Economic Modelling 26 (2009) 30–39

Contents lists available at ScienceDirect

Economic Modelling

journal homepage: www.elsevier.com/locate/econbase

Population ageing, time allocation and human capital: A general equilibrium analysis for Canada ☆

Maxime Fougère [a,*], Simon Harvey [a], Jean Mercenier [b], Marcel Mérette [c]

[a] Policy Research Directorate, Human Resources and Social Development Canada, Gatineau, Qc, Canada K1A 0J9
[b] ERMES (CNRS) Université Panthéon-Assas Paris 2, 12 place du Panthéon, 75230 Paris Cedex 05, France
[c] Department of Economics, University of Ottawa, Ottawa, Ont, Canada K1N 6N5

ARTICLE INFO

Article history:
Accepted 16 May 2008

JEL classification:
D58
J22
J24

Keywords:
Ageing
Overlapping generations model
Time allocation
Human capital
Labour supply

ABSTRACT

This study explores the long-term impact of population ageing on labour supply and human capital investment in Canada, as well as the induced effects on productive capacity. The analysis is conducted with a dynamic computable overlapping generations model where in the spirit of Becker [Becker, Gary (1965), A theory of the allocation of time, The Economic Journal, Vol. 75, pp. 493–517.] and Heckman [Heckman, James (1976), A life-cycle model of earnings, learning and consumption, The Quarterly Journal of Economics, Vol. 84, pp. 511–544], leisure has a quality-time feature and labour supply and human capital investment decisions are endogenous. The role of human capital in the growth process is based on the framework used by Mankiw et al. [Mankiw, N. Gregory, Romer, David and Weil, David N. (1992), A contribution to the empirics of economic growth, Quarterly Journal of Economics, Vol. 107, no. 2, pp. 407–437]. The paper indicates that population ageing creates more opportunities for young individuals to invest in human capital and supply more skilled labour at middle age. Consequently, the reduction in labour supply of young adults initially lowers productive capacity and exacerbates the economic costs of population ageing. However, current and future middle-age cohorts are more skilled and work more, which eventually raises productive capacity and significantly lowers the cost of population ageing. Finally, these results suggest that the recent increase in the participation rate of older workers might be the beginning of a new trend that will amplify over the next decades.

1. Introduction

With the decline in the fertility rate, increase in life-expectancy and ageing of the baby boom generation, the growth in labour force population is slowing in Canada and most OECD countries. According to recent demographic projections and despite immigration, the Canadian elderly dependency ratio (ratio of population 65+ as a proportion of the 15–64 population) is expected to at least double between 2000 and 2050. From one individual aged 65+ for five worker-age individuals in 2000, this ratio will rise to 2/5 in 2050.

The slowing in labour force growth being inevitable, the long-term consequences on growth in productive capacity could be substantial if it is not compensated by a significant rise in productivity.[1] The increase in relative scarcity of labour caused by population ageing could also lead to a reduction in national savings, an increase in physical capital intensity, an increase in real wages and a reduction in world interest rates.[2] However, most studies so far have ignored the effect of population ageing on time allocation, more specifically on time spent at work and in human capital formation.[3] This paper argues that since population ageing is expected to lead to significant

☆ This project was undertaken under the Skills Research Initiative, a research partnership between Human Resources and Skills Development Canada (HRSDC), Industry Canada (IC) and the Social Science and Humanities Research Council (SSHRC). The views expressed in this document are solely those of the authors and do not necessarily reflect the views of HRSDC, IC or SSHRC. The authors thank the participants of the 12th International Conference on Computing in Economics and Finance (CEF 2006), the International Conference on Policy Modeling (EcoMod 2007) and one anonymous referee for their valuable comments.

* Corresponding author.
E-mail addresses: Maxime.fougere@hrsdc-rhdsc.gc.ca (M. Fougère), Simon.harvey@hrsdc-rhdsc.gc.ca (S. Harvey), Jean.Mercenier@u-paris2.fr (J. Mercenier), Mmerette@uottawa.ca (M. Mérette).

0264-9993/$ – see front matter © 2008 Published by Elsevier B.V.
doi:10.1016/j.econmod.2008.05.007

[1] For example, Fougère et al. (2005) find that without policy changes, population ageing could lead to an average growth reduction of 0.4 percentage points in real GDP per capita over the period 2015–2050.

[2] See, for example Boersch-Supan et al. (2002), Équipe Ingénue (2001), Hviding and Mérette (1998) and Auerbach et al. (1989) for international studies. Alternatively, Fehr and Kotlikoff (2004) argue that population ageing will lead to a reduction in the capital-labour ratio.

[3] Although, Fougère and Mérette (1999, 2000a) and Sadahiro and Shimasawa (2003) look at the relationship between population ageing and human capital in a Lucas-type endogenous growth model, they assume that leisure time remains exogenous. Moreover, they do not relax the endogenous growth assumption to test the robustness of their results under a Mankiw et al. (1992) framework.

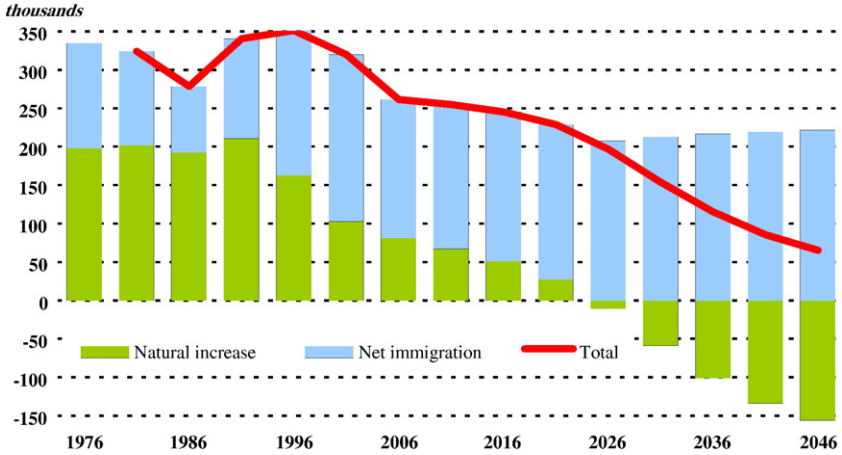

Fig. 1. Historical and projected population growth in Canada. Source: Statistics Canada, Census 1976–2001; HRSDC-PRCD, 2002–2046 (COPS Reference 2004).

changes in production factor returns, these effects and their potential impact on productive capacity could be important.

Several factors can be considered to compensate for the decline in labour force growth. First, since the return to human capital is the discounted sum of future wage revenues, future young cohorts might be inclined to invest more in education. Second, a greater participation of middle-age and older workers may arise as a consequence of the increase in real wage pressures. Third, current cohorts of young adults are better educated than older cohorts (young women in particular). These combined factors would lead to a rise in the quality of the workforce, in productivity and to an increase in hours worked.

This paper uses a dynamic applied general equilibrium model with overlapping generations and endogenous time-allocation decisions to explore the relationship between population ageing, human capital and labour supply. Two simulation experiments are undertaken. The first simulation performed examines the long-term economic and labour market impact of population ageing in Canada by assuming that time-allocation decisions are exogenous. The second simulation applies the same demographic shock, but this time with endogenous time-allocation decisions.

The difference between the two scenarios will isolate the contribution of endogenous labour supply and human capital investment decisions on productive capacity in the context of demographic changes. More specifically, the second simulation will explore to what extent the demographic shock observed since the 1960s and 1970s could explain the stylised facts on labour supply and human capital investment by cohort during the 1980s and 1990s and evaluate the long-term impact of more educated cohorts of workers on productive capacity.

The paper is structured as follows. Section 2 provides a few stylised facts on historical and projected future demographic changes. Section 3 presents an overview on the relationship between human capital and growth. Section 4 discusses the possible relationship between population ageing and human capital. Section 5 describes the technical structure of the model used for the analysis and Section 6 the calibration procedure. Section 7 presents the main simulation results. Finally, Section 8 raises some policy implications and concludes.

2. Some stylised facts on Canada's demographic changes

This section presents an overview of historical and projected demographic changes, according to HRSDC demographic projections using MEDS.[4]

Fig. 1 presents historical and projected population growth in Canada. As can be shown, over the period 1976 to 2000, the annual population increase has averaged about 325 thousands. Until 1991, the natural increase in the population accounted for about 2/3 of the population increase, the rest coming from net immigration. Over the past 10 years, although the population increase has remained constant, the substantial reduction in the fertility rate led to a reduction in the natural increase of the population, which was compensated by an increase in the composition of immigration in population growth. According to a recent demographic projection, the natural increase in the population will continue to slow and eventually turn negative. By 2026, the net population increase will essentially come from immigration.

The age-composition of the population is also expected to change substantially over the next decades. As shown in Fig. 2, the proportion of the younger population (0–14) is expected to continue to fall over the next decades from 18.9% in 2001 to 13.8% in 2046, while the proportion in age group 15–24 will fall more moderately from 13.6% to 10.4% over the same period, after a more significant decline since the early 1980s. In comparison, the proportion of the prime-age population (25–34) will decline at an even more moderate pace, from 13.9% to 12% over the period 2001 to 2046. In contrast, the proportion of the middle-age population (35–54) has increased substantially over the past two decades, which illustrates the effect of the demographic shock from the baby boom generation on the population structure. According to the demographic projection, the proportion of the middle-age population is beginning to decline. From the 31.5% peak in 2001, the proportion of this age group will fall to 25.7% of the population in 2046.

Following the effect of the baby boom cohorts, the proportion of the 55–64 age group is projected to increase from 9.4% in 2001 to 14.5% in 2020. This will be followed by a moderate decline in the longer term to 13.3% by 2046. Finally, to illustrate the demographics of population ageing, the older age group (65+) is expected to increase at a rapid pace during the next 25 years, from 12.6% in 2001 to 22.7% in 2030, then grow more moderately between 2030 and 2046 and reach 24.7% by 2046.

Fig. 3 now presents the historical and projected old-age dependency ratio (population 65+ as a ratio of the population 15–64). As can be seen from the chart, over the period 1971 to 2001, the old-age dependency ratio increased from 0.13 to 0.185. Over the next decades, it is expected to continue rising, first at an increasing rate, until about 2031, and at a slower pace for the remaining projection period. Between 2001 and 2046, this represents a 216% increase in the old-age dependency ratio.

3. The role of human capital in economic growth

The role of human capital formation in the growth process has been extensively analysed in the literature.[5] According to the theoretical literature, human capital would affect economic growth in two ways.

[4] See Models of economic-demographic system (MEDS), Research Institute for Quantitative Studies in Economics.

[5] See, for example, Lucas (1988), Romer (1989) and Mankiw et al. (1992).