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Demographic change, human capital and welfare ☆

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ABSTRACT

Projected demographic changes in the U.S. will reduce the share of the working-age population. Analyses based on standard OLG models predict that these changes will increase the capital–labor ratio. Hence, rates of return to capital decrease and wages increase, which has adverse welfare consequences for current cohorts who will be retired when the rate of return is low. This paper argues that adding endogenous human capital accumulation to the standard model dampens these forces. We find that this adjustment channel is quantitatively important. The standard model with exogenous human capital predicts welfare losses up to 12.5% (5.6%) of lifetime consumption, when contribution (replacement) rates to the pension system are kept constant. These numbers reduce to approximately 8.7% (4.4%) when human capital can endogenously adjust.

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1. Introduction

As in all major industrialized countries, the population of the United States is aging over time. This process is driven by increasing life expectancy and a decline in birth rates from the peak levels of the baby boom. Consequently, the fraction of the working-age population will decrease, and the fraction of elderly people will increase. Fig. 1 presents two summary measures of these demographic changes: the working-age population ratio is predicted to decrease from 84% in 2005 to 75% in 2050, while the old-age dependency ratio will increase from 19% in 2005 to 34% in 2050. These projected changes in the population structure will have important macroeconomic effects on the balance between physical capital and labor. Specifically, labor is expected to be scarce relative to physical capital, with an ensuing decline in real returns on physical capital and increases in gross wages. These relative price changes have adverse welfare effects, especially for individuals

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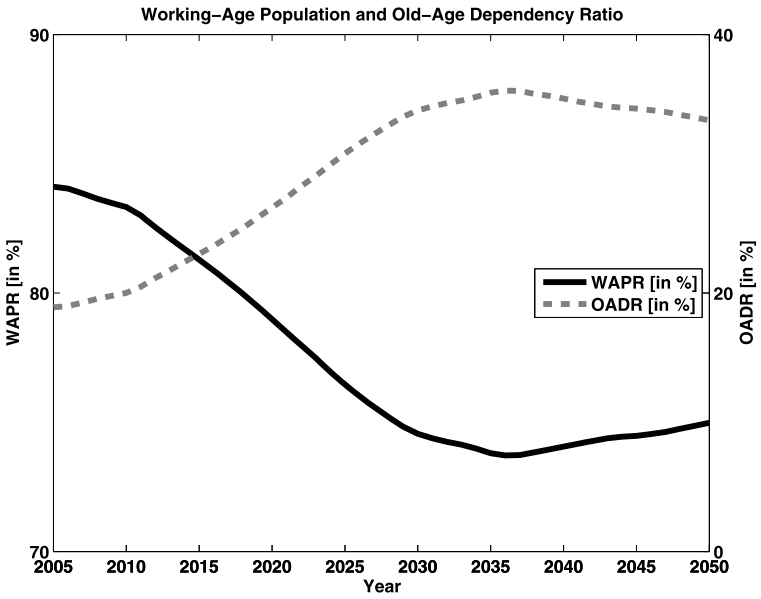

Notes: Working-age population ratio (WAPR, left scale): ratio of population of age 16–64 to total adult population of age 16–90. Old-age dependency ratio (OADR, right scale): ratio of population of age 65–90 to working-age population.
Source: Own calculations based on Human Mortality Database (2008).

Fig. 1. Working-age and old-age dependency ratio.

close to retirement because they receive a lower return on their assets accumulated for retirement and cannot profit from increased wages.

This paper argues that a strong incentive to invest in human capital emanates from the combined effects of increasing life expectancy and changes in relative prices, particularly if social-security systems are reformed such that contribution rates remain constant. At general equilibrium, such endogenous human capital adjustments substantially mitigate the effects of demographic change on macroeconomic aggregates and individual welfare.

The key contribution of our paper is to show that the human capital adjustment mechanism is quantitatively important. We add endogenous human capital accumulation to an otherwise standard large-scale OLG model in the spirit of Auerbach and Kotlikoff (1987). The central focus of our analysis is then to work out the differences between our model, with endogenous human capital adjustments and endogenous labor supply, and the "standard" models in the literature, with fixed (exogenous) productivity profiles.

We find that the decrease of the return to physical capital induced by demographic change in a model with endogenous human capital is only one-third of that predicted in the standard model. Welfare consequences from increasing wages, declines in rates of return, changes to pension contributions and benefits induced by demographic change are substantial. When human capital cannot adjust, some of the agents alive in 2005 will experience welfare losses up to 12.5% (5.6%) of lifetime consumption with constant pension contribution (replacement) rates. However, importantly, we find that these maximum losses are only 8.7% (4.4%) of lifetime consumption when the human capital adjustment mechanism is taken into account. Ignoring this adjustment channel thus leads to quantitatively important biases of the welfare assessment of demographic change.

Our work relates to a vast number of papers that have analyzed the economic consequences of population aging and possible adjustment mechanisms. Important examples in closed economies with a focus on social-security adjustments include Huang et al. (1997), De Nardi et al. (1999) and, with respect to migration, Storesletten (2000). In open economies, Börsch-Supan et al. (2006), Attanasio et al. (2007) and Krüger and Ludwig (2007), among others, investigate the role of international capital flows during a demographic transition. We add to this literature by highlighting an additional mechanism through which households can respond to demographic change.

Our paper is closely related to the theoretical work on longevity, human capital, taxation and growth[1] and to Fougère and Mérette (1999) and Sadahiro and Shimasawa (2002), who also quantitatively investigate demographic change in large-scale OLG models with individual human capital decisions. In contrast to their work, we focus our analysis on relative price

[1] See, for example, de la Croix and Licandro (1999), Boucekkine et al. (2002), Kalemli-Ozcan et al. (2000), Echevarria and Iza (2006), Heijdra and Romp (2008), Ludwig and Vogel (2009) and Lee and Mason (2010). Our paper is also related to the literature emphasizing the role of endogenous human capital accumulation for the analysis of changes to the tax or social-security system, as in Lord (1989), Trostel (1993), Perroni (1995), Dupor et al. (1996) and Lau and Poutvaara (2006), among others.

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