledge is a nonrival good or factor of input (scientific law, a principle of mechanical, a mathematical result, software) [2]. Although these kinds of knowledge can in any form be embodied in workers as well as materials, they were first invented by highly-specialized workers in research and development activities. So these kinds of technological knowledge were originally embodied in these workers only. Afterwards the embodied technological knowledge spilled over to other skilled workers, to public knowledge, to knowledge embodied in capital goods. The second feature of technological knowledge is that, because it is a nonrival good, competing firms cannot be excluded from using knowledge spill-overs. The features of technological knowledge are recognized to be relevant for self-sustaining growth in endogenous growth theory.

Endogenous growth theory explains the economic growth by assuming increasing returns to scale in the aggregate production function. In neo-classical models the production function usually exhibits constant returns to scale. This implies that, if firm multiplies the factor inputs, the output of the firm is multiplied by the same amount. However due to the existence of externalities between firms in endogenous growth models, other firms can profit from the increase of factor inputs of one single firm. The externalities are based on two above mentioned features of knowledge. So externalities result in a more than proportional increase in aggregate output with factor inputs, that is, increasing returns to scale. An important aspect of endogenous growth theory is that it focuses on modeling externalities like knowledge spill-overs from investment in research, development and human capital. The output of these investments, knowledge embodied in new product, production processes or workers, can become an input in the production function of all firms. Firms invest in knowledge that can only partially be kept secret [3]. Therefore both the state of knowledge in a firm and the aggregate level of knowledge are arguments in the production function. In the Lucas' model the general stock of knowledge accumulates due to external effects which arise from both investments in education and learning-by-doing of workers. Here knowledge acquired, whether by investments in education or by learning-by-doing, is called human capital [4]. Externalities ensure that new knowledge can be used by all firms.

The role of human capital in the generation of knowledge or knowledge spill-overs is modeled in the endogenous growth model of P. Romer and R. Lucas. The former considers human capital as an important input factor for the generation of knowledge in the research sectors. The latter considers spill-over from individual investments in human capital to public knowledge. Moreover, according to P. Romer, human capital is embodied knowledge, tied to specific workers. This makes it different from technological knowledge embodied in materials in the sense that each worker can acquire only a limited amount of knowledge during his working life. Moreover, the knowledge is lost if the worker died, whereas knowledge in materials can outlive individuals. Although the scientist argues that knowledge embodied in materials is for this reason different from human capital, R. Lucas assumes that the knowledge embodied in workers can outlive these workers if it is passed on to younger generations. According to R. Lucas the stock of knowledge in a country is related to human beings, because:"human capital accumulation is a social activity, involving groups of people in a way that has no counterpart in the accumulation of physical capital" [4, 19].

So human capital includes the workers' embodied technological knowledge, which can spill over not only to younger generations, but also to other workers, public knowledge, production processes etc.

References

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