



Human capital growth and destruction: the effect of fertility on skill obsolescence

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Abstract

This paper investigates the effect of exogenous fertility shocks on physical- and human capital accumulation in an Overlapping Generation (OLG) framework. Negative shocks in fertility cause a relative scarcity in the future labor market and stimulate human capital accumulation. In turn, this allows the introduction of new technologies at a faster rate, thereby accelerating the obsolescence of the human capital held by older workers who become less employable. The model can thus explain why, after a period of declining fertility, labor market participation of older workers slumped.

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1. Introduction

Are older employees less productive? During the last decades, the labor participation of older employees has declined severely (for instance, see [Hurd, 1997](#)), although life expectancy has increased. A lot of older employees are unemployed or have been offered

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an early retirement arrangement by the firm.¹ What could be the reason for the exodus of older workers and why would firms cooperate?² This paper illustrates that fertility shifts can affect the employability of older workers. A mechanism is examined, with an endogenous rate of depreciation of human capital, which may explain why, in periods of a decline in fertility, skills of older employees get obsolete.

As a result of a decline in fertility, labor will become scarce relative to physical capital, which boosts the return on human capital and stimulates human capital accumulation. For the youngest generations, human capital will be increased by receiving more education. Working generations accumulate human capital in particular by learning-by-doing and they have the incentive to supply more labor, thereby increasing their knowledge of existing technologies.

A higher level of education of the young adults induces adoption of new technologies. When new generations are better trained, the average human capital level of the labor force increases, which eases introduction of more sophisticated technologies. Moreover, the higher wage level induces introduction of new technologies that are more capital-intensive. Upgrading of technologies used implies that knowledge of older versions of the technology become partially obsolete. For instance, the availability of sophisticated software packages for empirical analysis makes extensive knowledge of programming languages like Fortran unnecessary.

Because of the partial obsolescence of knowledge of older technologies, human capital is subject to depreciation: the human capital effectively used, will decline. Older workers have much knowledge of (the version of) the technology that gets obsolete, and their productivity falls behind after the introduction of new versions of technology. The human capital of the youngest generations consists primarily of the technologies that are just introduced. As a result, the labor market position of older employees deteriorates.³

The role of the adoption of new versions of technologies in the decline of the labor participation of older employees is still under debate. There is indirect evidence, however, that the rate of technical change is affected by demographic shifts. [Cutler et al. \(1990\)](#) investigated the relation between productivity growth and labor force growth and found a strong negative relation during the period 1960–1985.

That the level of technical change is higher when fertility declines, is the result of the assumption that the quality and not the quantity of the labor force is the decisive factor in the process of technical change. This is in contrast to [Van Imhoff \(1988\)](#) who suggested that a high population rate means a high influx of recently educated people and a higher rate of technical change. It is in contrast as well to the notion that an increased market size makes innovations more profitable, which would imply a positive relation between population and the number of ideas (and thereby technological change). As noted by [Jones](#)

¹ Disability programs are used in several countries to facilitate early retirement. For the usage of nonemployment benefit schemes, see [Blöndal and Scarpetta \(1998\)](#).

² [Lazear \(1979\)](#) provides the classic explanation for mandatory retirement and for early retirement schemes offered by the firm. By stressing productivity shifts of older workers, the present paper gives a rationale for changes in the early retirement schemes.

³ When wages are sticky or when changing jobs is difficult, because of job specific human capital, the decline in productivity is higher than the decline in wages.

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